TechNote

XCAPI
voiceoverIP

VMware Virtual Machines

VMware ESXi Server

May 2, 2023

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Contents

1 Introduction

This document provides you with configuration advice regarding VMware ESXi Server in order to improve performance. Some license related information for VMware can be reviewed in section 3.4 (XCAPI License and MAC Address Binding), page 12. We will provide guidance how the resource management of the VMware ESXi Server should be adjusted so as to reserve sufficient system resources that will be assigned exclusively to XCAPI, with the goal of optimizing XCAPI operation without the disruptions that are common when sharing hardware resources between several guest operating systems. The assumption is that the hardware the VMware ESXi Server is running on and the software installed on the server, particularly the VMware ESXi Server itself and the guest operating systems, are already installed, configured properly and are running.

Refer to the respective manufacturer documentation and manuals for detailed information on installation procedures regarding the VMware ESXi Server and the virtual machines. We recommend a visit to our YouTube[1] channel for XCAPI related tutorials about licensing, the test tool, line monitor tool, trace analyzer, and other topics. Registered Community[2] users can check on the latest XCAPI documents, TechNotes, and versions of XCAPI for download.

The XCAPI Line Monitor and the XCAPI Trace Analyzer give some hints about the VMware state which should be followed when encountering performance issues.
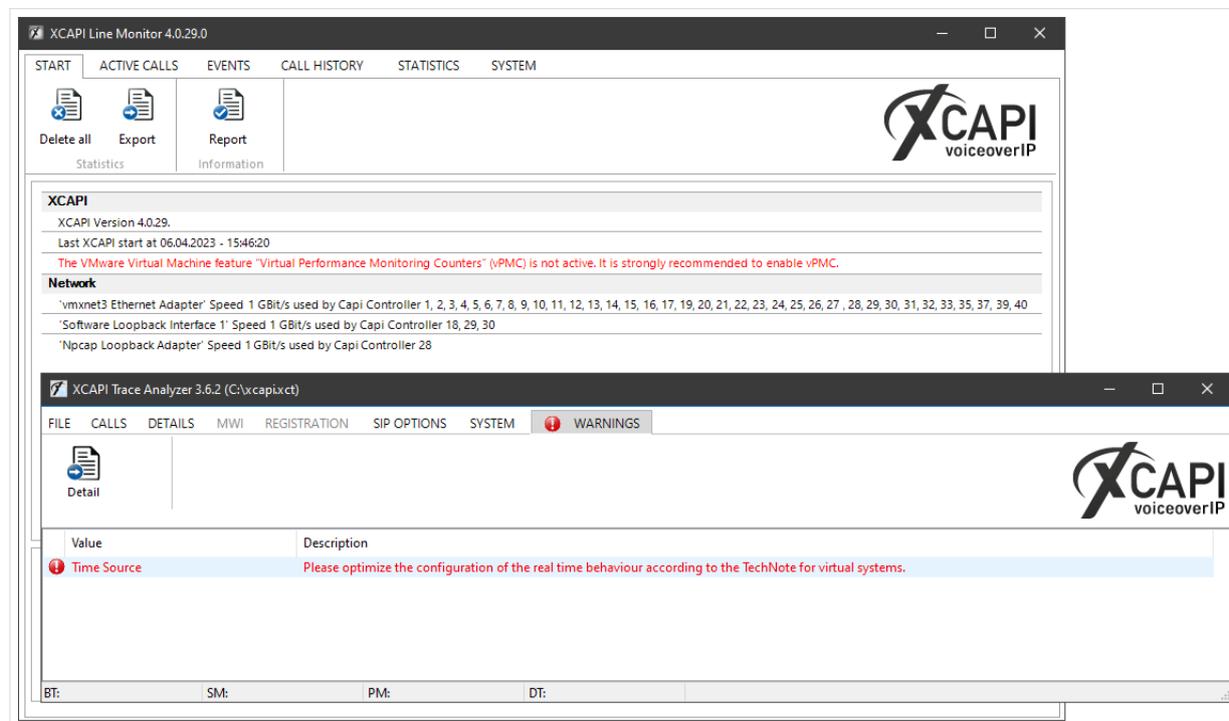

Figure 1: VMware related hints (XCAPI Line Monitor and XCAPI Trace Analyzer)

> ℹ️ Using the latest VMware ESXi server version is recommended. As a minimum version 5.5 is required.

2 Requirements and Recommendations for VMware Environments

Take note that VMware `Snapshots` significantly impact the performance and thus interfere with the real-time behavior of the media stream (i.e., the audio) within a virtual environment. Especially transmitting facsimile data in real-time requires the activation of the *Virtual Performance Monitoring Counters (vPMC)* for VMware and XCAPI. This procedure will be described in section 3 (Improving the Real-Time Performance), page 6. For this reason VMware points out that Snapshots should *not* run in production on a permanent basis for virtual machines. Thus it is assumed that Snapshots won´t be used on the guest systems. For more details review the VMware knowledge base entry Best practices for using VMware snapshots in the vSphere environment (1025279)[3]. Also review the KB entry Troubleshooting virtual machine performance issues for VMs running on VMware Workstation, ACE, Player, or Server (1008360)[4] for additional information.

Take note of the following requirements for VMware environments:

- Refraining from utilizing VMware Snapshots.
- Enabling High Latency Sensitivity
- Enabling the VMware performance counter for real-time based applications and protocols.
- Disabling of the Power Management in the host BIOS and vSphere

Further information based on various VMware releases can be found in the following documents:

- Performance Best Practices for VMware vSphere 8.0, VMware ESXi 8.0, vCenter Server 8[5]
- Digitalization of Power Substations - ESXi Real-Time Configuration, Tuning, and Testing[6]
- Host Power Management in VMware vSphere 7.0[7]
- Media and Entertainment Workloads on vSphere 6.7[8]
- Best Practices for Performance Tuning of Latency-Sensitive Workloads in vSphere VMs[9]
- Deploying Extremely Latency-Sensitive Applications in VMware vSphere 5.5[10]

3 Improving the Real-Time Performance

XCAPI can tolerate, to a certain degree, some latency in the virtual machine, which usually occurs when a virtual machine does not have sufficient CPU cycles due to other time-consuming processes running on the host. Without adjustments to compensate for this, the virtual environment can significantly negatively impact the performance and thus interfere with the real-time behavior of the media stream (i.e., audio, fax). Without this adjustment, real-time applications like Softfax (i.e., G.711 fax) are not feasible because of gaps in the audio stream which can lead to aborted fax transmissions.

3.1 CPU, Memory, Latency Sensitivity

Consider setting the maximum of the CPU Reservation to guarantee exclusive CPU access which reduces CPU halt/wake-up states. Note, if the number of physical CPUs in the host is greater than the amount of allocated virtual CPUs detected by the VMware ESX Server, no CPU affinity has to be assigned.
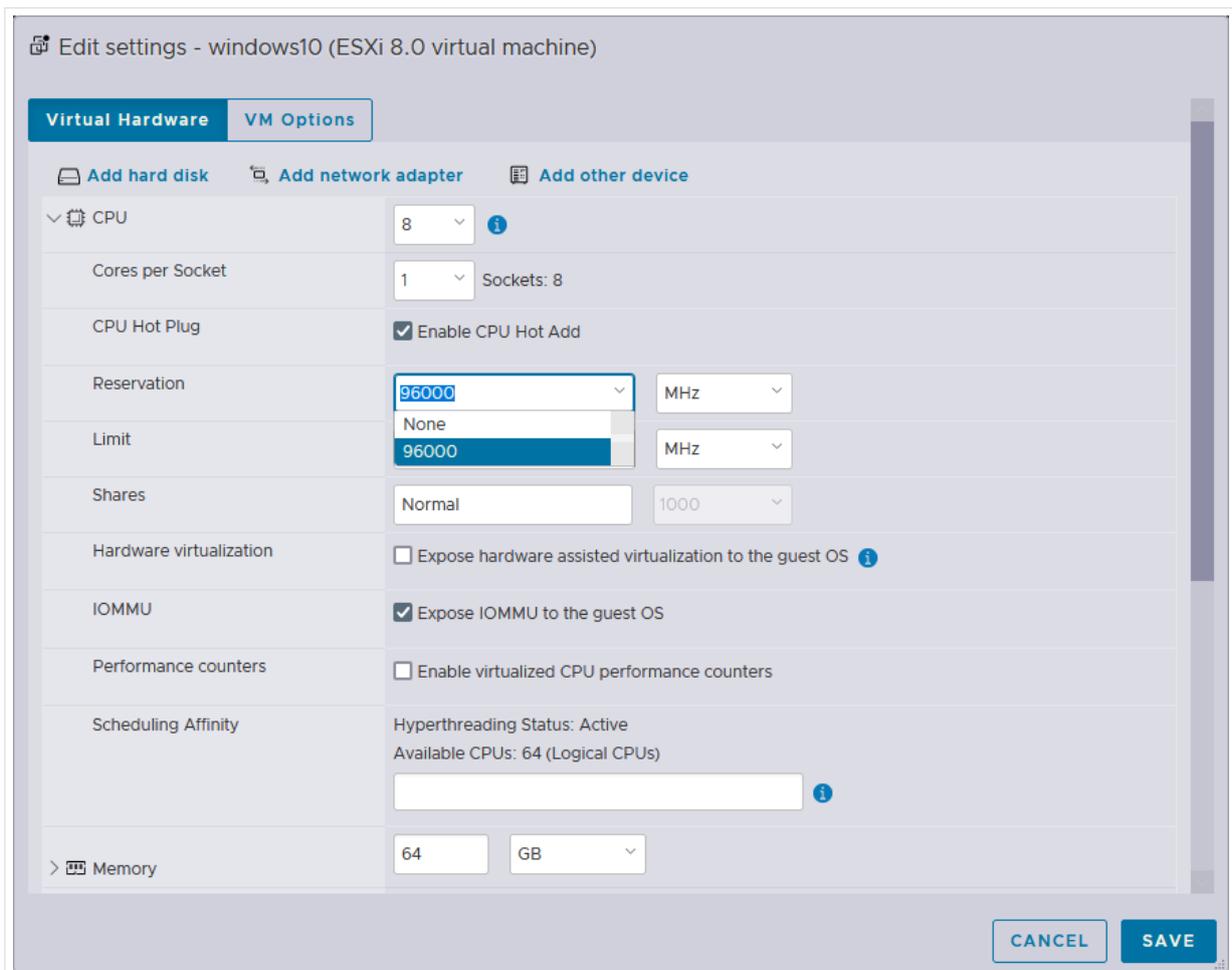

Figure 2: Virtual Machine / Virtual Hardware / CPU Reservation example

In the *Virtual Hardware* settings, the memory reservation must be fully allocated. This is also necessary for the referring Latency Sensitivity as shown in figure 4 (Virtual Machine / Virtual Hardware / VM Options / Latency Sensitivity example), page 8

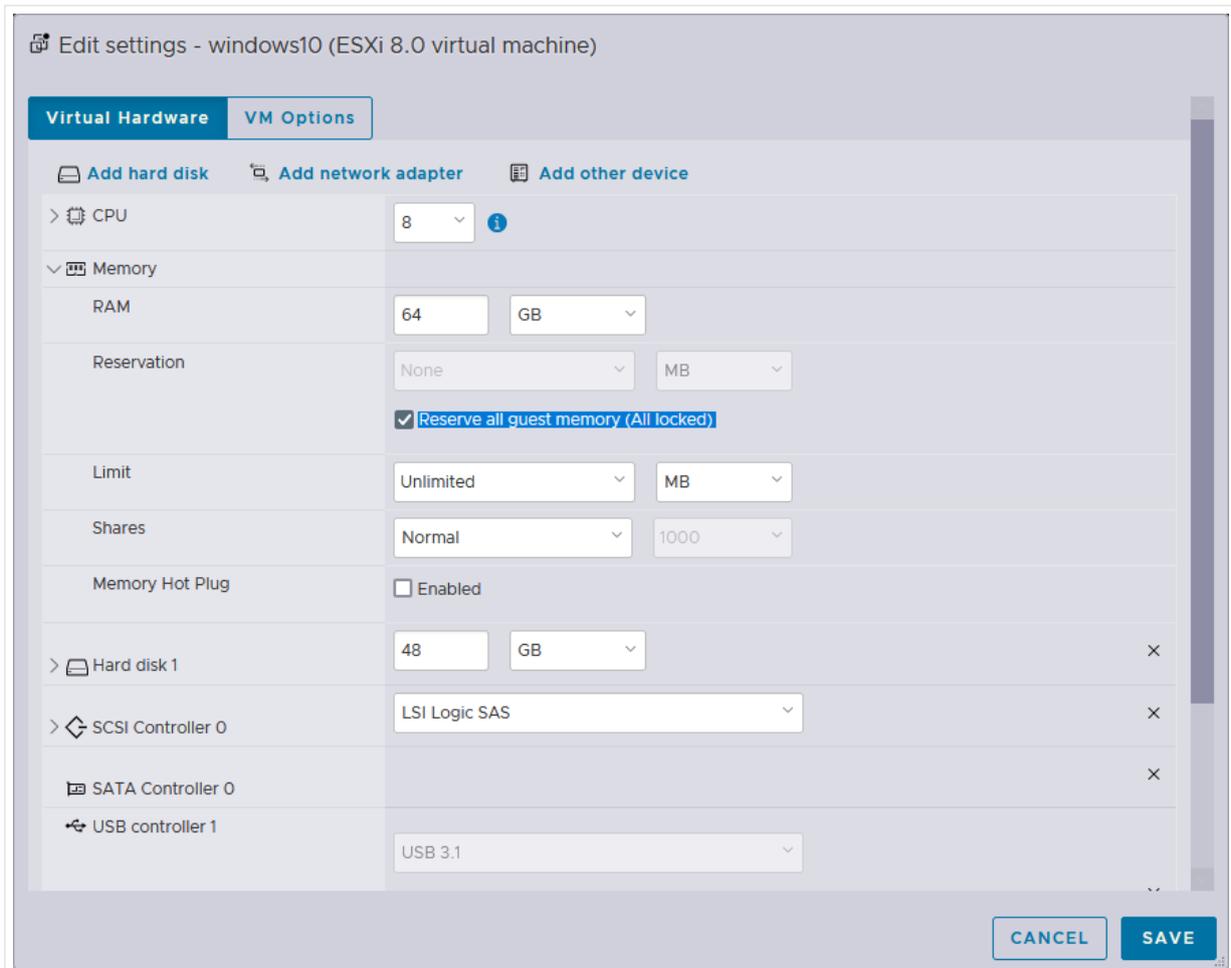**Figure 3:** Virtual Machine / Virtual Hardware / Memory Reservation example

In the VM Options, the Latency Sensitivity must be set to *High*.
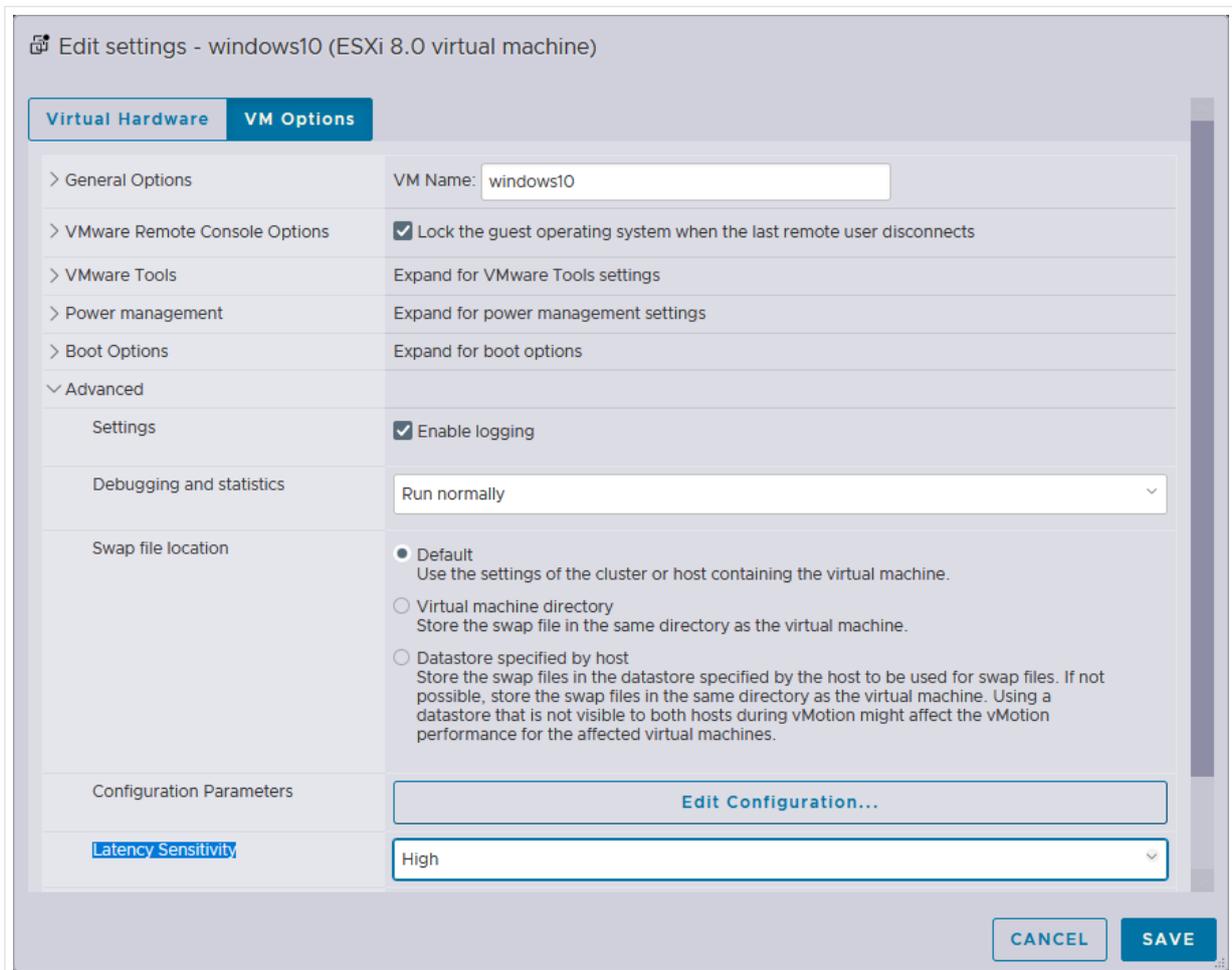

Figure 4: Virtual Machine / Virtual Hardware / VM Options / Latency Sensitivity example

3.2 Pseudo Performance Counter for VMware ESXi Servers

For setting up the pseudo performance counter, the virtual machine where XCAPI is running must be down. Use the *Edit settings* button for the VM configuration and switch to the *VM Options* tab. Open the *Advanced* details and click *Edit Configuration*.
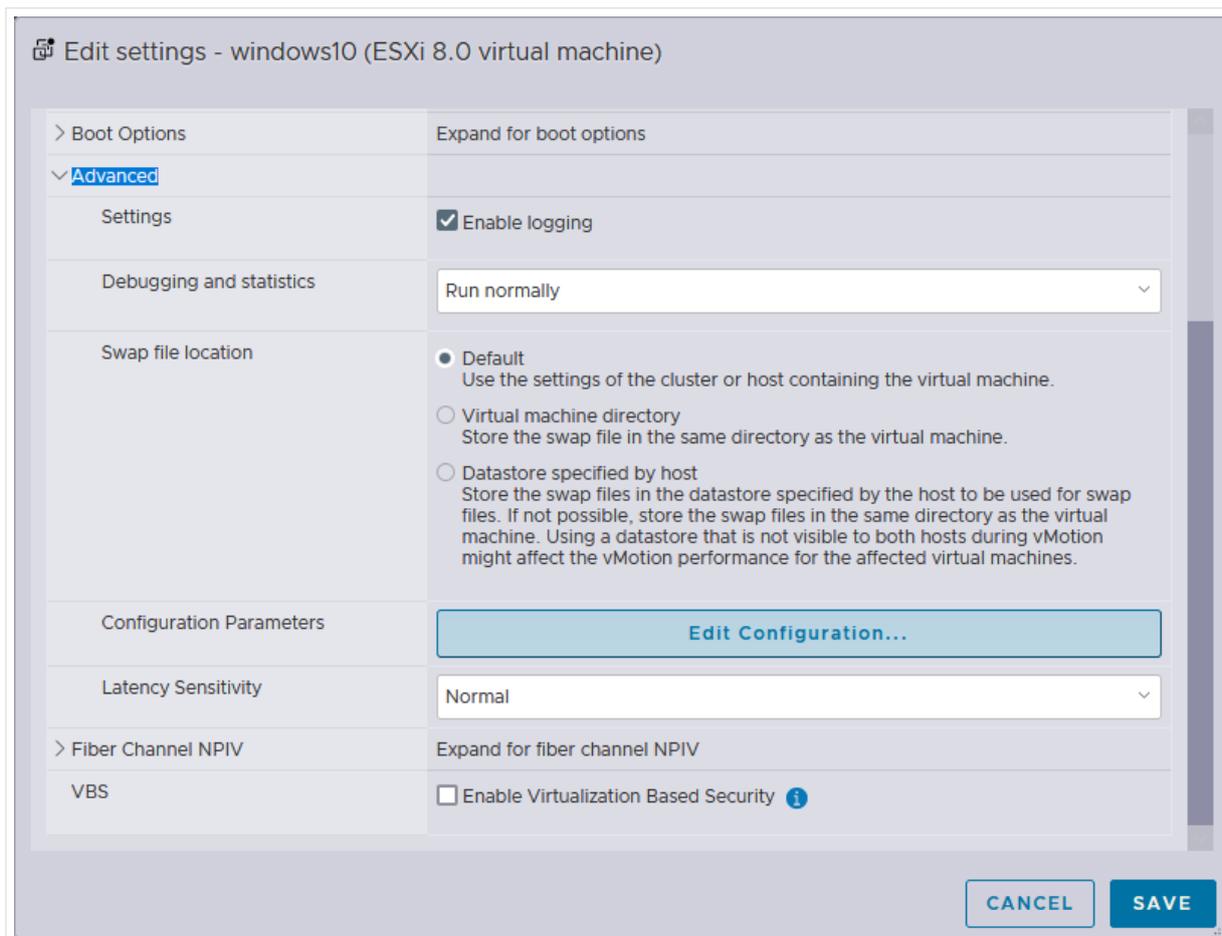

Figure 5: VM Options / Advanced / Edit Configuration example

Use the *Add parameter* button for entering the key **monitor_control.pseudo_perfctr**. The value must be set to **TRUE**. Apply the changes with *OK*. Back in the *Configuration Parameters* dialog, confirm the change with the *OK* button. Afterwards you can start the virtual machine again.
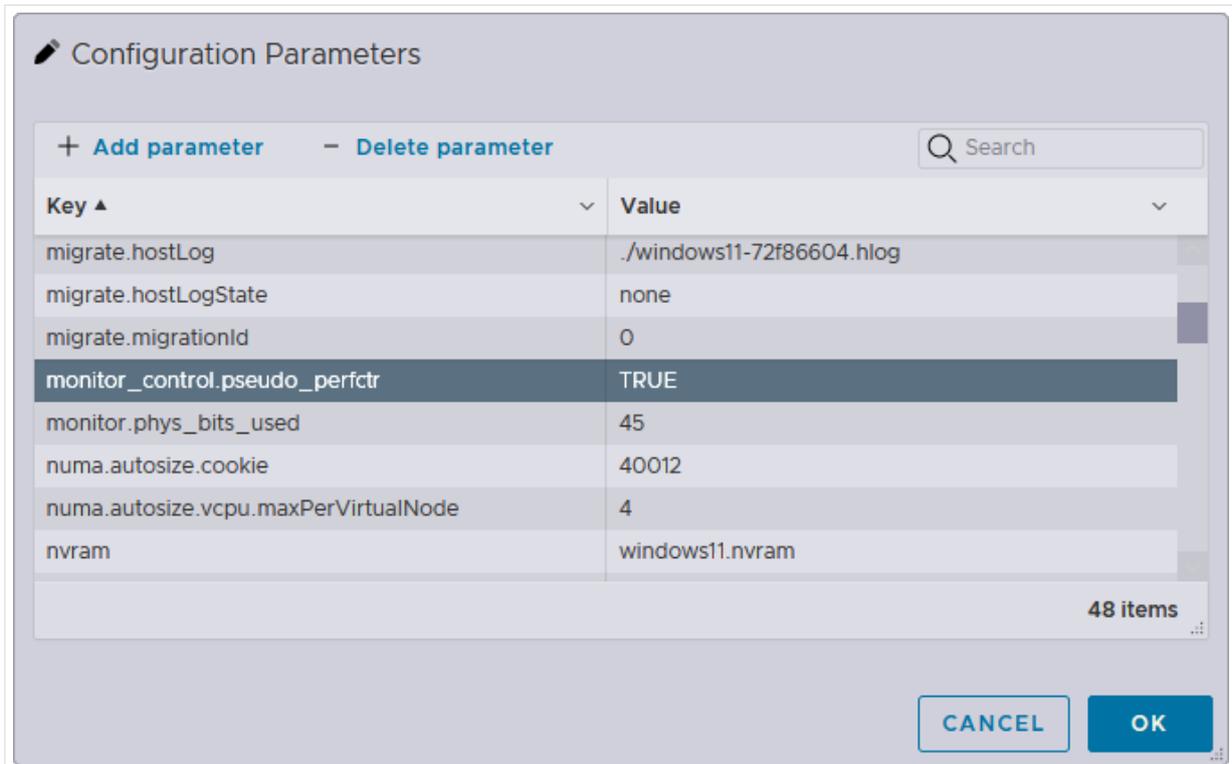

Figure 6: VMware Configuration Parameters example

3.3 Virtual Performance Monitoring Counters (vPMC) support for XCAPI

For enabling the pseudo performance counter for XCAPI, the *xfinetune.exe* tool must be started. The executable is located in the XCAPI installation path, by default: `"\\Program Files (x86)\TE-SYSTEMS\XCAPI\"`.
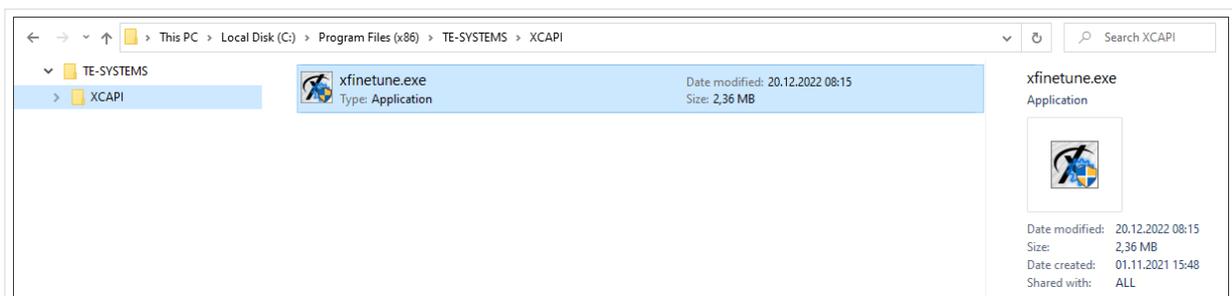

Figure 7: XFinetune (xfinetune.exe)

In the *General* settings, the **High Resolution Time Source** must be enabled, and **VMWARE** must be selected as time source. As soon as this value is selected, a warning pop-up box appears, stating that this setting can only be made when the pseudo performance configurations were previously done on the VM as described in section 3.2 (Pseudo Performance Counter for VMware ESXi Servers), page 9. Acknowledge both, the warning and afterwards the configuration changes with the *OK* button. Finally, a reboot is required to activate this change to the configuration, so be sure you have accounted for this.
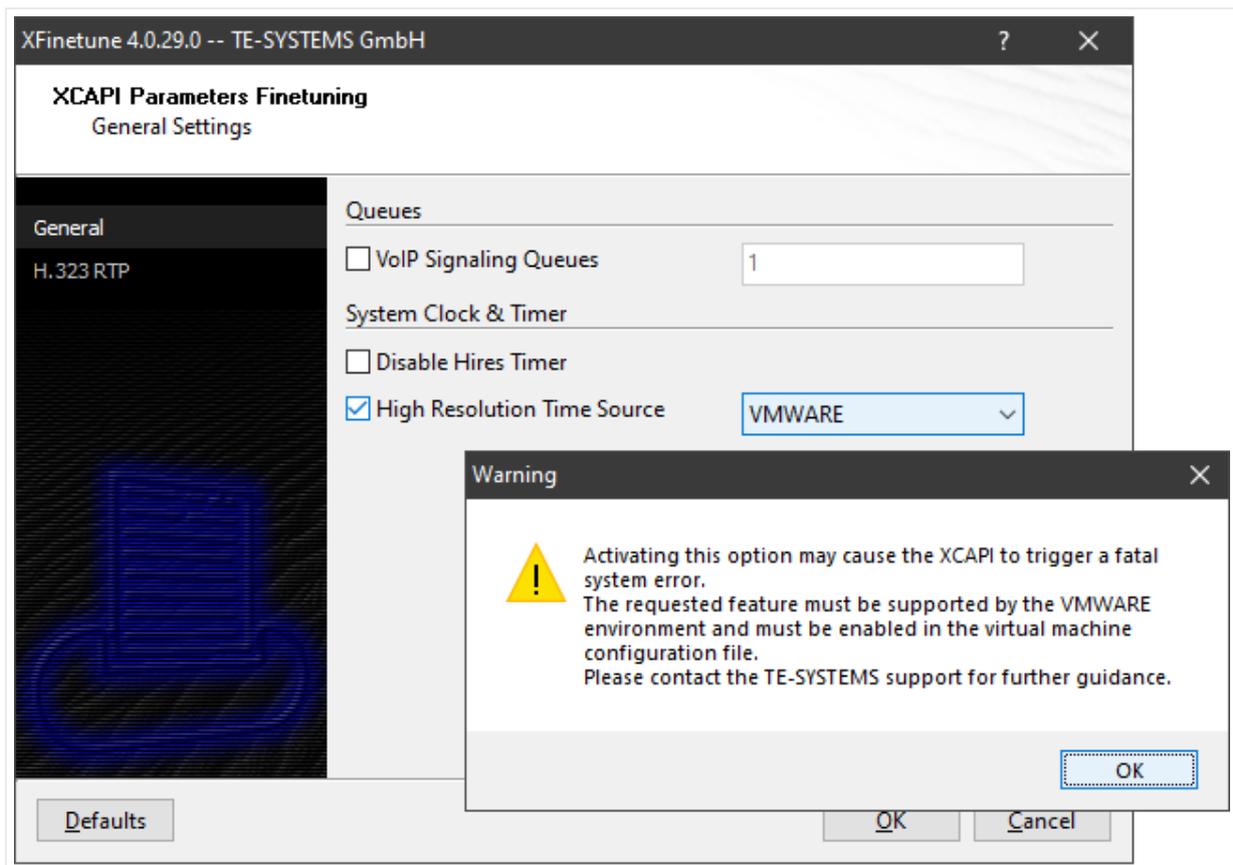
Figure 8: XFinetune (xfinetune.exe) / High Resolution Time Source example

> ⚠ Note, if the pseudo performance counter has not been enabled as described in section 3.2 (Pseudo Performance Counter for VMware ESXi Servers), page 9, but the XCAPI timer source has been set to *VMWARE*, this function call will instantly lead to a system error within the related VMware session. Ensure that the *Virtual Performance Monitoring Counters (vPMC)* configuration for the VM is done *before* switching the high resolution timer source for XCAPI.

3.4 XCAPI License and MAC Address Binding

A license key is commonly bound to the unique MAC addresses of a network interface. Avoid MAC address changes after requesting an XCAPI license, as a change in the MAC address (aka "System ID") will invalidate the license. Bear in mind that this also includes virtual machine movements. At this juncture you will be asked to choose a new *Identifier* at the first reboot. Without exception you have to select the option *Keep its old identifier*. When generating a new identifier by choosing *Create*, the MAC address of the virtual machine will be changed. Again, this will cause the XCAPI license to become invalid.

ESXi server requests *"Did you move this virtual machine, or did you copy it?"* must always be confirmed with *I moved it*. When generating a new "identifier" by means of *Create*, the MAC address of the virtual machine will be changed and thus XCAPI's license will become invalid. You can avoid such issues in advance by allocating a fixed MAC address for the virtual machine before installing XCAPI. More information can be found in the VMware knowledgebase entry: Changing the MAC address of a hosted virtual machine (507)[11]).

The MAC address must be set to `00:50:56:XX:YY:ZZ`. The variables **XX**, **YY**, and **ZZ** can be populated with the below value ranges:

`XX: 00h – 3Fh`, `YY: 00h – FFh`, `ZZ: 00h – FFh`.

Before determining the hardware ID it is necessary to perform a complete XCAPI installation. If the virtual machine will be moved after the XCAPI installation, the MAC address can be reverted to the manually defined values afterward to be able to use the original XCAPI license.

```
ethernet0.address = "00:50:56:38:43:43"
ethernet0.addressType = "static"
ethernet0.generatedAddressOffset = "0"
ethernet0.present = "true"
```

CLI 1: Hosted virtual machine with static MAC address

Take note of the **uuid.location** and **uuid.bios** parameters which might have to be adjusted too. The last three octets must carry the same value.

```
ethernet0.address = "00:50:56:38:43:43"
uuid.location = "56 4d c4 97 53 f9 9c da-a6 67 0a d2 31 38 43 43"
uuid.bios = "56 4d c4 97 53 f9 9c da-a6 67 0a d2 31 38 43 43"
```

CLI 2: "uuid.location" and "uuid.bios" example

References

[1] `https://www.youtube.com/tesystems/`

[2] `https://community.te-systems.de/`

[3] `https://kb.vmware.com/s/article/1025279`

[4] `https://kb.vmware.com/kb/1008360`

[5] `https://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/techpa-per/performance/vsphere-esxi-vcenter-server-80-performance-best-practices.pdf`

[6] `https://docs.vmware.com/en/VMware-Edge-Compute-Stack/1.0/ecs-enterprise-edge-ref-arch/GUID-A191D284-1CDE-4602-9940-CE1B9376684C.html`

[7] `https://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/techpa-per/performance/hpm-vsphere7-perf.pdf`

[8] `https://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/techpa-per/performance/media-workloads-on-vsphere67-perf.pdf`

[9] `https://www.vmware.com/files/pdf/techpaper/VMW-Tuning-Latency-Sensitive-Workloads.pdf`

[10] `https://www.vmware.com/files/pdf/techpaper/latency-sensitive-perf-vsphere55.pdf`

[11] `http://kb.vmware.com/kb/507`