

VMware virtualization benefits on Concurrent Technologies embedded Intel® Xeon® based processor cards

Contents

Summary	1
Introduction.....	1
Rugged Systems.....	1
Performance	2
Advantages.....	2
VMware vCentre Virtual Machine	4
Virtual Machine running as a VMware Storage Server	5
Multiple Virtual Machines running on a single TR G4x/msd Processor Board.....	6
VMware configuration on two TR G4x/msd Server Boards	7
Conclusion	8

Summary

Virtualization has proven to bring significant benefits to a user, especially when combining virtual machines with rugged Intel based processor cards. This short publication aims to give a comprehensive overview of the advantages of using virtual machines and, further explain why Concurrent Technologies now offers support for popular variants, including VMware vSphere.

Introduction

Before we can establish what benefits virtualization brings, we must first define what it is and how it is used. In layman's terms "The basic idea behind virtualization is to use software to simulate the existence of hardware. This powerful idea enables you to run more than one independent computer instance on a single physical computer system".ⁱ Each of these simulated computers are known as virtual machines (VM), and for all intents and purposes, each VM appears as a self-contained, complete system with its own memory, processor, storage driver and network ports.

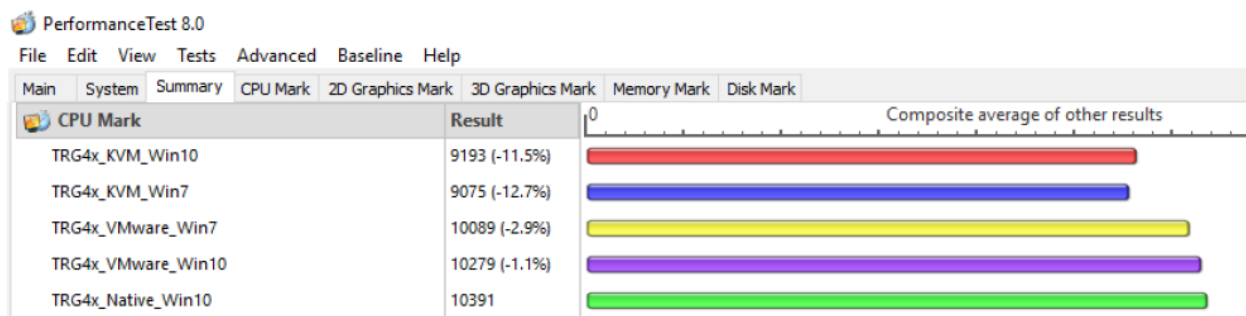
Rugged Systems

Traditionally the target platform for virtualized applications has been big power-hungry servers. These platforms are typically used in a benign data centre environment, with temperature controls in place. This server type product is not easily able to meet the more rigorous requirements that are expected of embedded systems deployed for use in the field. However, the use of a power optimized Xeon D-1500 processor and VPX technologies, allows the possibility for a rugged server system, where the virtualized application can be deployed in severe environmental conditions.

Performance

In benchmark tests that have been run on one of our Xeon D-1500 based processor cards, running VMware vSphere, only a 1-3% reduction in CPU performance has been shown when compared to running on an operating system natively.

The below table shows the performance difference between native, VMware Type 0, bare-metal hypervisor and KVM, a type 1, hosted hypervisor: -



Advantages

One key benefit of virtualization is that it allows legacy applications that run on unsupported or outdated operating systems to run on new, more powerful hardware. Furthermore, virtualization could be of benefit if a hardware platform has reached End of Life support, and has to be replaced by newer, more powerful processors that no longer support legacy operating systems.

In addition, the VMware vSphere solution provides some of the following key benefits:

- **Virtual Machine CPU/Memory/Disk Allocation**

Each VM created can be allocated a number of hardware resources, whether that be the number of CPU cores, the amount of RAM or Disk Space. These are typically allocated at creation time, but can be changed at a later date if required.

- **VM Passthrough or Direct Path I/O**

Passthrough or Direct Path I/O allows a guest operating system on a VM to access some hardware devices directly, such as PCI/PCIe or USB Devices. This restricts the hardware device to that specific VM and so cannot be seen/used by any other VM. There is also what is known as Single Root I/O Virtualization (SR-IOV) which makes a physical PCI device appear as multiple separate physical devices to the hypervisor or guest operating system.

- **VM vSwitch**

vSwitch is a virtual layer 2 switch. It allows the VMs to communicate between each other if required and also can be connected to a Physical Network Interface Card (NIC) for communication to other outside systems. Security layers can be included like a virtual firewall on each VM interface and also VLAN or grouping allows separation between VMs if required.

- **vSphere VCenter Server**

vSphere vCenter server provides centralized management, operation, resource provisioning and performance evaluation of virtual machines residing on single or multiple hosts.

- **vSphere VCSA**

vSphere VCSA (vCenter Server Appliance) is a pre-configured Linux virtual machine, which is optimized for running VMware vCenter Server and its associated services on Linux.

- **VM Backup/Restore**

vCenter Server provides the ability to back up the VCSA and take snapshots of VMs but does not include a GUI based backup/restore package. However, this can be achieved by using 3rd party software running on a VM. This can do full or incremental backup/restores to local storage or to NAS based disk arrays if required.

- **VM Replication**

VM replication is useful if creating many VMs with the same OS and can be achieved using either the vCenter Server or backup S/W.

- **Hypervisor/VM Start-up**

The hypervisor can be booted from local flash or SATA drive for quick start up or can even be PXE booted if required.

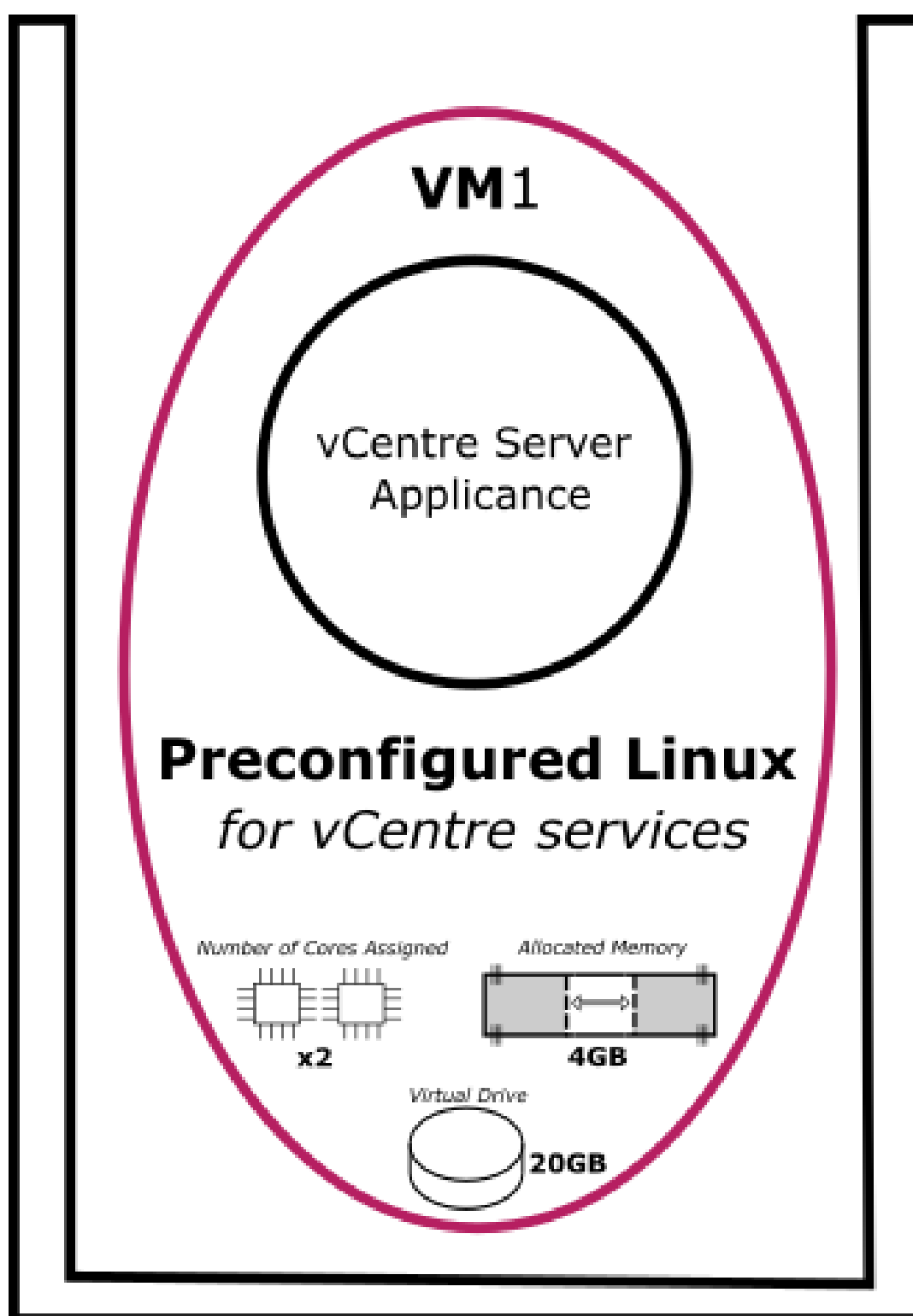
- **Workload Consolidation**

Virtualization allows a single processor board to run the application that would previously have run on separate boards within virtual machines.

These Benefits are shown diagrammatically in the following figures:

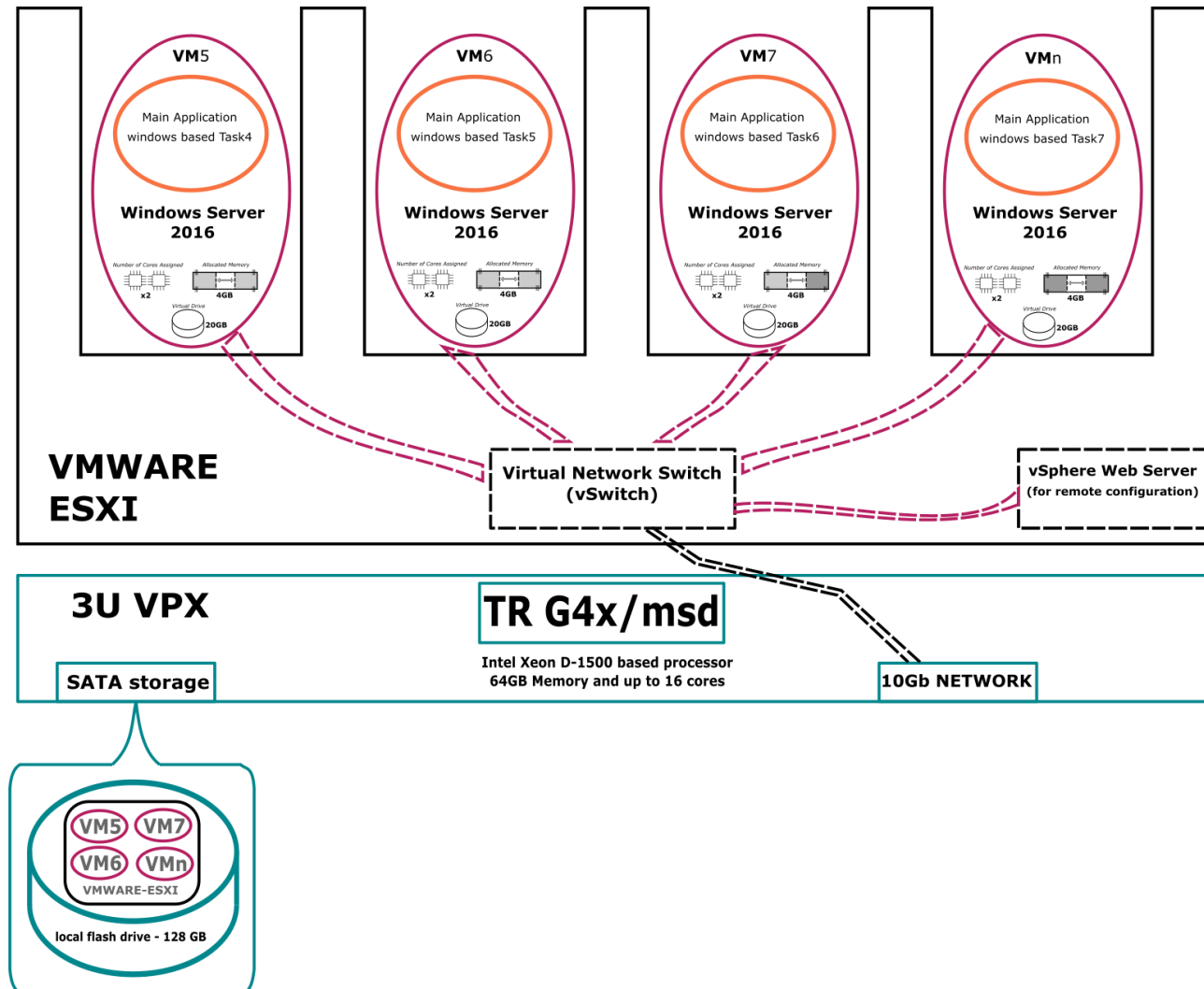
VMware vCentre Virtual Machine

The outer box is the VMware hypervisor 'shielding' the Virtual Machine (VM). The inner orange circle is the VM itself, which in this instance is a version of Linux. It has been allocated 2 CPU cores, 8GB of memory and 20GB of hard disk. The inner black circle depicts the actual application that is running on top of the Linux VM.



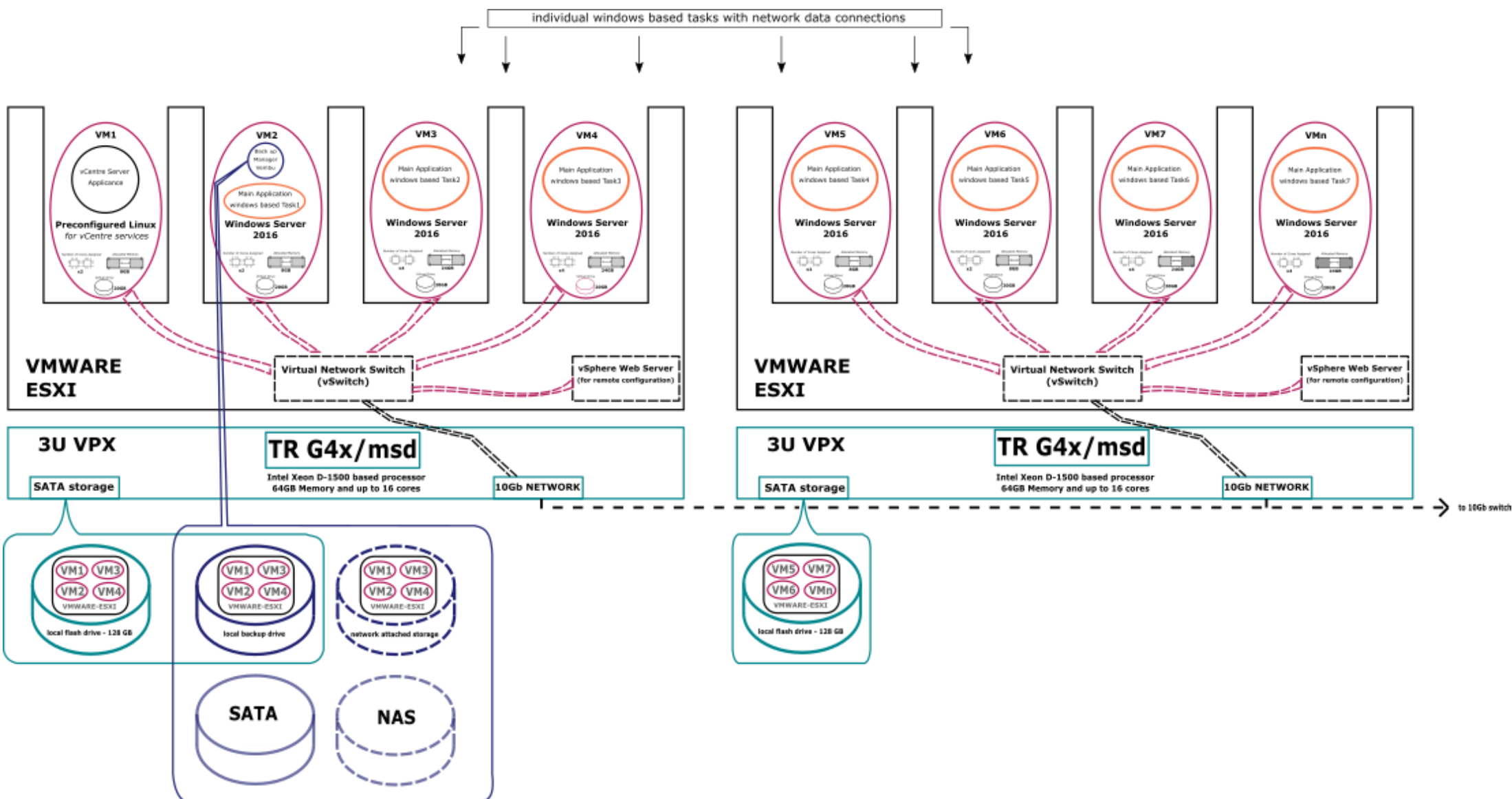
Multiple Virtual Machines running on a single TR G4x/msd Processor Board

This diagram expands on the previous by showing the hypervisor and four VMs running on a TR G4x/msd with 16 physical cores and 64GB of RAM, network and storage interfaces. Again, the outer box is the VMware hypervisor 'shielding' each of the VMs from each other. The inner orange cycle is the VM itself, which in this instance is a version of Windows Server. Each VM has been allocated 2 CPU cores, 8GB of memory and 20GB of hard disk.



VMware configuration on two TR G4x/msd Server Boards

This diagram shows a complete system of two TR G4x/msd boards within a VPX chassis, comprised of 8 VMs interconnected via a 10Gb backplane Ethernet link.



Conclusion

Virtualization can be applied to greatly improve the productivity of rugged High-Performance Computing (HPC) systems. The features and capabilities of VMware products described here have the potential to reduce costs, improve resource control, increase utilization, and enable wider usage of the compute environment by providing much greater flexibility in usage.

To this end we have a number of Application Notes available on request that detail installation, configuration and bench marking virtualized environments as used on a range of our VPX processor cards. *

ⁱ Virtualization as defined by <https://www.dummies.com/programming/networking/basics-of-network-virtualization/>

**While this white paper focuses specifically on use of Concurrent Technologies TR G4x/msd Processor board, it can also be extended for use with similar boards, such as; the TR H4x/3sd-RCx and the TR J4x/6sd-RCx.*