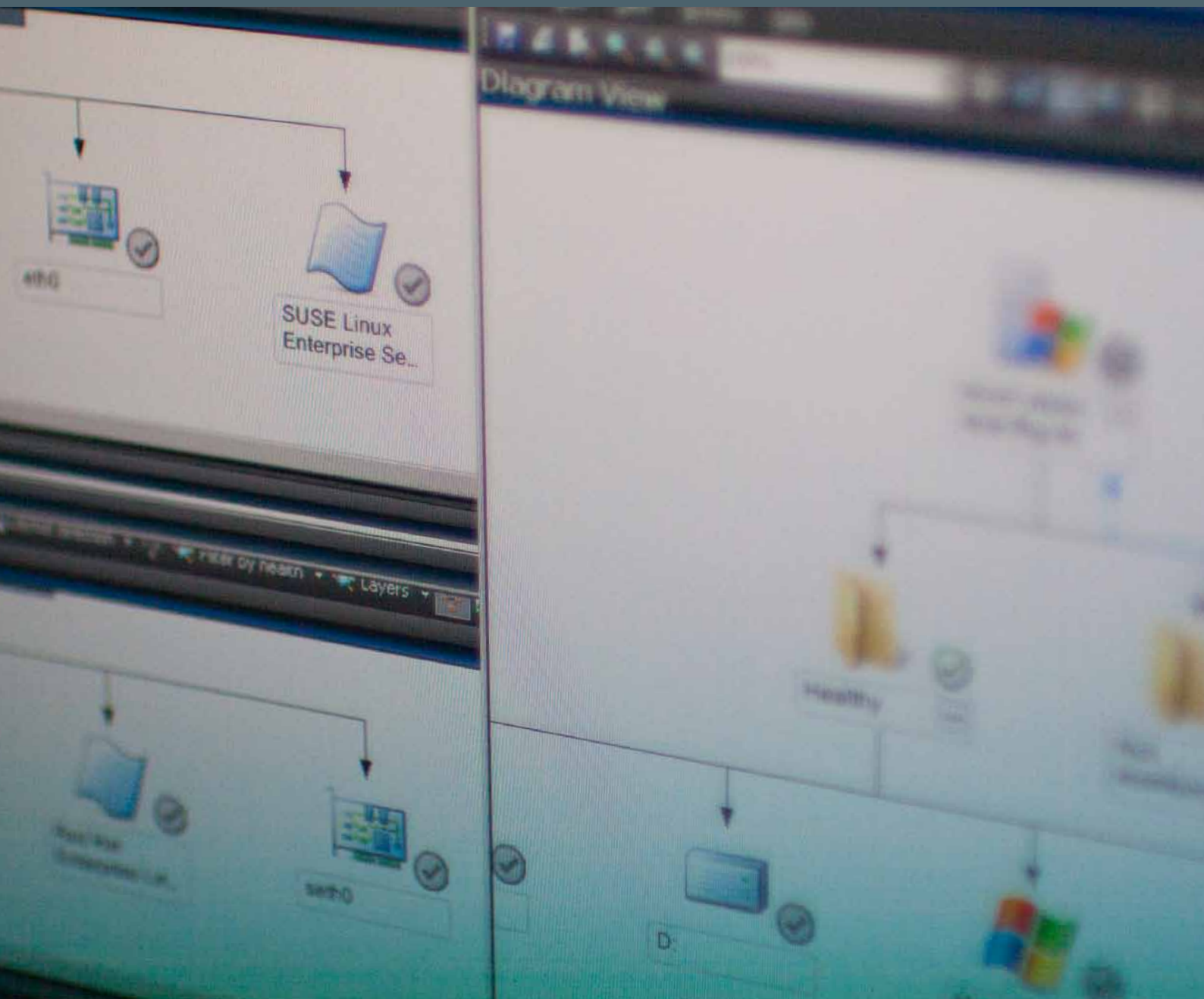


INTEROPERABILITY AND OPENNESS IN TODAY'S HETEROGENEOUS IT ENVIRONMENTS

Horst Schwichtenberg, Ulrich Trottenberg



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Horst Schwichtenberg, Ulrich Trottenberg

Contributors: Karsten Reineck, Steffen Claus, André Gemünd

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Actions:

- Use a template to add content to a workspace
- Describe and monitor a new operation
- Create a new group



Key Concepts & Videos

- The Authoring Space
- What's New for Operations Management Pack
- Management Pack Concepts
- Management Pack Templates
- Distributed

EXECUTIVE SUMMARY

Microsoft and Novell work closely together to enhance the interoperability between Windows and Linux and their supplementary products. Collaborating on technical and legal levels, they jointly launched an interoperability lab to develop and support interoperable software solutions, for example in the areas of virtualization, system management and identity management.

This paper outlines the solutions of Microsoft and Novell addressing challenges in heterogeneous IT environments typical for an application-oriented Fraunhofer research institute. It depicts how interoperability can help to master heterogeneous environments, and lists the benefits of an “open” software company in combination with interoperable software.

To enable scientific work for industry and academics, Fraunhofer institutes run highly heterogeneous IT environments. Microsoft System Center Operations Manager (SCOM) is an excellent example of interoperable software, as it helps IT administrators to monitor their entire IT environment, including Windows clients, servers, and Linux machines. SCOM additionally provides a bridge for customers to use the same management solution for on-premises and cloud software. Fraunhofer SCAI has built a proof of concept environment to demonstrate the benefits of this interoperability. This proof of concept shows, how SCOM helps the administrator not to lose track of a heterogeneous and virtualized Windows/Linux environment.



INTRODUCTION

Typical IT environments are highly heterogeneous nowadays. They usually consist of hard- and software from several different vendors, sometimes further supplemented by products of the Open Source community. To guarantee the flawless operation of such an environment, interoperable systems are extremely important. The complexity and thus cost expense of operation and support otherwise grows heavily exponentially with the number of its different systems.

Openness and Interoperability

The Fraunhofer Institute for Algorithms and Scientific Computing SCAI designs and optimizes industrial applications, implements custom solutions for production and logistics, and offers calculations on high-performance computers. SCAI services are based on industrial engineering, combined with state-of-the-art methods from applied mathematics and information technology, providing world leading mathematical software products for technical computing. To support this work, the institute operates a complex infrastructure of dedicated and virtualized systems including HPC clusters. The cost-effectiveness and efficiency of operating this infrastructure is a challenge. Both, technical interoperability and the “openness” of hardware and software vendors are key requirements in this regard. But what means “openness” in this context?

Naturally, customers look for solutions for their problems, rather than for specific products. They want to benefit from the latest technology and demand the best fitting solution for specific problems of their business, regardless of the platform the solution is based on. Successively, customers want the solution to integrate into and operate smoothly in their existing IT environment without any drawbacks or interface problems. Besides complying with well-known standards, support has to be given for all types of software, including Open Source. Open Source software has a large market share and is present in many ICT sectors, even in the independent software vendor (ISV) domains. For some Open Source products, commercial support models exist, but – just as with other products – it is unclear who might be able or willing to answer problems in case of interoperability issues. The diversity of software products in modern data centers already requires a huge number of support contracts – even without additional contracts for every software / platform combination.

Improving this situation requires not only technological standards, but also a close cooperation – technologically, legally, and in a certain sense also ideologically. Driven by user requirements, software companies should be willing to cooperate, share information and contribute to each other to build an ecosystem providing benefits to all partners. An open company should listen to customers, take them seriously, and support them in every possible way. In the long term,



cooperation with other companies has a positive effect for both parties involved and will lead to satisfied customers. Openness is about co-existence, a strategy to combine competition and cooperation to give customers a better choice.



By Openness of a software company we understand that a company cooperates on a technological, legal and ideological way, and 'lives' this openness by supporting standards, implementing "interoperability", sharing information, contributing to communities, and listening to customers.

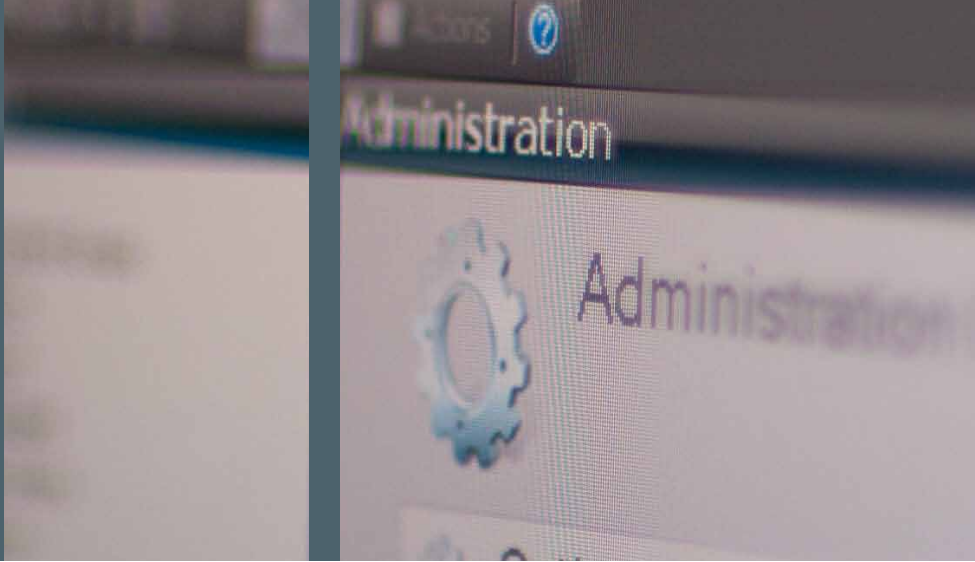
Interoperability, on the other hand, is a technical aspect of systems. Creating interoperable systems is considered as a basis for being an open company. The International Standards Organization (ISO) and International Electro technical Commission (IEC) define interoperability as follows:



Interoperability refers to the ability of two or more systems (computers, communication devices, networks, software and other IT components) to interact with one another and exchange information according to a prescribed method in order to achieve predictable results.

The European Committee for Standardization (CEN) and Information Society Standardization System (ISSS), explicitly add the aspect that this interaction has to be done "without the need for extra operator intervention". The European Parliament has concretized this in a technical manner, by defining that "computer programs have to mutually use the information which has been exchanged, including the ability to use, convert or exchange file formats, protocols, schemas, interface information or conventions". One technological key aspect here is to support standards, and refrain from proprietary protocols or file formats.

To run a business efficiently and to remain ahead of competitors, dynamic and heterogeneous IT infrastructures – e.g. virtualization for systems ranging from servers to desktops – are indispensable. This idea is further driven by the issue of cost control for IT services. From the perspective of IT departments, the most attractive offer to fulfill their requirements would probably be a fully integrated solution meeting the precise needs of the department. A provider trying to integrate all the different tools would face a challenge that is only met solvable with interoperable tools and cooperating companies.



Microsoft and Novell Collaboration

Since 2006, Microsoft and Novell have been working closely together to bridge the gap between open source and proprietary software. With the aim to enhance the interoperability between Linux and Windows, they signed a couple of agreements about technical and patent cooperation, as well as several legal covenants e.g. protecting customers from patent infringement lawsuits. The technical cooperation comprises the areas of virtualization, system management, identity management and document format compatibility. Microsoft and Novell launched a joint interoperability lab, where technical experts of both parties test new software solutions, and work together with customers and the Microsoft and Linux community to optimize and support these technologies. The lab develops reliable software and supports customers with interoperability issues, including open source solutions, e.g. the PHP hypertext preprocessor running on the Windows platform, for which several performance improvements were implemented in the lab. It also solves interoperability problems of customers of both companies. In this paper it will be evaluated how Fraunhofer may benefit from this collaboration.

As most other datacenters Fraunhofer SCAI uses Virtualization to provide flexible IT-services. Microsoft and Novell work together to ensure that virtual machines running Windows Server 2008 can be hosted on the XEN hypervisor shipped with SUSE Linux Enterprise Server (SLES), and virtual machines running SLES can be hosted on Microsoft's virtualization platform Hyper-V that is shipped with Windows Server 2008.

As a consequence of the high amount of computing systems that Fraunhofer operates, reducing the complexity and effort of System Management is a constant interest: Both Microsoft and Novell support industry standards and open source components to simplify the management of mixed IT environments. Microsoft already offers a cross-platform extension for their system management solution – the System Center Operations Manager – that utilizes industry standards such as WS-Management.

Adding an additional type of resource to the infrastructure often yields to redundant services. A typical example, and due to the separation of administrative domains between the single institutes also a central point of interest for the Fraunhofer-Gesellschaft at large, is Identity Management: Microsoft and Novell have decided to cooperate by relying on the industry standard WS-Federation to enable identity federation between applications using Microsoft's Active Directory (AD) and Novell's LDAP identity store eDirectory, which is utilized by Fraunhofer. The respective implementations are the "Active Directory Federation Services" by Microsoft and the "Access Manager" by Novell. Both implement the WS-Federation standard and thereby ensure that authorized users can seamlessly access applications and Web-based services with one set of passwords and policies – regardless of where the account was created.

It should also be pointed out that in case of Document Format Compatibility, Novell and Microsoft have both agreed to support open office formats for word processing, spreadsheet processing and presentations. The Microsoft Office suite uses the Office Open XML (OOXML) file format, a standardized XML based file format. OpenOffice.org, on the other hand, uses the Open Document Format (ODF) by default, which is also an open OASIS and ISO/IEC standard. Users of Word 2010 can seamlessly open, edit and save files in both the OOXML and the ODF format to exchange data.

Benefits

With their collaboration to provide interoperable products and by founding the joint Interoperability Lab, Microsoft and Novell concretely embrace the route to Openness. Their concerted effort additionally supports the adoption of Open Source products offering the same performance on Linux and Windows. Offering shared support and a single point of escalation for interoperable products including Open Source tools such as pioneered by Microsoft and Novell through the Interoperability Lab can serve as an example for other companies. The advantage for IT departments is obvious and the realization fulfills an urgent demand. To demonstrate the added benefit of the collaboration in a real-life scenario, we will hereafter document a proof of concept obtained by Fraunhofer SCAI, for the utilization of Microsoft System Center Operations Manager (SCOM) for cross-platform systems management. SCOM is part of the Microsoft System Center Management IT infrastructure solutions for physical and virtual IT environments (<http://www.microsoft.com/systemcenter>). The cooperation between Novell and Microsoft ensures that one can monitor all servers, regardless of whether they run SUSE Linux Enterprise Server or Microsoft Windows Server.



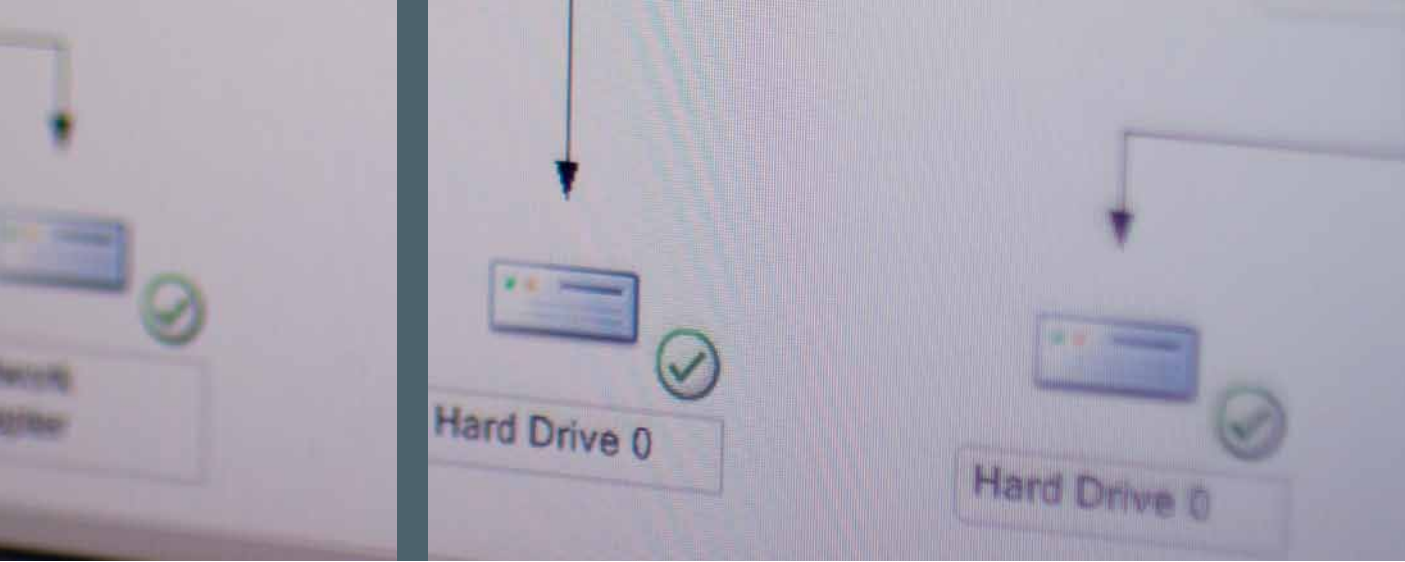
SCENARIO AT FRAUNHOFER AND STATUS QUO AT SCAI

The Fraunhofer-Gesellschaft consists of more than 80 research facilities (60 institutes) scattered to over 40 locations (mostly across Germany) with 18.000 employees. Each institute is autonomous and maintains its own IT department, with the possibility to outsource certain IT services provided by other institutes. To operate these federated services, SCOM seems to be a good solution. System administrators and users from different sites will be able to monitor the federated services and their availability.

Like other enterprises, Fraunhofer SCAI operates and manages several basic services needed for day-to-day business and projects. At SCAI, these services are mostly implemented as virtual services running on Linux and Windows operating systems. This includes core network services, mail, Active Directory and web services, access gateways and databases. For some of these services, Service Level Agreements (SLAs) – that have been negotiated within the institute itself or with external partners – have to be fulfilled. Compliance with SLAs must be proved, but verification without the suitable tools is cumbersome.

Besides consulting and research activities, Fraunhofer SCAI develops and distributes software products that are executed on different operating systems by industrial partners. The environment in which the software is operated by the customers might also differ in terms of patch/update level. Thus, for the complete software product life cycle, from development and testing to customer support, different systems have to be operated and maintained at SCAI. Product developers work together with customers and the IT staff to define the supported infrastructures. To analyze and react to customer issues, identical test environments need to be provided in a timely manner. The provisioning and maintenance of this diverse landscape in time is challenging and requires high effort. The availability is currently guaranteed by a couple of different monitoring tools, which emphasizes that a consolidated tool would be a tangible progress.

Apart from the challenge of managing a few hundred workstations with a variety of applications, the diversity of utilized operating systems, virtualized and non-virtualized, heavily increases the complexity. The current solution is based on several separate tools including self-written scripts to manage this task. However, it is desirable to minimize the number of employed tools to reduce the risk of missing a fault. Furthermore, the tools should be flexible enough to support the IT staff during the cross-platform management process.

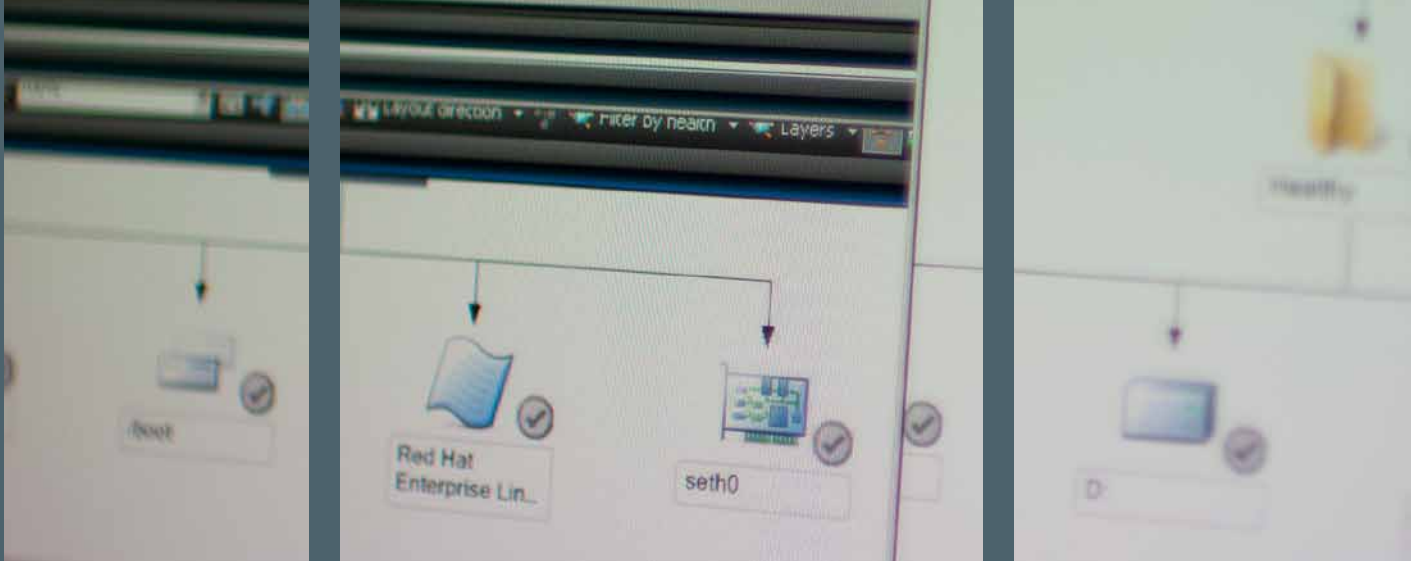


In the IT-sector in recent years the awareness for an economic consumption of energy has grown ("Green-IT"). Together with other Fraunhofer institutes on our premises, the Fraunhofer SCAI is consolidating its datacenter infrastructures and starts to introduce virtual hosted desktops which will offer the responsive and customizable user experience of a workstation. Advantages mainly encompass better utilization of resources and lower energy consumption of workstations. One can expect that this new private cloud infrastructure will grow very fast. It is not an easy task to manage such a centralized system and interoperable management and monitoring tools are mandatory in this context. For independent institutes with their own cost centers, multi-client capabilities down to a very low level are required for all management tools. In this respect, there is no essential difference between a public and a private cloud environment.

The particular scenario at Fraunhofer SCAI shows that a flexible and interoperable monitoring tool is needed to support typical virtualized services, virtual hosted desktops, hundreds of workstations and the environments which have to support the complete life cycles of SCAI's software products.

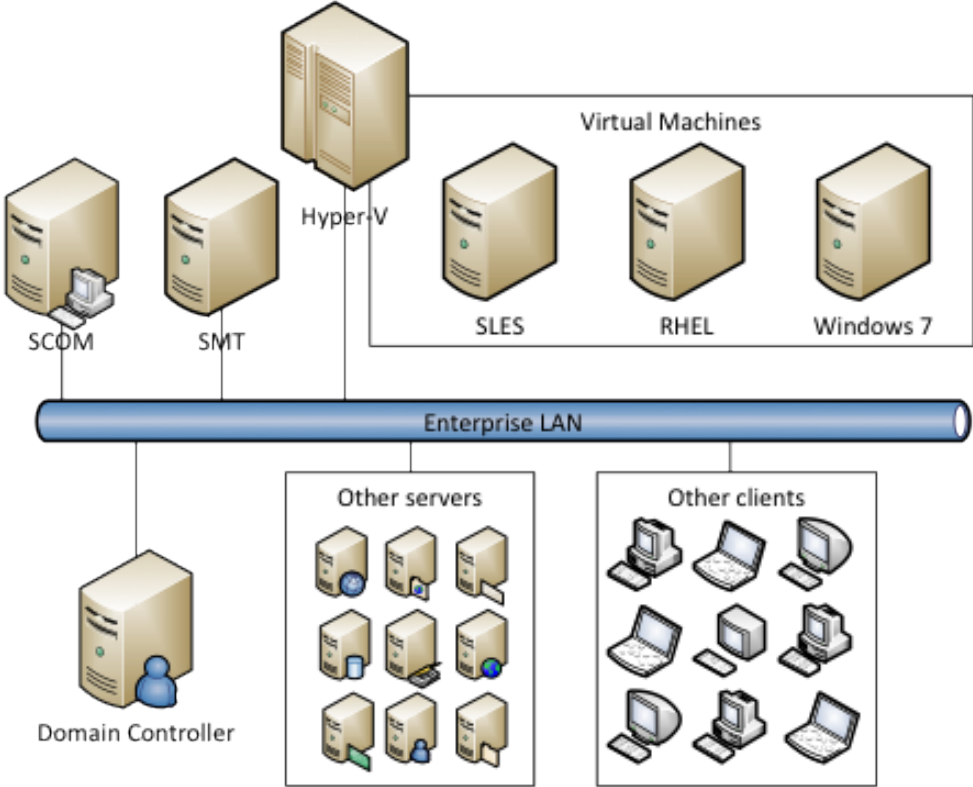
Microsoft SCOM fulfills these requirements and provides several so-called management packs, which extend the functionality of SCOM. Microsoft releases a SCOM management pack for each server function available from the Windows server suite. The interoperability effort from Microsoft and Novell result in a management pack -- the so-called cross-platform management pack -- that also allows monitoring Linux Enterprise Servers. This ensures that only one tool is required to monitor the entire server environment. Today, nearly 300 management packs exist (see the "Management Pack Catalog" at <http://pinpoint.microsoft.com/en-US/systemcenter>), not only from Microsoft but also from third party vendors. Anyone can use the open API to implement custom monitoring capabilities for its service.

The general deployment of SCOM at SCAI promises a substantial reduction of IT effort. A proof of concept has been installed at Fraunhofer SCAI to verify that SCOM can master the scenario described above and to get an impression of the interoperability of the SCOM services. Frankly spoken: Does the cooperation of Microsoft and Novell begin to bear fruits?



PROOF OF CONCEPT

The installed environment at the Fraunhofer Institute SCAI consists of 3 virtual machines: a SUSE Linux Enterprise Server 10.2 (SLES), a Red Hat Enterprise Server 5.3 (RHEL), and a Windows 7 client. All virtual machines run on top of a Hyper-V server that is installed on a Windows Server 2008 R2. A Subscription Management Tool server (SMT) provides updates for the SLES and RHEL machines. All servers are connected to the enterprise LAN. All Windows machines are joined to the domain provided by SCAI's enterprise Domain Controller, also running Windows Server 2008 R2. Finally, a System Center Operations Manager is integrated in this environment that monitors all of the servers mentioned above.



Setup of the proof of concept environment at SCAI



Hyper-V server

Having only one hypervisor greatly reduces the administrative complexity. Microsoft's Hyper-V supports both Linux and Windows. A large number of Linux distributions are certified for Hyper-V. To run Linux on top of Hyper-V, the "Linux Integrations Services v2.1" (LIS) are installed on the Linux operating systems. LIS, which is freely available on the Microsoft website, provides the Linux drivers for the virtual network interface cards (NIC) from the Hyper-V server. It is available as an ISO file that can easily be mounted in the desired virtual machine using the Hyper-V Manager. The virtual machines as well as the Hyper-V server are monitored by SCOM.

SMT server

The SMT server provides updates for the virtualized SLES and RHEL machine. The SMT server is registered at Novell, and the required catalogs are added by the Novell Update Service. In return, both the virtualized SLES and RHEL machines are not registered at Novell but at the SMT server and obtain their updates directly from the SMT server. The SMT server is also monitored by SCOM.

SCOM server

The SCOM server runs on a Windows Server 2008 R2 that is added to the Fraunhofer SCAI domain. The required services for SCOM also run on this machine, such as the Internet Information Services (ISS), ASP.NET, the .NET framework, ASP.AJAX, SQL Server, and the SQL Reporting Services. The installation wizard of the System Center Operations Manager 2007 R2 helps you to fulfill all requirements before the actual installation.

The interface of the SCOM 2007 R2 is divided into the three main sections "Monitoring", "Authoring" and "Administration", which are explained in the following: In the "Monitoring" section the administrator has an overview over all states and alerts. SCOM differentiates the "health" of its computers between critical, warning and healthy. In the "Authoring" section the administrator defines new monitoring policies. Depending on the installed management packs, one can, for example add rules to monitor TCP ports, processes, Windows services or Linux log files. Management packs extend the functionality of SCOM by providing specific monitoring capabilities for certain services, and can easily be added in the "Administration" section. One is also able to write a management pack for one's own proprietary software. The device management is also located in the "Administration" section, as well as the assignment of roles and access rights to SCOM users, among other general administrative settings.

All the servers, operating systems, Hyper-V and services are monitored by one SCOM server in this installation – thus providing a single point of monitoring. The following table lists all machines, operating systems and services monitored by SCOM.



Machine	Operating System (all 64 bit)	Monitored services
SCOM server	Windows Server 2008 R2	Logical and virtual disks, OS performance (CPU, memory, disk, ...)
Hyper-V server	Windows Server 2008 R2	Logical disks, OS performance (CPU, memory, disk, ...), hypervisor role, virtual machines, virtual NICs
SMT server	SUSE Linux Enterprise Server 10.2	OS health (logical disks, NIC), OS performance (CPU, memory, disk, ...)
RHEL server	Red hat Enterprise Server 5.3	OS health (logical disks, NIC), OS performance (CPU, memory, disk, ...)
SLES server	SUSE Linux Enterprise Server 10.2	OS health (logical disks, NIC), OS performance (CPU, memory, disk, ...)
Windows 7 client	Windows 7 Enterprise	Logical Disk, SCOM agent

To monitor all services listed in the above table, additional management packs are installed on SCOM. The Windows machines and services listed in the above table require the following management packs to be installed:

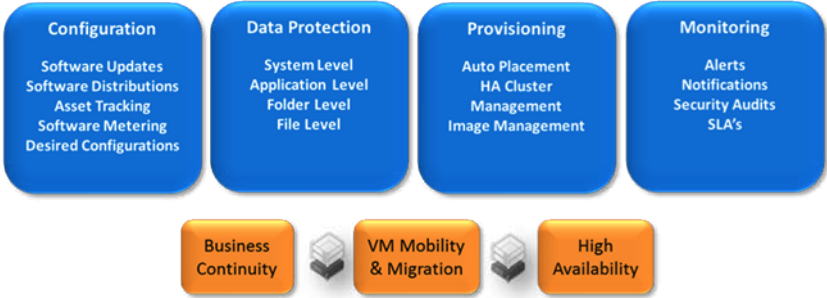
- Windows Client Operating Systems Library for features and components common to all versions of Windows Client Operating Systems
- Windows 7 Client Operating Systems Monitoring and Aggregate to discover, monitor and manage Windows 7 Clients across the enterprise
- Windows Server Operating System Library for features and components common to all versions of Windows Server Operating Systems
- Windows Server 2008 Operating System Discovery and Monitoring to discover and monitor Windows Server 2008
- Microsoft Windows Hyper-V 2008, Discovery and Monitoring

To monitor the Linux systems, the following five management packs are installed:

- "Linux Operating System Library" that contains general definitions for the Linux platform
- "SUSE Linux Enterprise Operating System Library" and "Red Hat Operating System Library" that contain definitions specific to the SUSE and Red Hat platform, respectively
- "SUSE Linux Enterprise Server 10 Operating System" and "Red Hat Enterprise Linux Server 5 Operating System" that discover and monitor specifically those server operating systems.



Management and Customer Dashboards, Control Panels, Alerts, and Notifications



The "MS System Center" IT infrastructure server management solutions for physical and virtual environments – SCOM is one part. Source: Microsoft

Using Management packs from third party vendors, SCOM is able to monitor and provision the entire infrastructure running Microsoft platforms – Windows Server, SQL Server, Hyper-V, etc. along with Linux, LAMP stack (Apache, MySQL, PHP on Linux), Oracle, Hypervisors, WebSphere.

The proof of concept has demonstrated that SCOM is a perfect solution for the described Fraunhofer SCAI scenario. Both tools, SCOM and SMT, are interoperable with other Linux operating systems, e.g. Red Hat. Both are open to other environments and prevent a vendor lock-in. The possibility to develop new management packs provides additional opportunities for application developers and administrators, and offers users to monitor arbitrary applications.

During the installation and operation we did not face any serious issues; additional support was not needed. Therefore the possibility to open a support call at Microsoft for a Windows/Linux interoperability problem was not evaluated, but the availability of one is reassuring. Having one single point of escalation for Novells SUSE Linux and Microsoft makes administrators life much easier and saves his time.

OUTLOOK: JOURNEY TO PUBLIC CLOUD COMPUTING

Utility computing has been a topic of research for Fraunhofer for years. Recently, SCAI has started to offer its products as software as a service (SaaS) using its own private cloud resources. SCAI works on the extension of its own infrastructure by adding public cloud computing resources. This will additionally increase the complexity of monitoring this assembly of internal and external infrastructure, platforms and software layers. This can be regarded as a hybrid cloud strategy, which intends to make the most efficient use of internal IT assets while seamlessly and effectively integrating the supplemental resources and capabilities available in the cloud. Unfortunately, SCAI and other organizations began to realize recently, that the basis of cloud computing, Virtualization, can quickly run out of control. In case of aggressive virtualization of the scenarios described above, server provisioning and performance monitoring might get too complicated and lead to a loss of administrative control. Operating delays are

Hyper-V Cloud – Bridge Reference Architecture



Source: Microsoft – “Hyper-V Cloud” supports starting up a private cloud. For more information, visit <http://www.microsoft.com/hyper-vcloud>.

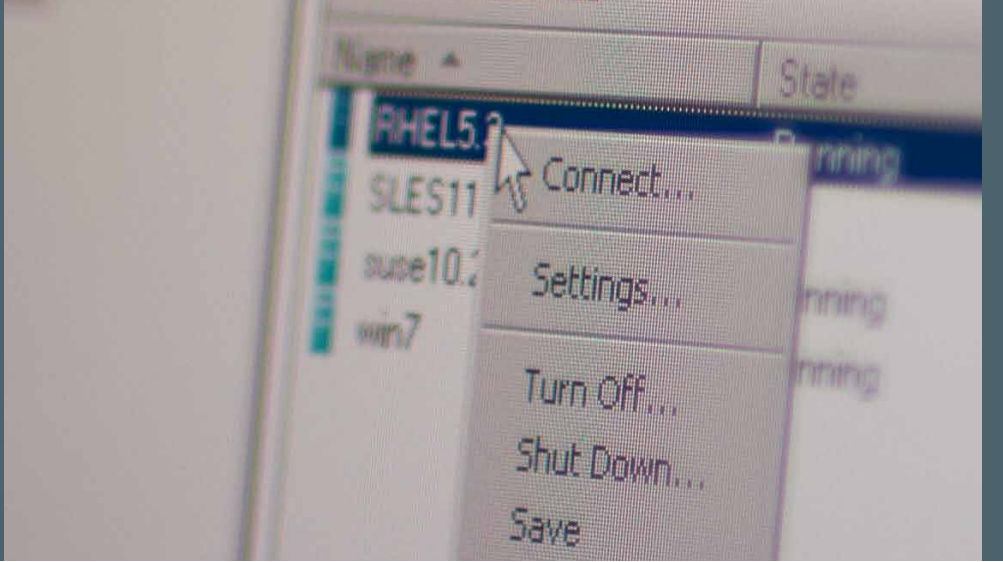


inevitable, lapsing into stasis. The key to the solution is central monitoring and automatic control of the complete cloud resources. Here the SCOM feature offers the solution. The interoperability and the openness to other players really can help to leverage public cloud.

The interoperability features of Microsoft products provide a path for every Enterprise in their journey to the cloud. For Microsoft customers and service providers building IaaS (Infrastructure as a Service) Cloud, Microsoft System Center where SCOM is a part provides capability to automate monitoring, alert triggering, provisioning, patching, etc. capability that spans heterogeneous platforms and mixed source software and complimenting the Hyper-V capability to run multiple guest OS like Windows Server, SLES, RHEL, CentOS and other distributions.

The architecture also automates patching and updating of software across multiple platforms including Linux as we have seen before in Fraunhofer SCAI's proof of concept.

The upcoming version of SCOM will address exactly the hybrid cloud scenario of SCAI and offer a single pane of glass monitoring solution. Important for Fraunhofer SCAI in its role as a SaaS provider are monitoring capabilities for customers. This SCOM version will also support "outside-in/end user" experience monitoring for "geo distributed" cloud services. Therefore the flexibility and interoperability of the Microsoft products is well adapted to different utility computing offerings.



CONCLUSION

The popularity of computing as a utility is heavily increasing and the different classes of cloud computing require interoperability between the different software products, even when used only in a private cloud. Modern datacenters and companies are no longer separate islands, as a high degree of heterogeneity and the inclusion of open source software is indispensable today. In the future "self-service portals" will allow individual end-users to automatically provision and deploy virtual machines to support business applications. The scenario of Fraunhofer SCAI with the respect to applications for monitoring in heterogeneous environments shows the advantage of interoperable tools. One functional tool supporting the Microsoft and the Linux world, that's the only chance to manage complex environments. An ever increasing number of tools to manage diverse environments will excessively complicate the control and management. With interoperable tools and their cooperation, Microsoft and Novell present a way to preserve customers' investments in different environments. Being interoperable and using standards is not the only necessary paradigm: The time in which customers were forced to use whatever their particular software vendor was providing is over. Today providers have to be open to their competitors and to customer needs. Otherwise, their products will be isolated in complex infrastructures. The possibility to develop management packs with Microsoft SCOM to monitor hardware and applications from different vendors is an example for this. Novell SMT, which supports upgrades of other distributors, is another one. The SCAI proof of concept shows how flexible these tools are, where combinations of Hyper-V with different Linux distributions, Novels Xen with Microsoft and other combinations are supported, and everything is monitored by one product.

The collaboration of Microsoft and Novell is a huge step forward – helping customers to manage their complex infrastructures on their journey to cloud computing. It is one of the steps in the vision of computing as a utility.

PUBLISHING NOTES

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Fraunhofer Institute for Algorithms
and Scientific Computing SCAI

Schloss Birlinghoven
53754 Sankt Augustin, Germany

Telephone +49 2241 14-2500
Fax +49 2241 14-2460

info@scai.fraunhofer.de
www.scai.fraunhofer.de

