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VIRTU, an open virtualization framework to test Ground Systems

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ABSTRACT

The recent developments in virtualization change completely the panorama of the Hardware/OS deployment. New bottlenecks arise in deployment of application stacks where IT industry will spend most of the time to assure automation. VIRTU tool aims at managing and configuring ground applications of space systems on a virtualized environment, based on open tools and cross virtualization support. The tool is a spin-off of previous activities performed by the European Space Operations Center (ESOC) and thus it covers the original needs from the ground data systems infrastructure division of the European Space Agency. The use cases foreseen and applied on Space focus on the development and validation activities of infrastructure or mission specific ground systems, composed typically of distributed systems that could take advantage of virtualized environments.

FULL TEXT

Introduction (from customer needs to a product)

While virtualization techniques have been around for some time the IT massification only occurred recently with the advent of low cost multi-core processors, hardware virtualization support and a wider Operating Systems' support. These technology developments change completely the panorama of the Hardware/OS installation when it comes to deploying machines. Nonetheless, new bottlenecks arise in installation and configuration of application stacks where it is foreseen that IT industry will spend most of time and money to achieve automatic machine deployment.

By anticipating these Application deployment and automation issues the

European Space Agency (ESA), in a joint consultancy with EVOLVE, has been developing for the last 2 years a custom solution to automate this process, since no product was identified and available at that time. EVOLVE has re-structured this solution into the VIRTU product in partnership with ESA, HP Labs, Universidade Nova de Lisboa and University of Coimbra.



Fig. 1 - product image

It now constitutes a viable alternative to Space application maintenance on this new age of computer availability and green IT.

VIRTU, a virtualization technology

The VIRTU tool aims at managing and configuring application stacks on a virtualized environment. The solution handles problems such as network, environment and application configurations with an open, simple and yet potential standard for dealing with issues of this nature. The development generalizes the configuration of customer applications based on open standards and tools and supports cross virtualization environments, namely VMware and Xen hypervisors.

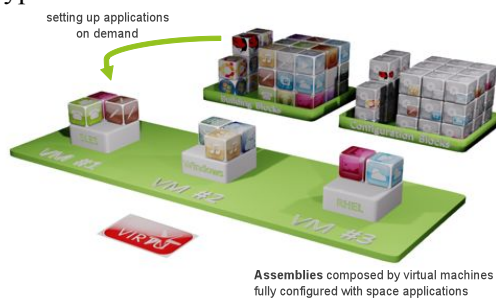


Fig. 1 - Configuring and Managing applications

The tool allows configuring a set of customer applications based on specific plug-ins to edit those configurations. Then, it allows creating Virtual Machines and configured applications which can be grouped into specific customer assemblies.

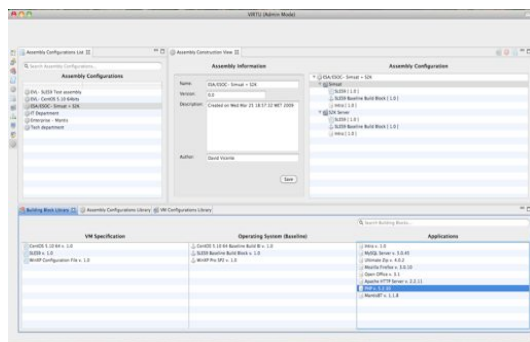


Fig. 2 - Assembly Configuration UI

These assemblies (Virtual Machines and application stacks) can be requested by the final user and, after approval, they are instantiated and deployed automatically according to a predefined order and rules.

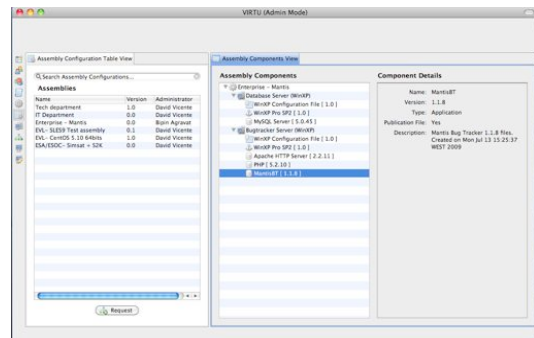


Fig. 3 - Assembly Request UI

The final user can then connect to the Virtual Machines and run his applications remotely from the tool or using a third party remote connection.

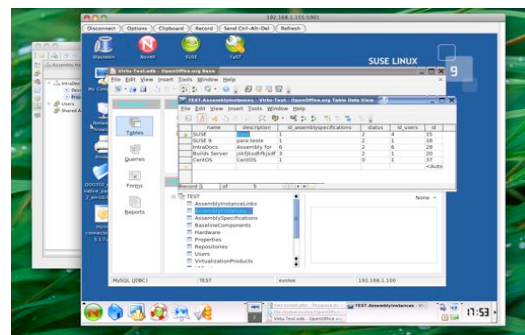


Fig. 4 - Assembly Instance Usage

In addition to the user interfaces, the tool provides some external interfaces which can be used to ease the integration with a pre-established infrastructure.

Use Cases in Space

This tool mainly targets the use cases of testing and developing applications in complex distributed environment as well as the server infrastructure consolidation.

The predecessor version of VIRTU (GoVI project) was started in 2006 and deployed in 2009 at ESOC for use within the ground systems infrastructure division. The typical scenarios considered were the testing of new systems and patches to existing systems on a virtualized environment composed by one or more virtual machines. Another important scenario is the use and deployment of common Virtual Assemblies, following an OS ESOC specific baseline, for each

Project in order to harmonize the use of Virtualization.

The extension provided with VIRTU is more focused on requesting and deploying multiple systems and test multiple configurations. The common example is to deploy two virtual machines one with the Mission Control System (SCOS-2000) and the second with the mission spacecraft model (SIMSAT and Simulation Models).

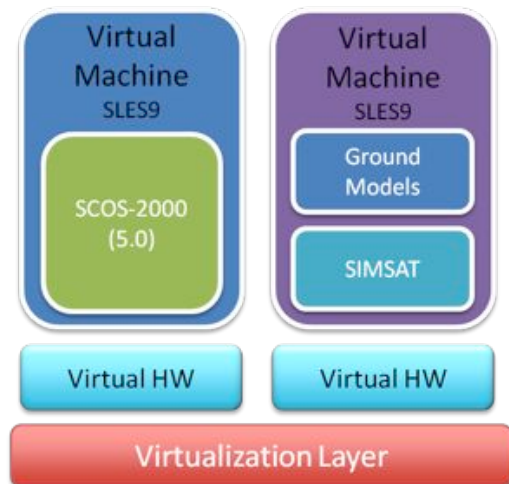


Fig. 5 - Typical GS testing scenario

All the required COTS products that need to be installed with each space product can also be automatically deployed.

This multiple deployment scenario is quite interesting for maintenance of a full mission infrastructure taking into consideration that normally each mission requires several ground applications and sometimes a dedicated machine per application is needed, with heterogeneous HW/OS. The possibility of making on-demand request of the mission testing infrastructure will provide some infrastructure optimizations, specially having in mind that ESA maintains ground control software of various missions, and each mission can last up to 15 years.

In general, virtualization may be used as way to optimize maintenance of Space infrastructure for tasks such as testing new releases and patches, test different system's configurations and replicate tests. The main benefits identified are related to test scenarios deployment and the possibility to have on-demand infrastructure.

In a similar way, the product is also being prepared to other customers on the telecommunication and pharmaceutical area where the use cases are also driven by the need of reducing costs on system deployment and configuration.

Open Source, a business decision

VIRTU will be distributed under a dual-licensing model: open-source and commercial.

The open-source package will be free-to-use and EVOLVE's main goal with it is to develop a widespread user community and enable its adoption as a standard for virtual machine application stack deployment. By supplying the VIRTU product free of costs to the open source community, it is EVOLVE's expectation that a community is developed, that in return will provide us with free testing, free enhancements and most importantly free marketing.

While maintaining the solution in open source assures a wider dissemination and acceptance, private source will assure the competitive advantages where customers wishing to use commercially, alter or bundle the VIRTU product must purchase it through a commercial license.

The final business solution follows a balance between open source and closed source software. In the open source business model this is known as Quid-Pro-Quo.