

Experience with Server Self Service Center (S3C)

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Abstract. CERN has a successful experience with running Server Self Service Center (S3C) for virtual server provisioning which is based on Microsoft® Virtual Server 2005. With the introduction of Windows Server 2008 and its built-in hypervisor based virtualization (Hyper-V) there are new possibilities for the expansion of the current service. This paper describes the architecture of the redesigned virtual Server Self Service based on Hyper-V which provides dynamically scalable virtualized resources on demand as needed and outlines the possible implications on the future use of virtual machines at CERN.

1. Introduction

Server Self Service Center (S3C) [1] is a web based application which allows any CERN user to create a virtual machine with an already preinstalled operating system. This system has proven to be very successful for provisioning virtual machines in the role of terminal servers, licensing servers, batch servers, test and development servers. The S3C service was based on Microsoft® Virtual Server 2005 [2] software. However this solution had limited possibilities in terms of emulated hardware of virtual machines (limited memory size, single processor only, no 64 bit support), it was not integrated with the other CERN computer management tools and it could provide only a limited number of virtualized resources.

The new solution for virtual infrastructure is now based on two core products from Microsoft – Windows Server 2008 [3] and System Center Virtual Machine Manager (SCVMM) [4]. Hyper-V [5], the next generation hypervisor-based server virtualization, is an integral feature of Windows Server 2008 and enables to efficiently run multiple operating systems – Windows, Linux and others in parallel on a single hosting server. System Center Virtual Machine Manager 2008 is an unified management solution for virtualized data centers that allows centralized administration of physical and virtual assets, increase server utilization, and provides dynamic resource optimization of virtual IT infrastructure.

Using SCVMM at CERN was not straightforward, because it does not integrate automatically with the other specific tools used for managing the complex computer and network infrastructure at CERN. It was decided to implement a middle layer with a web service interface which would not only use the official SCVMM API to create and manage virtual machines, but would also efficiently interact with all other CERN IT services, namely Network registration, Computer Account Manager, Computer Management Framework (CMF), CERN Authentication Services, Electronic Document Handling (EDH), Backup service, Active Directory and E-groups.

The new S3C [6] solution provides dynamically scalable and virtualized resource like in the cloud computing concept [7].

2. Architecture

In this section, the architecture of the system is detailed. The base of the whole project is Microsoft® Windows Server 2008 and its new server role for virtualization: Hyper-V. The designed system is using an architectural pattern Model-View-Controller (MVC), and consists of three main parts:

1. Management tool: System Center Virtual Machine Manager 2008,
2. Controller: Web Service written in Microsoft® .NET 3.5 technology and C# language,
3. CERN Self-Service Web Portal: implemented in Microsoft® ASP.NET.

The basic outline of the architecture of the system is shown in Figure 1.

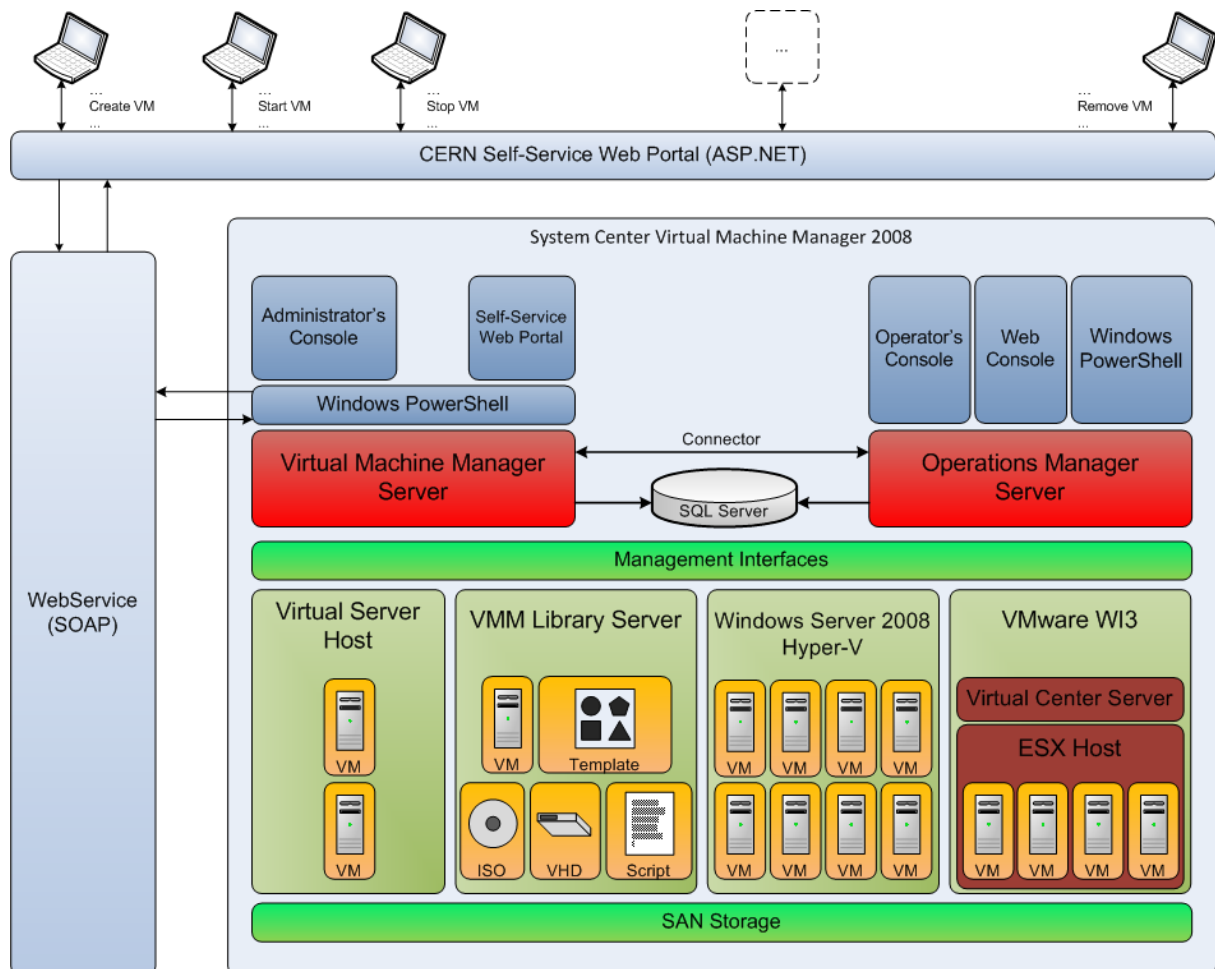


Figure 1. Architecture of the Server Self Service

The core of the implemented solution is the System Center Virtual Machine Manager 2008 (SCVMM 2008), which is a member of the Microsoft's® System Center products family designed for management and reporting. SCVMM 2008 is a consolidated interface for managing virtual infrastructure providing an Application Programming Interface (API) based on Microsoft® Windows PowerShell and many other features which significantly helped during developing process, like built-in algorithms for the intelligent placement of virtual machines on the base of performance and user requirements.

Every command that can be done using the Virtual Machine Manager Console is also available from PowerShell, and it is possible to execute it from the command line. This gives an opportunity to

enhance existing features and implement new functionalities which System Center Virtual Machine Manager 2008 does not provide out of the box.

The second element of the system is the web service, which is the controller managing the communication between SCVMM and the user interface. One of our goals was to avoid the creation of a dedicated database for the project, and use only SCVMM 2008 and Active Directory (for security groups). That explains why the controller is a middle layer connecting data saved in the SCVMM and other systems belonging to CERN infrastructure. Integration requires a number of interactions between our system and existing systems at CERN. The first step during the creation of a virtual machine is its registration in the network database. Each device requiring a connection to the CERN network infrastructure must be registered in this CERN network database. To communicate with this database our system invokes SOAP web service provided by the network group at CERN. The second step is creating the computer account in Active Directory and synchronizing it with the network database. The next step is the integration with the Computer Management Framework (CMF), the central tool used for managing Windows computers, deploying system patches, updates and also software installation according to the assigned roles of the computer. The person creating a virtual machine is its owner and administrator by default. He or she can specify an E-group of delegated administrators as well. At the end of the creation process the user is informed by e-mail that his virtual machine is ready and the selected expiration date is specified.

The controller is based on a SOAP web service, which could be easily used by other systems that demand an API for programmatic access to the system. The web service in order to send request to the SCVMM invokes PowerShell commands or, in case of a more complicated request, whole scripts, and as a result receives strings, objects or list of objects.

The web access to the system is provided by the Self-Service Web Portal protected by CERN Authentication. It gives user possibility to request, manage, monitor and delete virtual machines that he owns or he is member of administrators E-group responsible for this machine.

The system is integrated with central tape backup service based on IBM® Tivoli. It gives the possibility to restore the virtual machine from the backup in less than thirty minutes in case of a hardware failure. The backup agent runs daily on each host in the system.

The implemented system provides also high availability of virtual services. This means that if a particular server fails, the time from crash to repair should be as short as possible. To make it possible, we use the Failover Cluster technology and prepared an appropriate infrastructure. Users who request a virtual machine do not have any knowledge or control of the technology infrastructure "in the cloud" that supports them. In this concept (cloud computing) the resources are dynamically scalable, so in case of failure of a host in the cloud, all virtual machines, which were placed on it, will be immediately moved to another node in the cloud. The short time of moving virtual machines from one host to another one is possible by usage of a shared storage area network (SAN). The biggest part of the virtual machine – virtual hard drive is placed there, and during failure of the host this part is not moved between the hosts.

3. Use cases

There are many reasons to use server virtualization, but in this paper we concentrate on the most important one from the manageability point of view:

- A new virtual machine can be self provisioned when needed without hardware purchase.
- Hardware configuration of a virtual machine is flexible.
- A virtual machine can be relocated to a different physical machine.
- Backup and restore of a virtual machine is simple and flexible.
- Snapshots (sometimes called checkpoints) allow saving the state of a virtual machine at any point in time so that it can be reverted to that state at any point in the future.
- Independence from the hardware vendors.
- High availability of a virtual machine when using host clustering.

The main drawbacks of the server virtualization that we observe are the following:

- In case of hardware failure of a host, multiple virtual servers are affected.
- Disk I/O performance of the virtual machine is slower.

3.1. Server consolidation and provisioning

In case of server consolidation and provisioning, we profit from the fact that many physical servers are replaced by virtual machines running on larger physical servers which allows us to increase the utilization of costly hardware resources, save the diminishing space in the data centre, produce less heat and save on electrical power.

Our S3C service also supports physical-to-virtual (P2V) migration which can convert operating system running on a physical server to virtual machines running the same operating system and applications. This is a very useful feature allowing to increase the lifetime of old servers running on hardware with expired manufacturer warranty by virtualizing them.

3.2. Virtual Desktop Infrastructure

The idea of desktop virtualization [8] is to decouple a user's physical desktop computer and the operating system with applications that he or she uses to work. Virtual Desktop Infrastructure (VDI) is a server-centric approach to desktop virtualization which uses centrally managed desktop virtual machines in the data centre.

The S3C service is the first step in direction of possible VDI implementation at CERN in the future.

3.3. Cloud computing

Cloud computing is a style of computing in which dynamically scalable and often virtualized resources are provided as a service over the Internet. Users do not need any knowledge, expertise or control of the technology infrastructure "in the cloud" that supports them.

The S3C service is designed in such way that it hides the complexity of the infrastructure from the user and it allows automatic fail-over virtual machine to another host in case of a crash. In this context the service could also be used to provide additional computational resources to end users besides the traditional batch systems.

4. Conclusions

The previous version of Server Self Service based on Virtual Server 2005 had limitations which prevented us to fully exploit virtual machines for server consolidation, try the virtual desktop concept and provide dynamic provisioning of virtual machines.

The new Server Self Service Center has been in production since January 2009 and the number of virtual machines has increased by factor of two. The number of physical hosts will also be doubled soon.

The plans for the future include migration to the release two of Windows Server 2008 [9] which will improve virtual machine performance, simplify the management of machines stored in the SAN and increase availability for machines running in the failover cluster configuration.

The new Server Self Service Center is a fully scalable virtualization solution based on dynamic server pools. It is closely integrated with CERN computer environment. It allows users to easily create a virtual machine based on existing templates or their own images in several minutes. The web services interface has cloud computing features and is providing dynamically scalable virtualized resources on demand.

References

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