White Paper

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VMware ESX Server 3i – the industry's first generation of a thin hypervisor

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Abstract

This White Paper delivers the most important information about the VMware ESX Server 3i and Fujitsu Siemens Computer's implementation of this technology as the PRIMERGY TX/RX300 S4 – ESX 3i and PRIMERGY RX330 S1 – ESX 3i products. It explains the basic architecture compared to the traditional VMware VI 3.5 product. It shows the usage scenarios and the benefits customers can achieve using this new way of deploying a virtualized infrastructure.

Why is Virtualization so important today?

The initial driving force behind the implementation of VMware in IT environments was the issue of consolidating infrastructure services. Numerous customers use this technology successfully to deploy all kind of applications and services on virtual machines.
As more recent studies have shown, the range of possible applications with this software is far from exhausted. Customers now use VMware to pursue goals such as:

- Ensuring straightforward, efficient server deployment
- Improving the agility of applications by simply moving them to other servers without interrupting operations
- Achieving efficient high availability through n:1 high-availability solutions
- More flexible IT infrastructure design due to the elimination of the rigid assignment of hardware and software

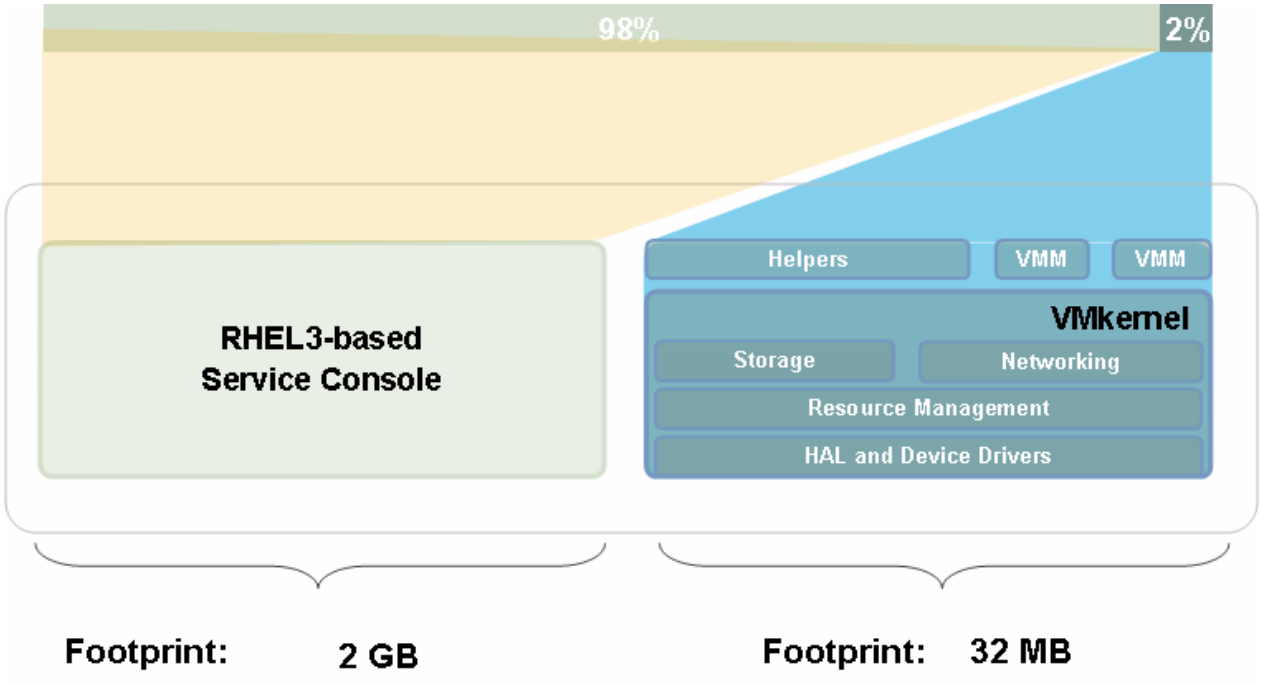
What was the motivation to introduce VMware ESX Server 3i?

In the six years and three product generations since its release, VMware ESX Server has become an industry-leading product, acclaimed for its quality and functionality. VMware is introducing a new paradigm where virtualization software is not separate from server hardware any more; it is simply how industry-standard servers operate. This new architecture allows integrating VMware ESX Server directly into the server hardware. Now customers will be able to turn on their virtualization-enabled servers and boot directly into a fully-functioning VMware ESX hypervisor. The obvious advance is to simplify virtualization and make it more easily accessible to customers.
As multi-core ISS (Industry Standard servers) become more common, virtualization will no longer be viewed as an optional capability by customers. VMware ESX Server 3i is the new architectural foundation for VMware Infrastructure 3. VMware customers will be able to easily implement the entire suite of VMware Infrastructure 3 based on this new architectural approach. The first VMware ESX Server 3i implementation is based on the VMware ESX Server 3.5 code base, which will be available from Fujitsu Siemens Computers at VMworld Europe 2008 by the end of February 2008.

What is VMware ESX Server 3i?

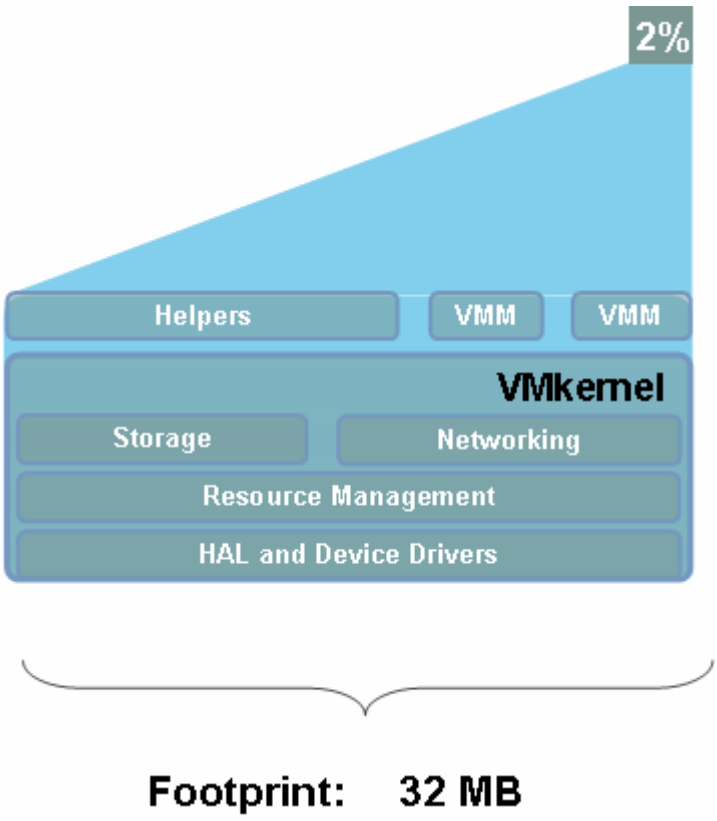
The traditional architecture of VMware ESX Server 3.5

For a better understanding of the VMware ESX architecture please refer to the following picture:



A VMware ESX 3.5 Server hypervisor consists out of two major building blocks. First there is the VMware kernel itself. This is the real heart of the VMware ESX Server product. This kernel was exclusively developed by VMware itself and hosts the most important functions that make VMware ESX Server such an outstanding product. From an architectural perspective it has all functions included a modern operating system needs to manage the underlying hardware most efficiently. In addition this piece of code has the capability to share the hardware resources among several independent instances; so called Virtual Machines. Surprising is the size of such a kernel, which sis about 32 Megabyte only.
The other part of an traditional VMware ESX Server product is best described as a kind of 'rucksack'. This piece of code supports the kernel and overtakes various tasks like console communication with the administrator, loader for the kernel itself etc. It is also the area, where the ServerView agents from Fujitsu Siemens Computers are running in. Most code of this building block has its source in the RedHat Linux product. This sometimes gives an user the impression, that VMware is a modified LINIX OS, which is true for that piece, but definitely not true for the kernel itself. Interesting is also the difference in the size of both building blocks. The `rucksack´ is about the size of 2 Gigabyte, and so it represents nearly 98% of a VMware ESX Server.

The architecture of VMware ESX Server 3i



The basic idea of VMware ESX Server 3i was to get rid of the so called `rucksack´. The remaining part still represents the most important functions but the small size of only 32 Megabyte of code allows a total new paradigm of the deployment of that product. This formfactor allows implementing the VMware ESX Server product directly into the hardware. This means a customer does not need to buy a server and a separate CD-ROM in order to install VMware ESX Server. With the PRIMERGY servers powered by VMware ESX Server 3i there is no need to install, and it is as simple a to order the VMware ESX 3i license. By selecting dedicated PRIMERGY TX/RX300 S4 – 3i or RX 330 S1 – 3i servers, an embedded VMware ESX Server 3i is always part of the shipment, the server is prepared to act as virtualization platform based on proven VMware technology.

What is important to understand about the term `ESX 3i´?

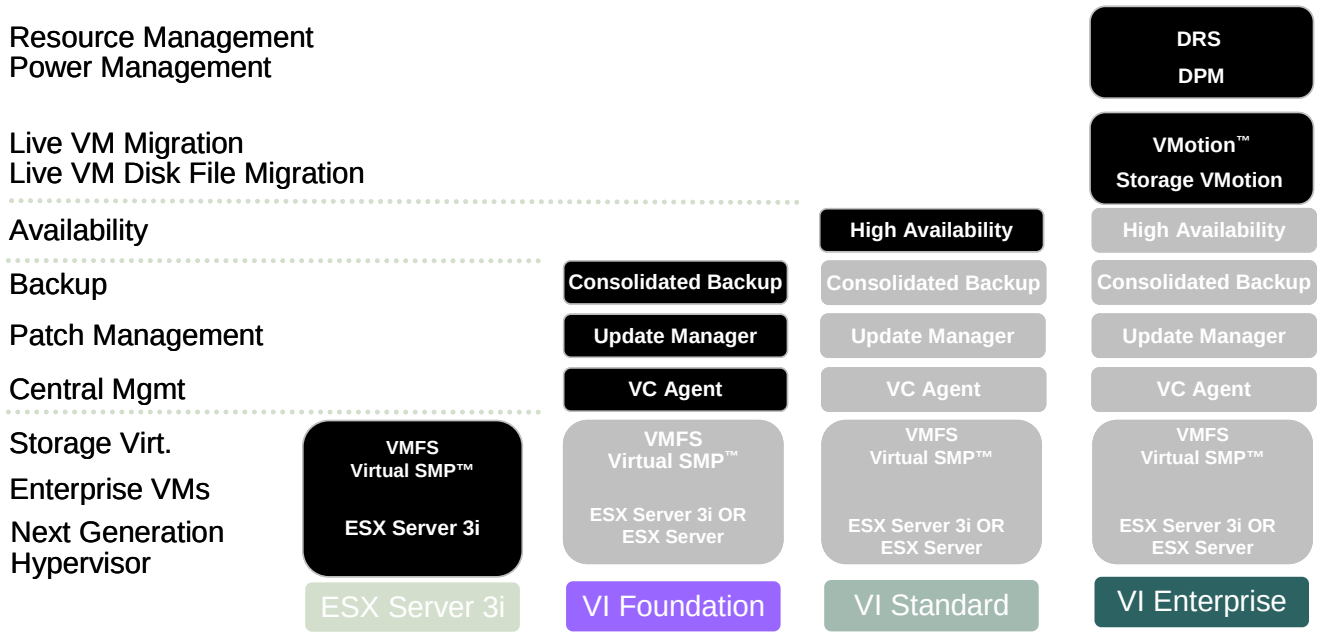
VMware is using the term `ESX 3i´ in two different ways. On one side ESX 3i stands for the architecture described in the previous passage of this document. On the other side ESX 3i is used as the new name for the cheapest license of a VMware ESX 3i architectured product offering, and co-exists along-side with the traditional license names FND, STD, ENT which all exist for the ESX 3i architecture as well. This very often leads to problems in understanding the holistic picture about this new architecture, specially when it comes to the usage scenarios and target customer groups for this technology. You will find more details in the following chapters.

The differences of the both architectures

The both pictures above clearly show that there is no difference in between both products from a functional perspective when we focus on the kernel itself. Both architectural developments are using the identical kernel code sequences and so both can provide the same function set without any restrictions. The obvious difference in between both flavors is the way the different products are going to be deployed. While VMware ESX Server 3.5 (VI3) is installed via a separate media kit like a CD, the 3i basic technology is a fix part of the ISS server itself and needs no additional effort for the installation. When an embedded hypervisor dedicated PRIMERGY server is switched on the very first time, the 3i kernel is booted automatically and the administrator has to go thru a couple of simple questions, to create a final full function VMware ESX server based on the proven VI3 technology.

The new product structure

As already mention, VMware ESX Server 3i product is coming as a dedicated offer of the VMware ESX Server 3.5 product family. In the following picture you will find the product structure VI 3.5.



We basically distinguish between 4 different VMware ESX Server licenses:

- VMware ESX Server 3i

  This is the cheapest license of the VMware ESX Server product range. This license comes inclusive the Virtual SMP™ and it supports the VMFS file system format. This license is only available for ESX 3i Embedded server hardware.

- VMware VI 3.5 Foundation

  This is the new name for the license formerly known as VI Starter edition. In addition to the Virtual SMP™ and VMFS supports this version includes a Virtual Center agent, the new functionality of an Update manager and it supports the Consolidated Backup procedures of VMware ESX Server.

- VMware VI 3.5 Standard

  In addition to the functionalities of the VI Foundation license, this license unlocks the rich function set of VMware High Availability (HA)

- VMware VI 3.5 Enterprise

  The VI Enterprise version is the flagship product of the VMware ESX Server family. In addition this license unlocks the VMotion™ capability as well as the new Storage VMotion technology. It also supports the Distributed Resource Scheduling (DRS) and the related Distributed Power Management (DPM)

How to apply the new 3i architecture to your organization

As already mentioned earlier in this document, we have to distinguish in between the general 3i architecture and the VMware ESX Server 3i product offer. The VMware ESX Server 3i product offer is cheapest product version but it also provides the lowest function set. Ordering this dedicated product means:

- You have to select a dedicated PRIMERGY - 3i product offer, which includes the embedded thin hypervisor (without the `rucksack´) technology
- If you select the ESX 3i license as your fovourite, this license unlocks the basic virtualization technology of the VMware ESX VI technology inclusive Virtual SMP™ and VMFS support
- This ESX 3i license is intended to be installed on a single server instance. This server could not be managed via VirtualCenter and can not make use of the rich function set other VMware ESX Server flavors offer (e.g. VMotion™)
- Instead, you may select from the VI-FND, VI-STD, VI-ENT license at the point of sales. This unlocks additional functions within the embedded 3i technology.
- A customer who has ordered the VMware ESX Server 3i license initially and at a later date, after the original point of sales desires to unlock enhanced functionaliy, can upgrade this ESX 3i license to any of the above mentioned VMware ESX Server VI flavours at any time. He has to order the upgrade from the ESX 3i license to the appropriate licence for a specific VMware ESX Server VI version and simply apply the license file to the existing 3i infrastructure. This will then automatically enable the related function sets of the selected VI version. No additional installation steps are necessary.
- If the customer decides to upgrade the initially ordered 3i version and also wants to use the `rucksack´ again, has to re-install the server with the related VI product binaries for VMware Infrastructure 3 version 3.5. This requires the separate CD-ROM media kit for VMware Infrastructure 3 which is available at Fujitsu Siemens Computers through the PRIMERGY Price List.

What are the restrictions of the new 3i architecture and the related 3i product offers?

As we already worked out, there are no functional differences between the VMware ESX Server 3i kernel and a traditional VMware ESX Server VI kernel. Both are based on the same kernel code. The main differences and in some way also restrictions of the two product versions are:

- The VMware ESX Server 3i product comes as an integrated component of selected dedicated PRIMERGY server models. The VMware ESX Server VI products could be applied to any PRIMERGY server which is part of the VMware HCL (Hardware Compatibility List)
- The basic VMware ESX Server 3i product license is a single server edition. It does not support any extended enterprise functions of other VMware ESX Server VI products except Virtual SMP™ and VMFS
- There is no ServerView support for VMware ESX servers based on the new 3i architecture. Due to the fact that there is no address space available any more where the traditional ServerView agent was initially running in, a new architectural approach for this agent is necessary in a long term perspective. Fujitsu Siemens Computers is intensively working on an interim solution to provide basic ServerView support soon. All major OEM vendors a re facing this challenge with their individual server management products

What are the benefits of the new 3i architecture and the related 3i product offers?

In general Fujitsu Siemens Computers expects that this new 3i architecture will be the future foundation of all VMware ESX Server product offers. This architecture will support the general evolution of virtualization in the industry and virtualization will no longer be viewed as an optional capability by customers. It will become a commodity part of the server infrastructure like as controllers, disks or an OS.

From a technical perspective the small foot print of 32 Megabyte only has a strong impact to secure such a sensitive server instance. Such a small code base could much more easily harden against attacks from outside like viruses and computer worms than a normal OS of a typical size in the Gigabyte area. And it is obvious that such a clearly arranged code base is much easier to be maintained and adopted to new technology evolutions which we expect in the virtualization space in the nearest future.

Fujitsu Siemens Computers sees two different customer areas which could take benefit out of that new 3i approach.

Small and midsized organizations:

For this type of customers the new 3i approach will lower the barrier to apply virtualization technology to their organizations. It makes it simply easier to initially deploy VMware Servers. And especially for smaller organizations more flexibility, more high availability and increased agility become a business competitive factors in the future. No LINUX know how is necessary any more to run a VMware ESX infrastructure.

Large Enterprise customers:

For this type of customers also the new way of deploying virtualization is a key argument to use the 3i technology. It makes it easier and faster to install a new server, especially when this server is located in a branch office and not in the well managed data center. But also in the data center this new approach will more homogenize their IT infrastructure. Faster deployment with less administration efforts will lower the operational costs for such organizations.

How Fujitsu Siemens Computers supports this new 3i architecture

Fujitsu Siemens Computers was involved by VMware from the very beginning of the development of this approach. As a result Fujitsu Siemens Computers offers a selected range of PRIMERGY servers which are powered by the embedded hypervisor technology of VMware ESX Server 3i. Dedicated order numbers are available for two PRIMERGY rack mount server type by end of February 2008, and one BX600 blade server with an enabled BX620 S4 server blade by mid of April 2008. We were aiming to support VMware ESX Server 3i with both of the important processor vendors AMD and Intel.
The following picture shows the PRIMERGY Server models which Fujitsu Siemens Computers are offering:

Dedicated Server Models ESX Server 3i **Embedded**		Enabled Server Model ESX Server 3i **Installable**
		
PRIMERGY RX300 S4 – 3i	PRIMERGY RX330 S1 – 3i	PRIMERGY BX620 S4

The both rack optimized PRIMERGY server models come with an integrated USB/Flash ROM solution, which hosts the VMware ESX Server 3i product. Due to architectural reasons this technical approach is not possible for the related PRIMERGY BX620 S4 model. In this case the bootable 3i image is part of an installable CD. For more information to apply the technology to your production environment, please refer to the related documentation.

Summary

Building virtualization into the server hardware simplifies the deployment and management of virtual infrastructure. With VMware ESX Server 3i, customers will be able to go from booting up a server to reaping the benefits of virtualization in a matter of minutes. VMware ESX Server 3i represents a major advance in a radically small footprint for unparalleled reliability and security. Fujitsu Siemens Computers supports this first approach of an embedded hypervisor because it underlines the importance of virtualization sustainable. It will definitely have a strong impact of the wide distribution of virtualization more or less as a standard component for ISS servers.

Supportive material

- Datasheets for the dedicated PRIMERGY models TX/RX300 S4 – 3i and RX330 S1 – 3i
- PRIMERGY Configuration tool
- How to get started with 3i PDF document
- VMware ESX Server / VI 3.5 slide set
- Vmawre ESX Server 3i slide set

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