AlphaVM for Windows
User Manual

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1 Scope

This is a user manual for the AlphaVM line of products currently represented by AlphaVM-Pro, AlphaVM-DC and AlphaVM-Basic running on Windows.

AlphaVM-Pro, the professional Alpha system emulator. It is meant to replace Alpha servers working in data centers or industrial settings. It has high performance and reliability characteristics. Its performance is on the level of the real Alpha systems. AlphaVM-Pro is capable of replacing machines of DS10, DS20, ES40, DS25, ES45 class of Alpha systems.

AlphaVM-DC is a variant of AlphaVM-Pro for data centers. The main difference is in the licensing. AlphaVM-DC license binds to the hypervisor appliance virtual hardware rather than to a USB dongle.

AlphaVM-Basic is a basic emulator that supports 1 basic CPU and 1GB RAM.

2 Installation

2.1 Host platform requirements

2.1.1 Requirements for AlphaVM-Pro

The general requirements are as follows:

- The operating system must be Windows x64 6.0 or higher:
    - Windows Server 2008,
    - Windows Server 2008R2
    - Windows Server 2012,
    - Windows Server 2012R2
    - Windows Server 2016
    - Windows Server 2019
    - Windows Vista,
    - Windows 7,
    - Windows 8.
    - Windows 10.

    We recommend a server operating system Windows Server 2008 or 2012. We do not recommend Vista.

- The host system must have a CPU, which supports CMPXCHG16B, SSE3 and SSSE3 instruction set features. These features are not available only on very old CPUs.
- The host CPU performance has a direct influence on the emulated system performance. The actual host CPU type depends on your performance requirements. We recommend fast new Intel CPUs (at least 3GHz). Here are some of them
    - E3-1240v3 (4 cores, 3.4GHz),
    - E3-1270v3 (4 cores 3.5GHz),
    - E3-1280v3 (4 cores, 3.6GHz),
    - E5-2643v2 (6 cores, 3.5GHz),
    - E5-2637v2 (4 cores, 3.5GHz, the host system can have 1 or 2 CPUs).

    HP ProLiant servers can be equipped with these CPUs.
- The product requires a reserved host CPU core for each emulated CPU. This means that a single CPU emulator requires at least a dual-core host system. A dual CPU emulator requires a 3 core system. We advise a double amount of cores with respect to the emulated CPUs.
- The host memory requirement depends on the emulated Alpha memory size and other emulator settings. The general requirement is as follows: if the emulated system has N GB memory, than the host system must have at least N + 2GB memory. Besides the emulated memory size, the following factors may influence the required amount: number of CPUs, number of disks, caching settings for disks. We advise at least N + 4GB.
- JIT CPU versions require more memory and CPU resources than the basic CPU.

- The product is supported on virtual platforms: Hyper-V, VMware, Proxmox VE. The product may also run on other platforms like Virtual Box. However, running on a hyper-visor means extra level of virtualization, which can cause performance degradation. This document does not cover in detail the configuration specifics for these platforms. Some details can be found on our website.
- Emulated Ethernet controllers are mapped to host Ethernet controllers (NICs). Note that mapping to Wireless Ethernet controllers does not always work. It is advisable to have a separate host NIC for each emulated NIC.

The actual requirements are very specific for a given configuration and workload. Contact our support to get an advice about hardware required for your configuration.

2.1.2 Requirements for multiple instances

It is possible to run multiple instances of the emulator on the same host machine. The requirements in this case just add up.

For instance, if you run two similar virtual machines on the same host, the requirements are double of the single instance requirements.

2.1.3 Requirements for running on a hyper-visor.

AlphaVM is an application that runs on the host OS. The host OS in turn can run on a physical hardware or on virtual hardware provided by VMware, Hyper-V, Proxmx VE, etc.

The requirements for the hosting VM are the same as for a hardware host requirements.

It is recommended to use a dedicated host VM NIC for each AlphVM NIC.

When running on a hypervisor, the hypervisor controls how the host hardware system resources are assigned to the VM that host AlphaVM. It is important that AlphaVM gets enough resources to show adequate performance. AlphaVM performance will suffer on an overcommitted hypervisor.

The AlphaVM CPU emulator for each Alpha CPU has a single main thread that implements the main CPU workflow. This thread either interprets Alpha instructions read from memory or executes native code created by the just-in-time compiler for the Alpha instruction stream. Alpha CPU has more auxiliary threads that, for instance, run the just-in-time compiler. However, the main CPU workload is inherently single threaded, because the CPU actions are essentially sequential, although in real CPU some fine grained parallelism could occur due to pipelining. In AlphaVM the instructions are executed sequentially.

The single-threaded nature of Alpha CPU means that a single Alpha CPU is not scalable and it needs 100% of the host CPU to execute efficiently. If Alpha CPU gets, for instance, only 50% of the host CPU power, Alpha CPU performance will be about 50% of what it could be.

Alpha CPU constantly keeps executing the Alpha instruction stream, which explains 100% host CPU resource usage. The only reason why Alpha CPU can stop using 100% of the host CPU resources is the idle release – a feature that allows to release the host CPU when the guest OS (OpenVMS or Tru64) is idle. This is achieved by the guest OS idle loop detection feature.

Naturally, different Alpha CPUs can run in parallel on different host cores.

It is recommended for the VM hosting AlphaVM to be given enough resources to ensure that AlphaVM always gets 100% of the host CPU and enough memory backup.

If AlphaVM performance is important, we recommend running on a physical server rather than on a hypervisor.

2.2 Obtaining the software

Please contact us per e-mail

mailto://sales@emuvm.nl

AlphaVM-Pro requires a USB license key to run. The key and the software will be sent to you when you purchase the software.

AlphaVM-DC requires a software key to run. We generate the license key based on the information about hypervisor appliance virtual hardware provided by our tool.

The software license price depends on the virtual Alpha system configuration. You can request a quote on the page http://emuvm.com/alphavm_pro_quote.php.

2.3 Installation procedure

The product is distributed in the form of Windows installer package. To install the emulator, run the installer. Then just follow the installation procedure.

The installer installs the following third party components needed for AlphaVM operation.

- **.NET Framework**. The installer will check and install the .NET Framework 4. It is required for proper operation of the user interface. The installer does not contain the full redistributable package of the framework. Instead, it will try to perform a network download and installation. If needed, you can install the framework before the installation.
- **PuTTY terminal emulator**. PuTTY terminal emulator is used to connect to the emulated Alpha serial console. The user can use another terminal emulator. However, we recommend installing PuTTY anyway as a fallback. The putty executable will be put in the same directory where the emulator is installed.
- **WinPcap Ethernet packet driver**. WinPcap is used to pass packets between the emulator and the real network. This is widely used driver certified to work in Windows operating systems. You may want to disable installation of WinPcap if it is already installed. This is especially useful if you want to keep another version of software.

For AlphaVM-Pro the installer installs the following Windows services:

- **EmuVMSrv**. This service is needed to run the virtual machine automatically. It’s executable is emuvmsrv.exe
- **EmuVMLicense**. This service implements the licensing mechanism. The executable is keylok_service.exe.

2.4 Uninstallation

To uninstall the emulator use the "uninstall" icon provided in the program menu reachable from the Start menu or launch the un-installation otherwise.

3 Configuration

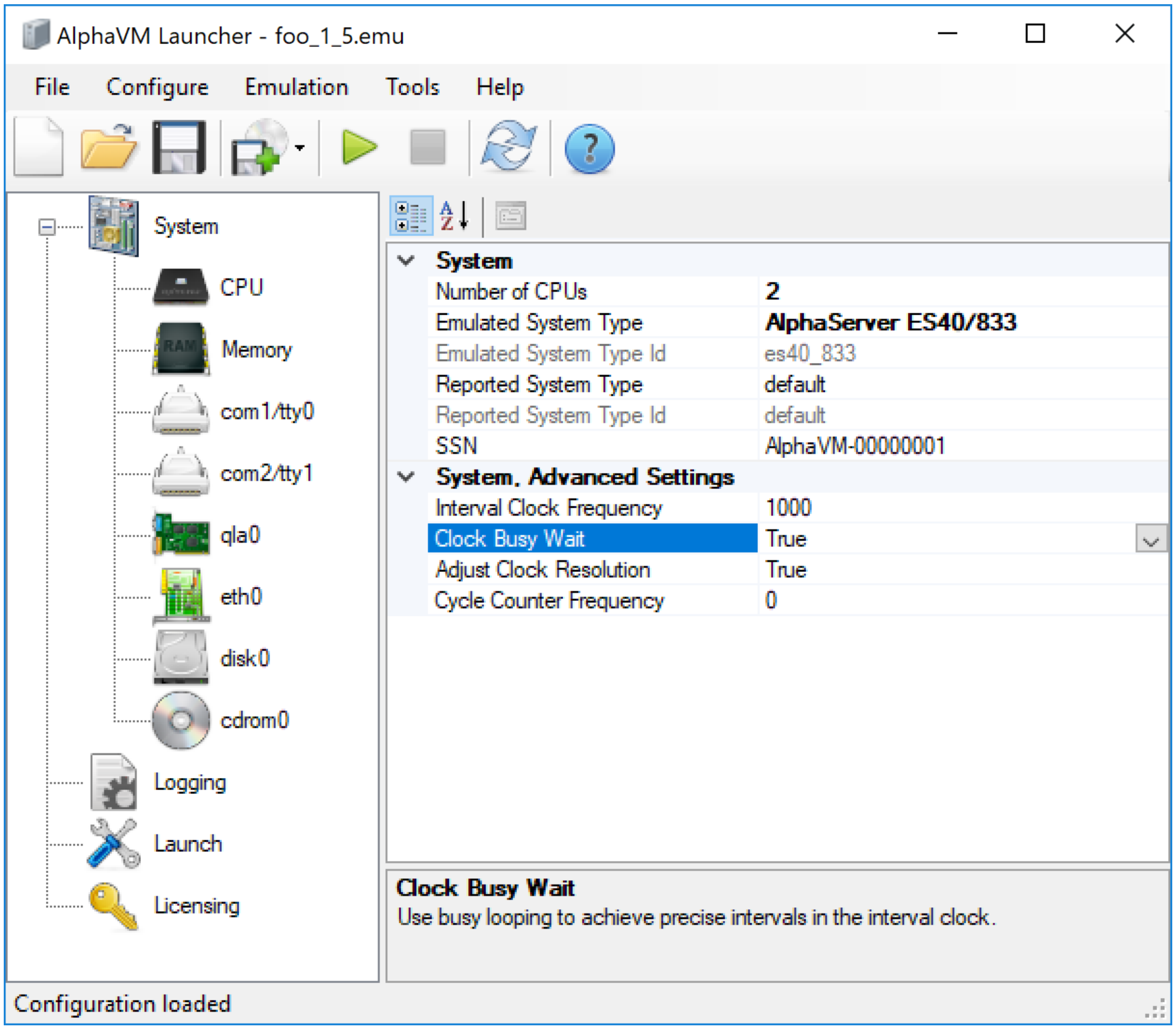
Before you can run you virtual Alpha system, it has to be created and configured. The VM configuration specifies properties of the emulated system: the number of CPUs, the memory size etc.

The emulator is configured by means of the elements of the user interface. The configuration tree allows selecting objects to configure. The property grid on the right side allows specifying properties of the selected object.

The configuration can be loaded and saved via the file menu or via the toolbar.

3.1 System configuration

System configuration screen enables configuration of the emulated Alpha system.



System	
Number of CPUs	**2**
Emulated System Type	**AlphaServer ES40/833**
Emulated System Type Id	es40_833
Reported System Type	default
Reported System Type Id	default
SSN	AlphaVM-00000001
System, Advanced Settings	
Interval Clock Frequency	1000
Clock Busy Wait	True
Adjust Clock Resolution	True
Cycle Counter Frequency	0

Clock Busy Wait
Use busy looping to achieve precise intervals in the interval clock.

Configuration loaded

Configuration properties:

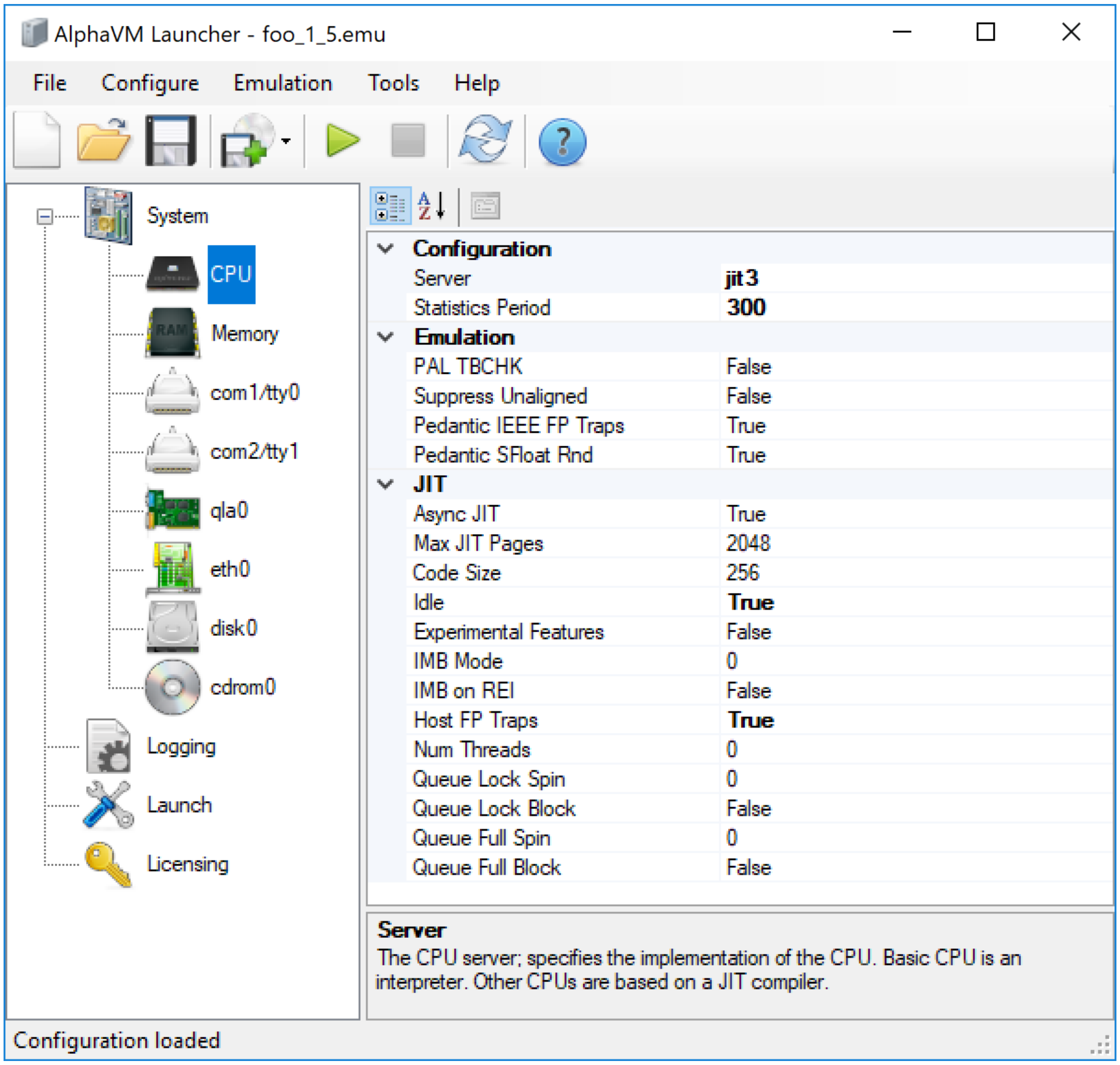
- **SystemType** specifies the type of the emulated system. Currently the following systems are supported:
  - AlphaServer DS10 466MHz, model 1839 (ds10_466)
  - AlphaServer DS10 616MHz, model 1970 (ds10_616)
  - AlphaServer DS10L 466MHz, model 1961 (ds10l_466)
  - AlphaServer DS10L 616MHz, model 1962 (ds10l_466)
  - AlphaServer DS20 500MHz, models 1839, 1920 (ds20_500)
  - AlphaServer DS20E 500MHz, models 1840, 1921 (ds20e_500)
  - AlphaServer DS20E 667MHz, models 1939, 1940 (ds20e_667)
  - AlphaServer DS20E 833MHz, models 1982, 1983 (ds20e_833)
  - AlphaServer DS20L 833MHz, model 2006 (ds20l_833)
  - AlphaServer ES40 500MHz, models 1813 -1816 (es40_500)
  - AlphaServer ES40 500MHz, models 1817 -1820 (es40_667)

    - AlphaServer ES40 833MHz, models 1984 – 1987 (es40_833)
    - AlphaStation XP900 466MHz, model 1879 (xp900_466)
    - AlphaStation XP900 500MHz, model 1821 (xp1000_500)
    - AlphaStation XP900 667MHz, model 1822 (xp1000_667)
    - AlphaStation XP900 750MHz, model 1922 (xp1000_750)
- **SystemTypeId** shows an internal system type identifier for SystemType. Launcher passes this identifier to the VM to select a system to emulate.
- **ReportedSystemType** specifies the type of the system reported to the OS informational routines (like licensing). This option allows a system pretending to be another system, which is not actually implemented. By default, the same system information is returned as specified by **SystemType**. The value **default** instructs the system to use the same type as the specified by **type**. See values in the drop down menu of the Launcher. Other systems can be added upon request.
- **ReportedSystemTypeId** shows an internal system type identifier for **ReportedSystemType**. Launcher passes this identifier to the VM to select a system.
- **NumCPUs** specifies the number of CPUs in the emulated system. Please note that on a 32-bit Windows multi-processor configuration is not supported. The emulator reserves one core of the host system for each emulated CPU. The emulator needs at least one core for bookkeeping and IO processes. Thus, you need a dual core system to run with one emulated CPU, and at least 3-cores to run a dual CPU configuration. The maximal number of CPUs depends on the emulated system and on the product license. The default number of CPUs is 1.
- **SSN** specifies the system serial number of the emulated system. SSN is often used by third party software to identify the hardware for licensing purposes. This value is a string of max 16 characters long.
- **Interval Clock Frequency** specifies the interrupt clock frequency in Hz. Interrupt clock frequency specifies the number of timer interrupts per second. Please do not change this value unless you know what you are doing. This value can affect stability of the system. The standard Alpha frequency is 1000 interrupts/second. However, this frequency can be changed for performance tuning reasons. It is communicated to the operating system via HWRPB. OpenVMS and Tru64 adjust to this value. For performance reasons, it could be better to set this value to 100. Currently Linux does not seem to work correctly with non-standard values.
- **Busy Clock Wait** specifies whether to use a busy loop to make the clock intervals precise. The default value is True, which corresponds to the behavior of the product prior to introduction of this option. This option is introduced to prevent excessive CPU usage by the timer when the host is not capable of providing reliable intervals. Disabling busy loops can be useful when running on a host with scarce CPU resources or on a virtual host that is poorly scheduled.
- **Adjust Clock Resolution** specifies whether AlphaVM tries to change Windows clock resolution to have a better response time on Windows level. By default, it is true.
- **Cycle Counter Frequency** can be used to override the default cycle counter frequency defined by the emulated system. The default value for this option is zero, which means that the default clock of the emulated system is used. This option does not influence the real performance of the

VM. However, this option can be useful when an application in the guest system uses a timing calibration algorithm based on the cycle counter frequency.

3.2 CPU Configuration

CPU configuration node is used to configure all CPUs in the system. All CPUs in the system will get the same properties.



Configuration	
Server	**jit3**
Statistics Period	**300**
Emulation	
PAL TBCHK	False
Suppress Unaligned	False
Pedantic IEEE FP Traps	True
Pedantic SFloat Rnd	True
JIT	
Async JIT	True
Max JIT Pages	2048
Code Size	256
Idle	**True**
Experimental Features	False
IMB Mode	0
IMB on REI	False
Host FP Traps	**True**
Num Threads	0
Queue Lock Spin	0
Queue Lock Block	False
Queue Full Spin	0
Queue Full Block	False

Server
The CPU server; specifies the implementation of the CPU. Basic CPU is an interpreter. Other CPUs are based on a JIT compiler.

Configuration loaded

Configuration properties:

- **Server** specifies a CPU server to be used. Currently there are the following servers available:
    - **Basic** server is a server with a basic performance.

    - **JIT1** is the server with the performance on the level of fast EV4. It is based on Just-in-time compilation technology (JIT), which translates the Alpha code to a faster native code.
    - **JIT2** is a server with the performance on the level of high-end EV5 – low-end EV6 Alpha CPUs.
    - **JIT3** is the fastest server with the performance of high-end EV6 – EV7 Alpha CPUs. Its performance is approximately double of **JIT2**.
- **Statistics Period** specifies the period between the CPU statistics dumps. For the workload profiling purposes, the CPU can dump statistics over a specific period. The default value is zero, which means that the dumps are disabled. Do not turn this option on for a production system.
- **TBCHK** specifies whether PAL TBCHK instruction is implemented. By default, it is not implemented. Do not change this default unless you know what you do.
- **Suppress Unaligned** specifies whether unaligned trap is to be generated when applicable; true by default. For some workloads that generate a lot of unaligned accesses it could be desirable to disable the unaligned access traps to increase performance. In that case AlphaVM performs unaligned access fixup in the similar way to the unaligned trap handler of OpenVMS or Tru64.
- **Pedantic IEEE FP Traps** specifies whether IEEE FP trapping is implemented exactly according to the Alpha architecture specification. It is by default true. When false, some more performance optimizations are possible. When disabled, it the inconsistency with Alpha architecture affects only trapping cases.
- **Pedantic SFloat Rnd** specifies whether rounding in IEEE single-precision floating point computations is implemented exactly according to the Alpha architecture specification. It is true by default. When disabled, some performance optimizations are enabled.
- **Queue Lock Retries** specifies the number of retries when trying to acquire the queue lock in the OpenVMS interlocked queue PALcode instructions. The default value is zero, which means that the system chooses the value.
- **Queue Lock Spins** specifies the number of spins when trying to lock a queue in the OpenVMS interlocked queue PALcode instructions. The default value is zero, which means that the system chooses the value.
- **Async JIT** specifies whether JIT compilation process is synchronous with respect to the CPU or asynchronous. By default, it is asynchronous. The synchronous mode is needed mostly for debugging.
- **Experimental Features** enables some JIT optimizations that are have not yet proven stable. These features are available on the field test basis and are not subject to the product support. Do not enable the experimental features in production environment.
- **Idle** when enabled, instructs the emulator to release the host CPU when the guest OS is idle. Most version of OpenVMS and Tru64 5.1b are currently supported. Note that this feature may negatively affect the performance of some IO-bound loads. The idle feature is available only in JIT CPUs.
- **IMB Mode** - this is an advanced feature for performance tuning. Do not change it unless advised to do so by EmuVM.

- **IMB on REI** – this is an obsolete feature that enables automatic instruction memory barrier on PAL REI. Do not enable it.
- **Max JIT Pages** specifies the maximal number of JIT pages that can be simultaneously active in the system. Each JIT page corresponds to a single page of Alpha code. Please do not change unless you know what you are doing. Lower values can lead to performance degradation, while higher values can cause excessive memory usage.
- **Code Size** specifies the default size in KB for memory allocation of code chunks. The default is 256k. Too big chunks can cause excessive memory consumption. Too small chunks can degrade the system performance due to frequent allocation. The advised values are in range 128 - 1024. The value is rounded up to 64k.
- **Host FP Traps** specified whether the FP traps are implemented using the host FP traps or by checking conditions. It is false by default, which corresponds to the old behavior. Setting it to true can yield a drastic performance improvement for some FP intensive workloads.
- **Num Threads** specified the number of just-in-time compiler threads used to compile the Alpha instruction stream into native code. This number specifies the number of threads per AlphaVM CPU, rather than in total. The default is zero, which means that AlphaVM selects the appropriate value automatically. Currently AlphaVM sets it to one. The value currently could be 0, 1, 2 or 4. The other values are converted to one of these values. Setting more than one thread can improve some workloads that cause a lot of JIT compilation. The host machine must have enough CPU power to benefit from additional threads.
- **Queue Lock Spin** is for performance tuning by EmuVM engineers. It specified the number of attempts the CPU tries to acquire the JIT queue lock. Actually, **Queue Lock Spin** + 1 attempts are performed. The default value is zero, which means that only a single attempt is made. When all attempts are exhausted, the action depends on **Queue Lock Block**. The CPU is either blocked until it can acquire the lock or the request is dropped.
- **Queue Lock Block** is for performance tuning by EmuVM engineers. Specifies whether the CPU is blocked or the request is dropped when **Queue Lock Spin** attempts to lock the JIT queue are exhausted. The default is not to block. Blocking the CPU can lead to performance problems.
- **Queue Full Spin** is for performance tuning by EmuVM engineers. It specified the number of attempts the CPU tries to push a JIT request onto the JIT queue. Actually, **Queue Full Spin** + 1 attempts are performed. The default value is zero, which means that only a single attempt is made. When all attempts are exhausted, the action depends on **Queue Full Block**. The CPU is either blocked until the request can be pushed or the request is dropped.
- **Queue Full Block** is for performance tuning by EmuVM engineers. Specifies whether the CPU is blocked or the request is dropped when **Queue Full Spin** attempts to lock the JIT queue are exhausted. The default is not to block. Blocking the CPU can lead to performance problems.

3.3 Memory configuration

Configuration properties:

- **Memory Size** specifies the RAM size in megabytes of the emulated system. The amount of memory you can use here depends on the amount of memory on your host computer. It is recommended to have at least 2GB of host memory. Maximal memory size depends on the emulated system and on the product licensing. The default size is 128M.

- **Lock** specifies whether to lock the guest memory in the host memory. Locking means that the pages are not unloaded from the memory by swapping. Locking can degrade performance, because other pages will be offloaded. This is an advanced option added for experimentation purposes. Locking is by default off. Note that you can only lock pages when the working set is large enough. If the VM fails to lock pages and logs an error, it continues without locking.

3.4 SCSI Controller Configuration

SCSI controllers can be added using the "Configure" menu and removed using a menu that appears on a right-click. The controllers have consecutive fixed names: *qla0*, *qla1*, … Only the last controller can be removed, which is to preserve this naming sequence.

The number of plugged controllers determines the number of SCSI buses available. You can select a SCSI bus in the SCSI device configuration using the bus number option.

Some Alpha systems have one or two built in SCSI controllers. These controllers will be present in the resulting system even if they are not present in the Launcher GUI configuration. Since the number of available buses in the GUI depends on the number of controllers available in the GUI, the controllers must be present to make the buses available.

The configuration of built-in controllers is given by qla0 and qla1. If the system does not have built-in controllers, then qla0 and qla1 cause controllers to be loaded in the available system slots.

Configuration properties:

- The option **SCSI ID** specifies the SCSI ID of the controller. Values are 0 .. 15. The default value is 7.
- The option **Slot** specifies the PCI slot to which the adapter is plugged. The default behavior is automatic; thus, you do not have to specify this option or know about slots. The automatic behavior covers most cases with OpenVMS. Tru64, however, is very sensitive to changes in the hardware configuration. When you copy your disk images from the real system, it can be required to specify the slots in such a way to reflect the configuration of the real. However, we advise to reconfigure Tru64 and rebuild the kernel rather than playing with the slots. The number of slots depends on the actual emulated system. The mapping of the slots to PCI hoses and IDSELs also depends on the system.

3.5 Disk configuration

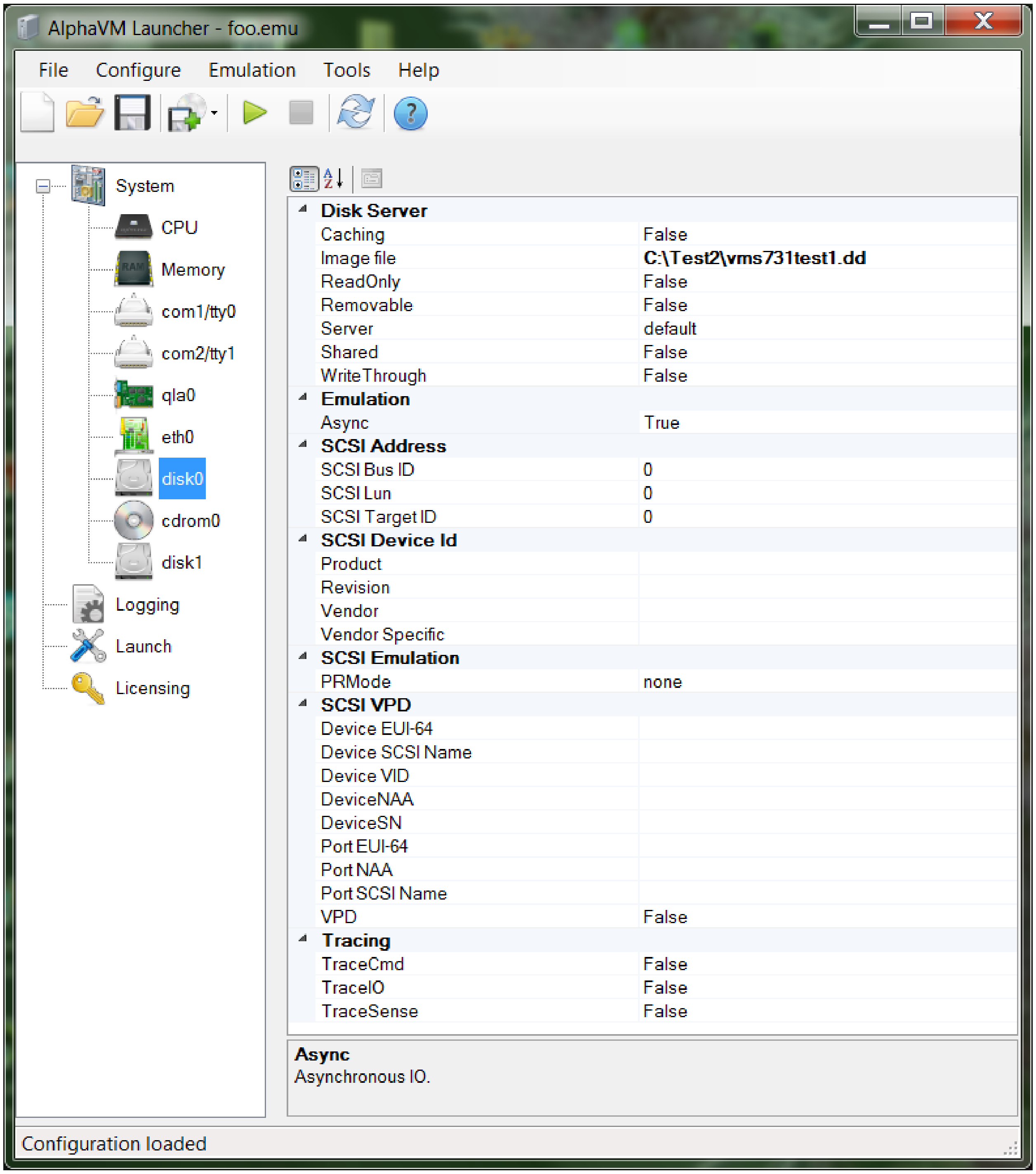
New disks can be added using the Configuration menu. A disk can be removed or renamed by means of a context sensitive menu available on right-click on the device in the configuration tree. Note that the device name has no meaning for the system; it is only used for convenience. For instance, you can choose this name to be

- the disk label of the disk like mydatadisk, or

- the disk name in the SRM console like dka100, or
- the disk device name in your guest OS, like rz12.

The disk image must exist before you can attach it to the emulator. A fresh disk image can be created by means of the Make Disk tool available in the Tools menu. The Make Disk tool just creates an empty disk image file. It does not attach it to the emulator. Therefore, you have to attach it yourself after creation.

The disk configuration table enables configuration of the emulated disk properties.



Disk Server	
Caching	False
Image file	**C:\Test2\vms731test1.dd**
ReadOnly	False
Removable	False
Server	default
Shared	False
WriteThrough	False
Emulation	
Async	True
SCSI Address	
SCSI Bus ID	0
SCSI Lun	0
SCSI Target ID	0
SCSI Device Id	
Product	
Revision	
Vendor	
Vendor Specific	
SCSI Emulation	
PRMode	none
SCSI VPD	
Device EUI-64	
Device SCSI Name	
Device VID	
DeviceNAA	
DeviceSN	
Port EUI-64	
Port NAA	
Port SCSI Name	
VPD	False
Tracing	
TraceCmd	False
TraceIO	False
TraceSense	False

Async
Asynchronous IO.

Configuration loaded

Configuration properties:

- **Server** specifies how the disk is served. The default value is **default**, which means that the system determines how to server the disk. The servers are:
  - **basic** – disk server based on a basic IO.
  - **cport** – disk server based on asynchronous IO that uses Windows completion ports.

    - **mapped** – disk server based on a memory-mapped file IO. This server can only be used with regular files.

  The **default** value normally maps to **cport**. In some cases it can map to **basic**.
- **Image** specifies a file name of the disk image file used to store disk data. An empty disk image can be created with "Tools/Make disk". Please note that creation of a disk image does not connect it to the system. After creation, you still need to specify it in the **Image** property of one of the disks. The default value is empty, which means that there is no disk.
- **SCSI ID** specifies the SCSI target ID of the disk. The SCSI ID can have values 0 .. 6, 8 - 15. SCSI ID 7 is reserved for the SCSI controller. All SCSI devices in the configuration must have unique SCSI IDs. The default value is the disk number, which ensures that the disks have unique IDs.
- **SCSI BUS** specifies a SCSI bus to which the device is connected. The buses are numbered from zero. The number of SCSI buses depends on the amount and type of the SCSI controllers in the system. The number of SCSI buses depends on the amount and type of the SCSI controllers in the system. If you see and empty drop down box, it can mean that you have no SCSI controllers loaded. The default value is zero.
- **SCSI LUN** specifies SCSI logical unit of the disk device. The value can be 0..7. SCSI allows several logical devices to be associated with a single bus device. The default is 0.
- **Async** enables asynchronous operation of the disk with respect to the SCSI controller. It is by default **True**. It can make sense to turn it off for very fast memory-mapped IO, when extra context switches may cause extra overhead.
- **Caching** specifies whether caching of the disk image file is enabled on the host operating system level. The default value is off. In some situations, caching can improve IO performance. However, we noticed that disk IO intensive usage with caching enabled leads Windows to use most memory for disk caching, which results in excessive page faults, system trashing, and as the result CPU sanity checks on OpenVMS SMP configurations. There are complicated inter-decencies of this setting with the amount of available memory and working set settings.
- **WriteThrough** specifies whether write-through mode is enabled on the host operating system level. The default value is off. See the comment on the option Caching.
- **Shared** specifies whether the VM opens the disk image in shared mode. Normally it should be opened in exclusive mode to prevent multiple usage of the same file. The default value is false (exclusive mode), which guarantees that the disk can be modified only by the emulator.
- **ReadOnly** specifies whether the emulated disk is read-only. In this case the VM opens the image in read-only mode. The default value is false (writable)
- **Removable** specifies emulation of a removable disk. The default value is **no**. This option only makes sense for an image file. Essentially, if the image file cannot be open, the "no medium" status is returned instead of "offline". The file is closed upon the SCSI STOP command with LOEJ bit set. Unfortunately OpenVMS mount /unload does not set LOEJ bit. The following commands can be used on OpenVMS to force unload of a disk (or CDROM):

  ```
  $ rzt:==$sys$etc:rztools_alpha
  $ rzt dka100: /stop
  ```

  When such disk is mounted, AlphaVM tries to open the file.

- **Vendor, Product, Revision** specify the emulated disk attributes. When these attributes are unset, the AlphaVM provides some default attributes.
- **Vendor Specific** specifies the vendor specific field in the VPD field.
- **PRMode** specifies how the SCSI persistent reservations are implemented.
  - None – means that persistent reservations are not implemented and the disk returns the status "invalid command" for these SCSI commands.
  - Dummy – means that the device implements the commands, but no actual protection of reservations is done. The implementation is dummy. This option can be used when there is just one node working with the disk. It is useful for a single node Tru64 cluster.
  - Real – the system implements persistent reservations.

  *Currently only **none** is supported.*
- **VPD** enables SCSI vital product data reporting. The default is currently false.
- **Device EUI-64** specifies the device indetifier in the EUI-64 form (8,12 or 16 bytes). This form is provided by some SCSI or FibreChannel disk arrays. Example: *0000-0E11-0012-5205*. It corresponds to Tru64 *SCSI-WWID:0c000008:0000-0e11-0012-5205*.
- **Device SCSI name** specifies the device identifier in the SCSI name form.
- **Device VID** specifies the device identifier (VPD page 83). Example: *DEVICE-VID-EMUVM-0001.* It corresponds in Tru64 to something like *SCSI-WWID:03100025:"RZ26L   DEVICE-VID-EMUVM-0001".*
- **Device NAA** specifies the device identifier in the NAA form (8 or 6 bytes). Example: *6000-1fe1-0010-8d40-0001-0460-7270-00ca*. This corresponds to Tru64: *SCSI-WWID:01000010:6000-1fe1-0010-8d40-0001-0460-7270-00ca*.
- **Device SN** specifies the device serial number (VPD page 80): Example: DEVICE-SN-EMUVM-0001. In Tru64 it corresponds to something like *SCSI-WWID:0410002c:"DEC   RZ26L   DEVICE-SN-EMUVM-0001"*. The device serial number can also be used to emulate a HSZ unit. To emulate HSZ the vendor must be *DEC* and the product must start with *HSZ*. In this case the device SN is a concatenated SNs of this HSZ and the other HSZ in the dual set (20 characters together, 10 for each SN). Thus, *ZG41000118ZG41000119* corresponds to Tru64 *SCSI-WWID:0910003c:"DEC   HSZ70   ZG41000118ZG41000119:d00t00003l00000"*
- **Port EUI-64** specifies the device port EUI-64 identifier.
- **Port NAA** specifies the port NAA identifier.
- **Port SCSI Name** specifies the port name in the SCSI form.
- **TraceCmd** – enables tracing of SCSI commands
- **TraceSense** – enables tracing of SCSI sense information. SCSI sense information is normally send when an error or a non-standard situation occurs.
- **TraceIO** – enabled tracing on the level of disk server.

3.5.1 Disk names in AlphaVM SRM console

The SRM or VMS disk device name, e.g. dkb1201, is formed as follows:

- The First two letters **dk** designate SCSI disk

- The third letter designate the SCSI controller number **a**=0, **b** =1, …
- The number **n** defines SCSI id and logical unit: id=**n**/100, lun = **n** % 100

Thus dkb101 means that the disk is connected to the bus of the second SCSI controller (bus=1), SCSI ID is 12, SCSI Lun is 1.

3.5.2 Performance considerations

For most workloads it is recommended to use asynchronous IO with caching off and write through off.

Caching causes performance degradation for some operations like large file copy. In this case it causes excessive swapping at the host OS level.

Caching can be beneficial when the disk is relatively small comparing to the host RAM.

Disk IO performance depends on multiple factors. Some of them are given below.

- AlphaVM process working set size. The working set limits can be set in the Launch configuration section.
- Host system file cache size. It can be adjusted by the emulator at startup. See the Launch configuration section.
- Whether or not Windows has a paging file.

3.6 CDROM configuration

CDROM configuration is similar to disk configuration.

New CDROM can be added to the system using the Add CDROM button. It can be removed or renamed by means of a context sensitive menu available on right-click on the device in the configuration tree.

The image property here normally specifies a CDROM image file (ISO image). However, it can also be a physical CDROM name like \\.\Cdrom0.

CDROM does not have write-related properties. ISO images are always opened in read-only mode.

To programmatically eject CD on OpenVMS use the following commands:

```
$ rzt:==$sys$etc:rztools_alpha

$ rzt dka400: /stop
```

On Tru64:

```
scu –f /dev/rdisk/cdrom0c eject
```

3.7 SCSI Tape configuration

AlphaVM supports virtual (logical) SCSI tapes. The tape is emulated using tape image file. A virtual tape drive can be added from the configuration menu. As with other SCSI devices, the SCSI path should be unique.

Currently the virtual tape drive has no button in the UI to load/unload the medium. On OpenVMS please use rztools:

```
        $ rzt:==$sys$etc:rztools_alpha
```

Send load command to the tape:

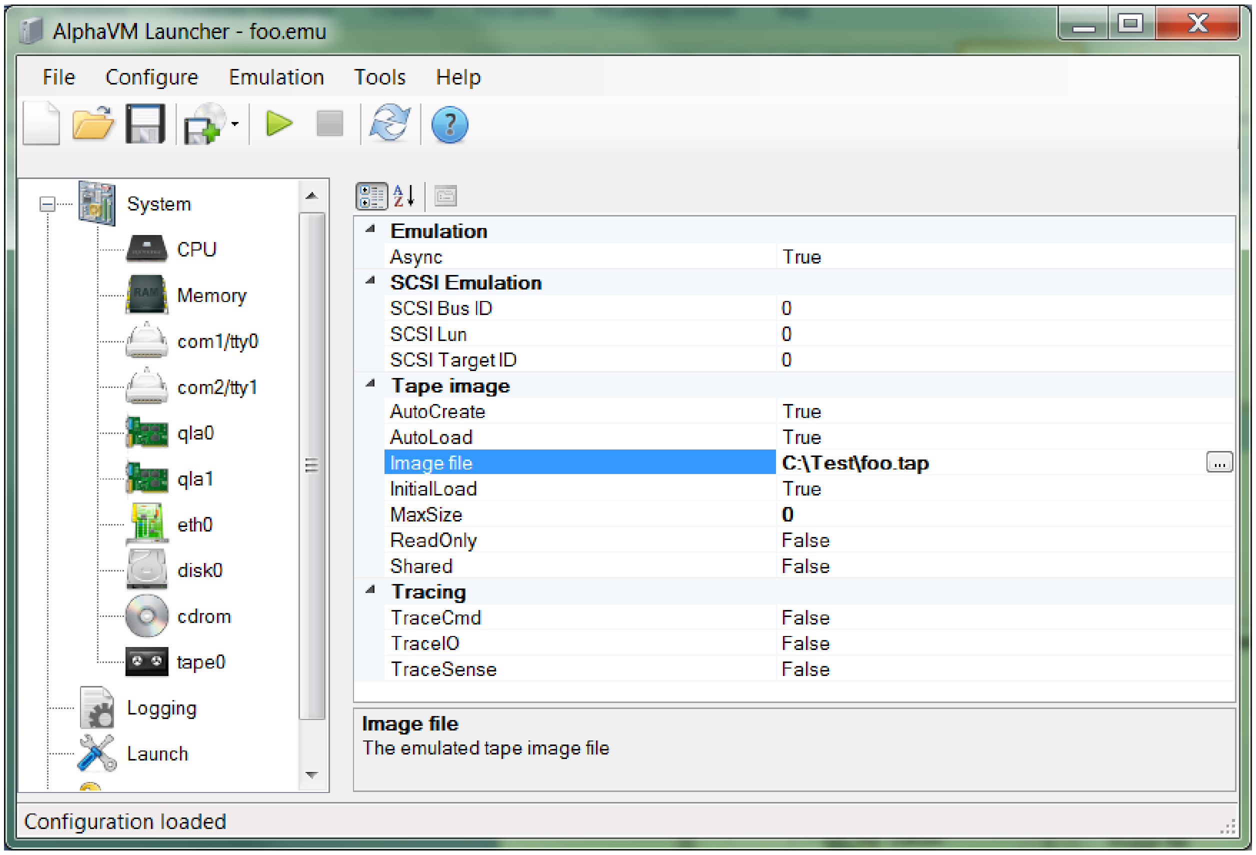
```
        $ rzt mka600: /start
```

Send unload command to the tape:

```
        $ rzt mka600: /stop
```

On Tru64 the tape can be operated with:

```
        # scu -f /dev/rmt0h
```



Emulation	
Async	True
SCSI Emulation	
SCSI Bus ID	0
SCSI Lun	0
SCSI Target ID	0
Tape image	
AutoCreate	True
AutoLoad	True
Image file	**C:\Test\foo.tap**
InitialLoad	True
MaxSize	**0**
ReadOnly	False
Shared	False
Tracing	
TraceCmd	False
TraceIO	False
TraceSense	False

Image file
The emulated tape image file

Configuration loaded

Configuration properties:

- **Image file** specifies a file name of the tape image file used to store data. An empty tape image can be created by creating an empty file. The default value is empty, which means that there is no medium in the tape drive.

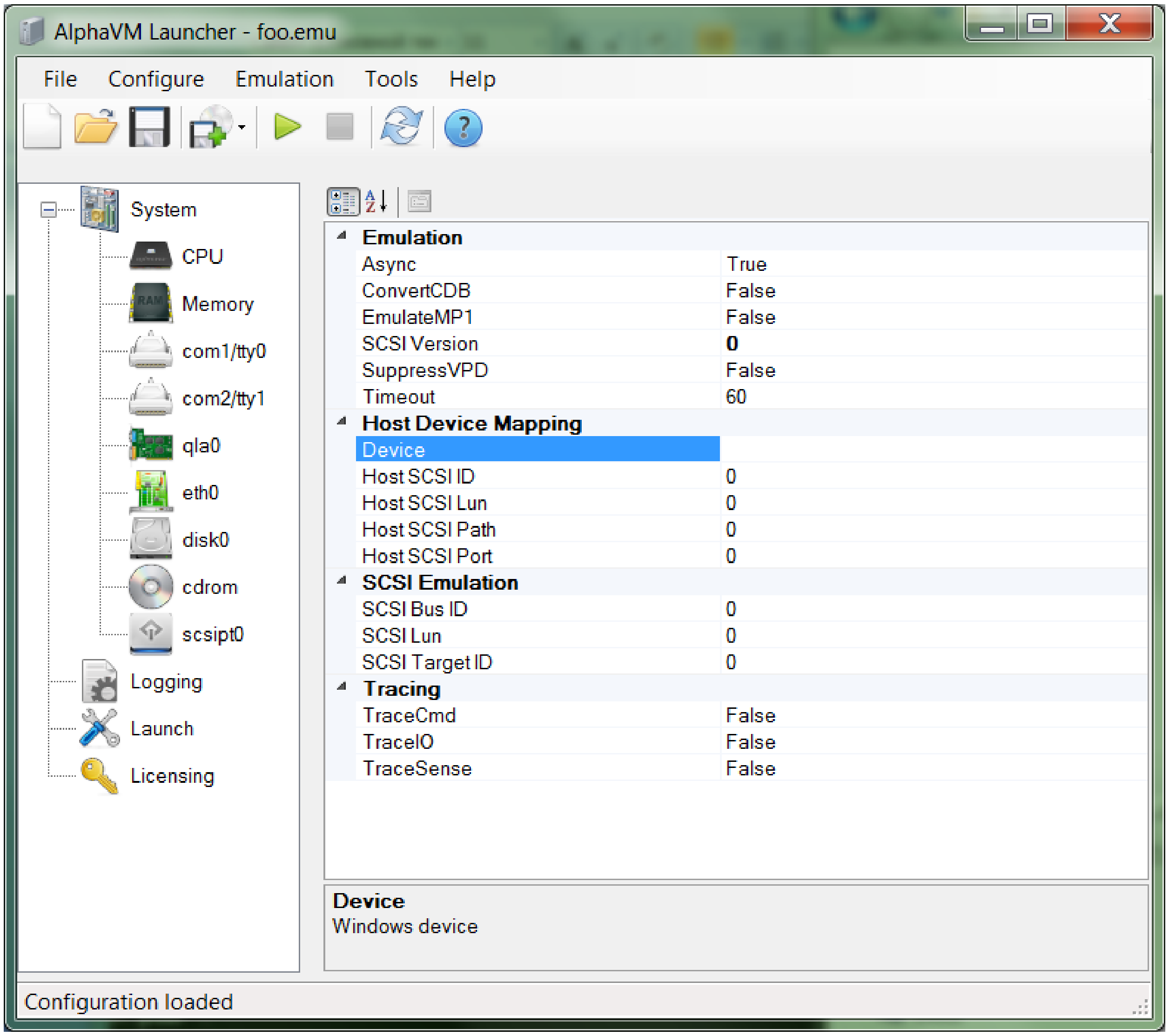
- **SCSI ID** specifies the SCSI target ID of the tape. The SCSI ID can have values 0 .. 6, 8 - 15. SCSI ID 7 is reserved for the SCSI controller. All SCSI devices in the configuration must have unique SCSI IDs. The default value is the disk number, which ensures that the disks have unique IDs.
- **SCSI BUS** specifies a SCSI bus to which the device is connected. The buses are numbered from zero. The number of SCSI buses depends on the amount and type of the SCSI controllers in the system. If you see and empty drop down box, it can mean that you have no SCSI controllers loaded. The default value is zero.
- **SCSI LUN** specifies SCSI logical unit of the disk device. The value can be 0..7. SCSI allows several logical devices to be associated with a single bus device. The default is 0.
- **Async** enables asynchronous operation of the tape with respect to the SCSI controller. It is by default **yes**. Tape it is a very slow device, which can block IO when in synchronous mode. This option is provided for debugging.
- **Initial Load** specifies whether the tape medium is loaded in the drive when the emulator starts. This is applicable only if the tape image file exists. If the image does not exist, it is considered that there is no medium in the drive.
- **AutoLoad** specified with the tape is automatically loaded on access. This means that the tape file is opened on access. When this option is off, a special load command must be issued to load the tape (see *rztools* commands earlier in this section). When auto-load is on, you do not need those commands. Note that multi-volume backups do not work with auto-load, because you do not have a chance to swap the media: the tape will automatically reopen the same file when it is done with the first volume.
- **AutoCreate** specifies whether an empty tape file is created, if it does not exist. It is convenient because you do not have to create empty tape files yourself.
- **Max Size** specifies the maximal size of the tape image file. This parameter can be used to create a multi-volume tape backup. The default value is zero, which means no limit.
- **ReadOnly** can be used to protect the tape from writing.
- **Shared** indicates the shared open mode of the tape drive.

3.8 SCSI Pass-Through (aka Direct SCSI, aka Generic SCSI) Configuration

AlphaVM-Pro is capable of accessing the host system SCSI devices by means of so called SCSI Pass Through mechanism. SCSI commands and data are passed between the guest and the hosts systems “as is”. This feature allows to access devices that are not available via the emulation layer. Examples of where the SCSI Pass Through is useful include access to the following devices:

- SCSI tape, which is not available otherwise
- SCSI disk, which can be taken from the real system and attached to the emulator to simplify migration
- ATAPI CDROM, which works as expected
- iSCSI disks
- SCSI devices of other types

Although the intention of SCSI Pass Through mechanism is to pass commands and data “as is”, some options are available to adjust commands and data in such a way that some useful devices are not rejected by OpenVMS or Tru64.



Emulation	
Async	True
ConvertCDB	False
EmulateMP1	False
SCSI Version	**0**
SuppressVPD	False
Timeout	60
Host Device Mapping	
Device	
Host SCSI ID	0
Host SCSI Lun	0
Host SCSI Path	0
Host SCSI Port	0
SCSI Emulation	
SCSI Bus ID	0
SCSI Lun	0
SCSI Target ID	0
Tracing	
TraceCmd	False
TraceIO	False
TraceSense	False

Device
Windows device

Configuration loaded

Configuration properties:

- **SCSI ID** specifies the SCSI target ID of the disk. The SCSI ID can have values 0 .. 6, 8 - 15. SCSI ID 7 is reserved for the SCSI controller. All SCSI devices in the configuration must have unique SCSI IDs. The default value is the disk number, which ensures that the disks have unique IDs.
- **SCSI BUS** specifies a SCSI bus to which the device is connected. The buses are numbered from zero. The number of SCSI buses depends on the amount and type of the SCSI controllers in the system. The number of SCSI buses depends on the amount and type of the SCSI controllers in the system. If you see and empty drop down box, it can mean that you have no SCSI controllers loaded. The default value is zero.

- **SCSI LUN** specifies SCSI logical unit of the disk device. The value can be 0..7. SCSI allows several logical devices to be associated with a single bus device. The default is 0.
- **Async** enables asynchronous operation of the unit with respect to the SCSI controller. It is by default **False**. A slow device in a synchronous mode can block IO. This option is provided for debugging.
- **Device** specifies the Windows device used to access by the SCSI Pass Through. It can be for instance "\\.\Tape0" or "\\.\PhysicalDrive2". If the value is empty, the following properties are used to identify the device: **Host SCSI Port**, **Host SCSI Path**, **Host SCSI Id**, **Host SCSI Lun**. These parameters are used to access the device through \\.\ScsiX. The default value is empty.
- **Host SCSI Port, Host SCSI Path**, **Host SCSI Id, Host SCSI Lun** specify the SCSI path of the host device. These options are ignored when the **Device** is specified. Their default values are all zero.
- **Suppress VPD** enables suppression of Vital Product Data in the SCSI Inquiry.
- **Emulate MP1** enables emulation of SCSI Mode Page 1 (read-write error recovery) in case the device does not provide it.
- **ConvertCDB** enables conversion of 6-byte SCSI commands to 10-byte SCSI commands. This mode is can be used to access some ATAPI devices. The default value is **False**.
- **Trace Command** enables logging of commands with sense data. Normally sense data is associated with errors or non-standard situations, so you may wish to enable it to see if something is going wrong. The default value is **False**.
- **Trace Sense** enables logging of all SCSI commands. This option is for debugging. The default value is **False**.

3.8.1 SCSI Tapes

One of the typical uses of the SCSI Pass Through is to access a physical SCSI tape attached to the host.

The tape device name in Windows has the form of \\.\Tape0, which should be used to configure the tape in the emulator.

Alternatively, if the tape device is disabled in the device manager, one can access it using **Host SCSI Port, Host SCSI Path**, **Host SCSI Id, Host SCSI Lun.** In that case the **Device** option should be empty.

3.8.2 iSCSI devices

The SCSI Pass Through can be used with devices available via iSCSI. This means that the iSCSI initiator must be configured for the device in Windows.

iSCSI target can naturally be on the same host or on a different host.

Linux iSCSI target is compatible with the emulator. It can be directly used.

Windows 2012 SCSI target can require **Suppress VPD** and **Emulate MP1** to be enabled.

3.8.3 Non-SCSI disks

Windows converts SCSI commands to ATAPI device commands, in such a way that SCSI Pass Through can be used to access ATAPI devices. For instance, an ATAPI CDROM drive or a USB stick can be accessed this way.

Note that not all devices respond in a way accepted by OpenVMS or Tru64.

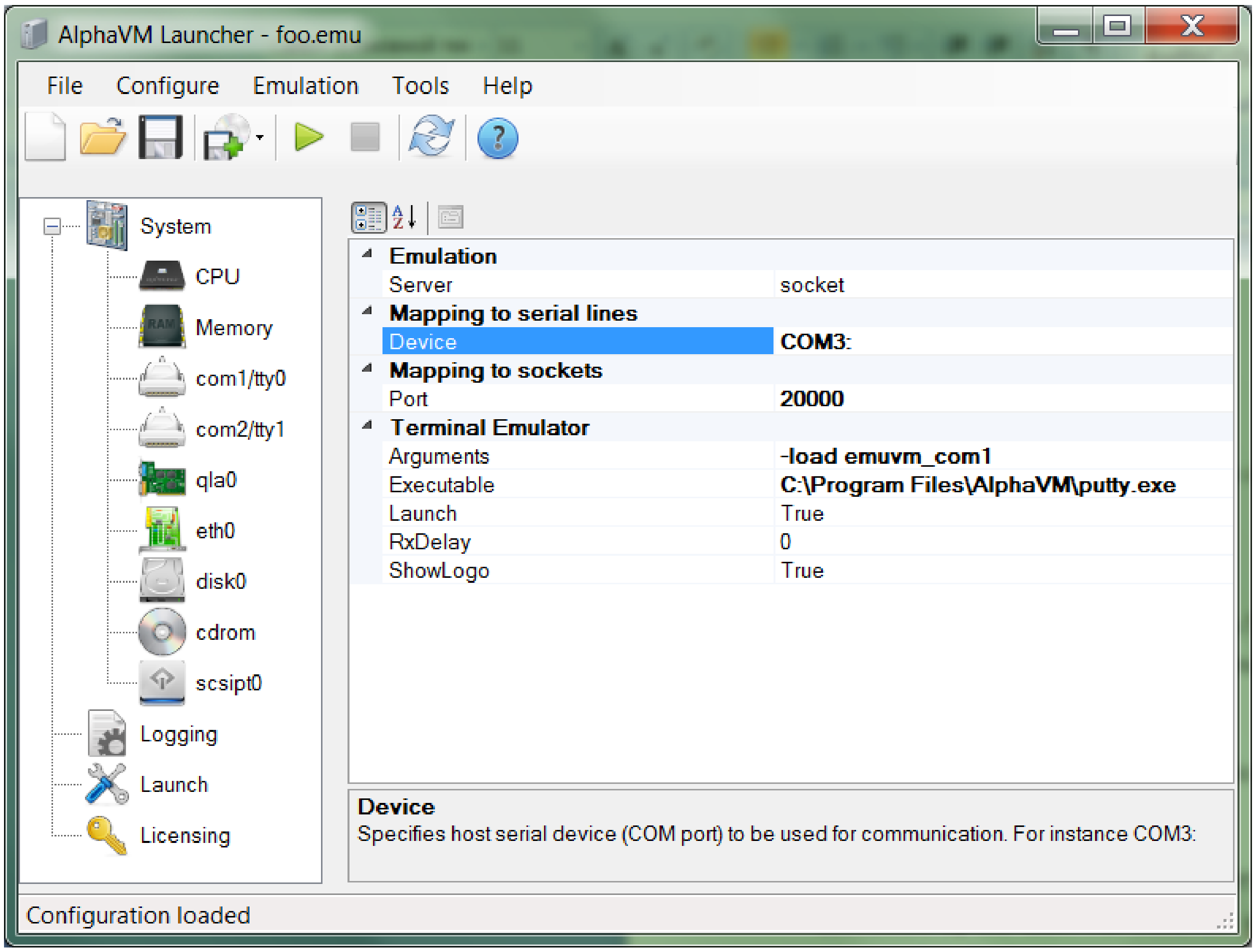
3.8.4 Booting from a SCSI Pass-Through device

Alpha can boot only from a device that supports the block size of 512 bytes. Most CDROM drivers have block size of 2048. However, Alpha CDROM drives are able to switch the logical block size to 512, which enables Alpha booting from these devices.

If your device is not capable of switching to logical block size of 512, AlphaVM will not be able to boot from it.

3.9 Serial port configuration

Serial port configuration pane enables specification of how the port is connected. Currently the port connected only to a virtual terminal. Virtual terminal can be connected to a terminal emulator. We provide a free terminal emulator PuTTY (written by Simon Tatham), which is widely used. This is the default terminal emulator used by AlphaVM. You can choose another terminal emulator and configure it here.


AlphaVM Launcher - foo.emu

Emulation	
Server	socket
Mapping to serial lines	
Device	**COM3:**
Mapping to sockets	
Port	**20000**
Terminal Emulator	
Arguments	**-load emuvm_com1**
Executable	**C:\Program Files\AlphaVM\putty.exe**
Launch	True
RxDelay	0
ShowLogo	True

Device
Specifies host serial device (COM port) to be used for communication. For instance COM3:

Configuration loaded

Configuration properties:

- **Server** – selects the way the serial line emulation is served. Currently there are two possible servers: **socket** and **serial**. The socket server maps the serial line to a TCPIP connection. Normally this connection has a terminal emulator (e.g. PutTTY) on the other side. The serial server maps the emulated serial line to a real host serial line (COM port). By default, the value is **socket**. The **serial** server is available only in the professional version of the product.
- **Device** specifies the host serial device (COM port) to be used when the server is serial. For instance, *COM3:*. This value is ignored when the socket server. Currently the SRM emulator ignores the SRM variable changes related to the serial line. By default, it initializes the serial line to 9600 baud, 8 bits, No flow control, no modem control.
- **Port** - is the TCPIP port number used to connect to the terminal emulator. The default value is 20000 for COM1 and 20001 for COM2. This value is ignored for the serial server.
- **Launch** - indicates whether to launch the terminal emulator automatically when the emulation starts. The default value is true.
- **Executable** - The terminal emulator executable. By default, the terminal emulator is PuTTY. PuTTY is delivered together with the AlphaVM product. You can choose another terminal

emulator here. The default value is the path to putty in the AlphaVM product location. For instance, “C:\Program Files\AlphaVM\putty.exe”.

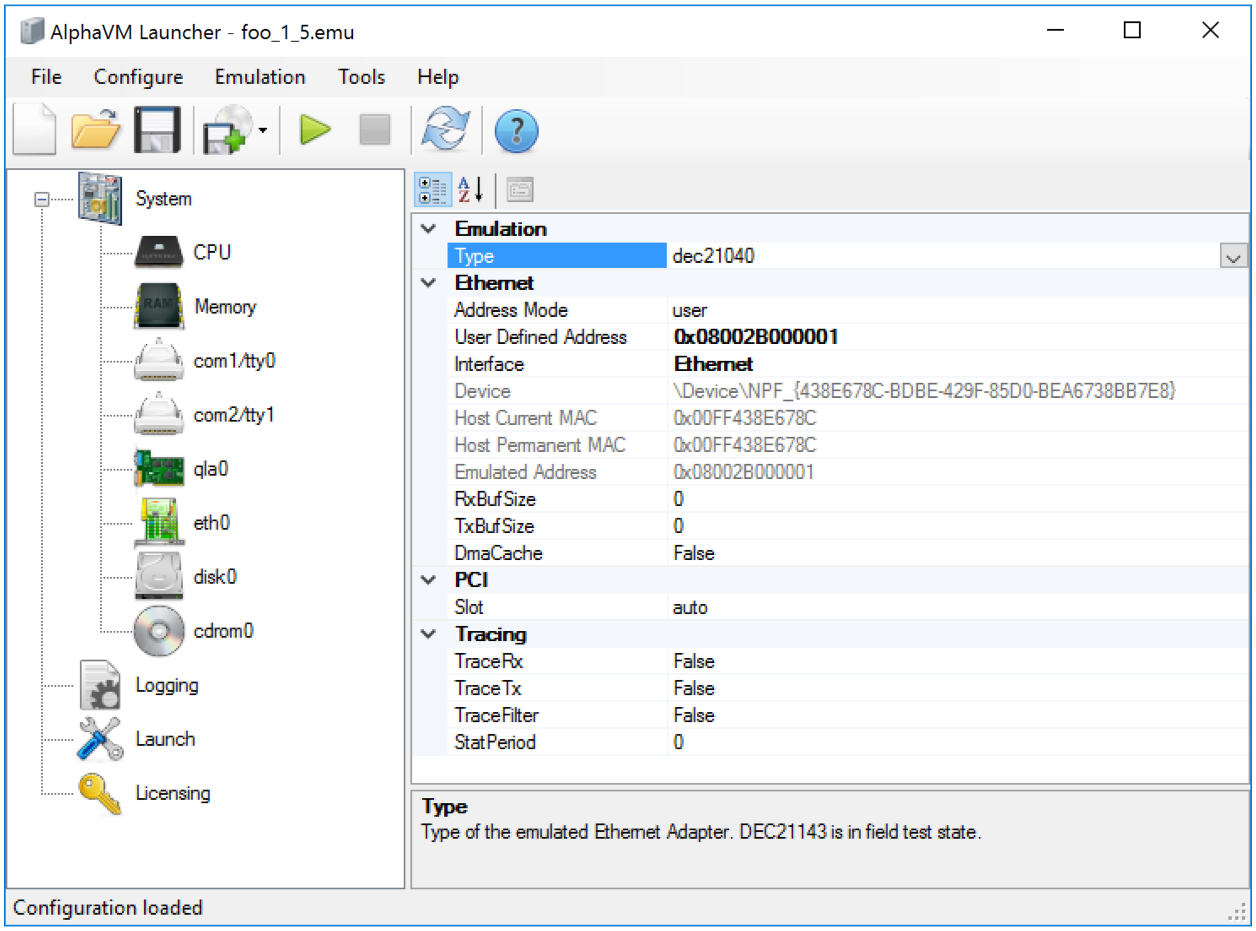
- **Arguments** - The arguments passed to the terminal emulator executable. AlphaVM provides default putty configurations for COM1 and COM2. In this example the PuTTY configuration emuvm_com1 is loaded. Note that the port property used here is the same as the port used by the emuvm_com1. The default value is “-load emuvm_com1” for COM1 and “-load emuvm_com2” for COM2
- **ShowLogo** specifies whether the VM prints logo text on the terminal when then terminal is connected. The default value is true. This can be disabled, which is useful in situations when the logo transmission breaks down the communication protocol.
- **Session Log Enabled** controls whether the session log is enabled
- **Session Log Append** indicates whether the session log is open in append mode.
- **Session Log Binary** indicates whether the session log is open in binary mode.
- **Session Log File** specifies the session log file. The log file gets all the output in binary mode.

3.10 Ethernet configuration

The AlphaVM system emulates Ethernet adapter based on DEC21x4x also known as Tulip. You can add these adapters in the “Configure” menu. The added adapters are named automatically: *eth0*, *eth1*, … Only the last controller can be removed to preserve this naming sequence. The removal option is available on right click.

Some Alpha systems have one or two built-in Ethernet adapters. Configurations eth0 and eth1 correspond to the built-in adapters in this case. These adapters will be present in the VM even if not configured in the Launcher GUI.

The emulator communicates with the real Ethernet by means of WinPcap packet filter driver. The user has to provide the information about the connection. In particular, the user has to specify which Windows network interface will be used by the emulator.


AlphaVM Launcher - foo_1_5.emu

File Configure Emulation Tools Help

Emulation	
Type	dec21040
Ethernet	
Address Mode	user
User Defined Address	**0x08002B000001**
Interface	**Ethernet**
Device	\Device\NPF_{438E678C-BDBE-429F-85D0-BEA6738BB7E8}
Host Current MAC	0x00FF438E678C
Host Permanent MAC	0x00FF438E678C
Emulated Address	0x08002B000001
RxBufSize	0
TxBufSize	0
DmaCache	False
PCI	
Slot	auto
Tracing	
TraceRx	False
TraceTx	False
TraceFilter	False
StatPeriod	0

Type
Type of the emulated Ethernet Adapter. DEC21143 is in field test state.

Configuration loaded

Configuration properties:

- **Type** defines the emulated Ethernet controller type. Currently we have just two options available:
  - dec21040 – a 10Mbit controller also known as DE435
  - dec21143 – a 100Mbit controller also known as DE500
- **Address Mode** specifies how the emulated station MAC address is constructed.
  - **user** – the emulator will use the **User Defined Address** as the station address. Make sure all MAC addresses are unique on your network. This is the default value.
  - **host** – the emulator will use the MAC address of the host NIC. This setting is to be used NICs dedicated only to AlphaVM. The Windows IP protocols have to be disabled on this NIC, otherwise a MAC address conflict would occur. Both the host and the guest systems would have an IP stacks using the same MAC.
  - **auto** – the address is automatically generated. This option is convenient, because you do not have to invent a unique address. Note however, that the address will not be unique when two instances of the emulator process use the same host NIC. This is because the instances do not coordinate the MAC address allocation. Use the user defined address mode if you are configuring several instances sharing the same host

NIC. Within one instance, if several AlphaVM NICs use the same host NIC, the addresses will be unique.

- **User Defined Address** specifies a MAC address to be used when **Address Mode** is **user.** If **Address Mode** is not **user**, this field is ignored. The address is specified in a TCPDUMP format, as a hexadecimal number. If there are several emulators on your network, make sure their Ethernet controllers have a unique MAC addresses. Otherwise MAC address conflict occurs.
- **Interface** specifies the Windows network interface used to connect to the network. Normally you would use “Local Area Connection” or “Local Area Connection 2”.If you wish to disable network, use “No interface”, which disables mapping of the emulated Ethernet to any host network interface.

  Note that not all wireless controllers seem to work with the emulator. Please select wired controllers.

  The default value is “Local Area Connection”, if it exists; otherwise it is “No mapping”.

- **RxBufSize** specifies the PCAP RX buffer size in megabytes. The default is zero, which means that the default PCAP buffer size is used.
- **TxBufSize** specifies the PCAP TX queue size in megabytes. The default is zero, which means that a default queue size is used.
- **DmaCache** specifies whether the NIC (Tulip) caches the DMA translations. This option allows to significantly decrease the number of DMA translations. It works if the DMA rings reside at a constant DMA addresses, which appears to be true for the supported guest OSes. The default value is false.
- **Device** shows the device name used by WinPcap. This property is read-only and is shown for informational purposes.
- **Slot** specifies the PCI slot to which the adapter is plugged. The default behavior is automatic; thus, you do not have to specify this option or know about slots. The automatic behavior covers most cases with OpenVMS. Tru64, however, is very sensitive to changes in the hardware configuration. When you copy your disk images from the real system, it can be required to specify the slots in such a way to reflect the configuration of the real. The number of slots depends on the actual emulated system. The mapping of the slots to PCI hoses and IDSELs also depends on the system.
- **TraceRX** enables tracing of the packets received by the NIC.
- **TraceTX** enables tracing of the packets transmitted by the NIC.
- **TraceFilter** enables tracing of filter changes on the level of the NIC and PCAP.
- **StatPeriod** specifies a period used to print PCAP level statistics. The default is zero. Zero means that the trace is disabled.

The emulator shares the same Windows network interface with other Windows programs. However, the emulator maintains a different Ethernet address from Windows. This is necessary that the address is different, so that packets meant for the emulator are not mixed with packets meant for Windows.

For performance reasons you may wish to use a dedicated network interface for the emulator. To achieve this, disable all Windows protocols in Windows NIC settings. In this case Windows will not interfere with the activity of the emulator. You may also wish to use the same Ethernet address as the real address of the Windows NIC.

3.10.1 Communication between the host and AlphaVM

When both the host and the emulator use the same network interface, there is a problem of communication between the host and the guest. This options works only for communication with a remote system. However often it is desired to communicate between the host and the guest. For instance, you may wish an X-server running on the host to connect to the guest. This section describes how to configure network to allow for such communication.

The simplest solution is to use a dedicated host network interface for the emulator. Thus, you should have two network interfaces in your host: one used by the host and one by the emulator. They should both be connected to the same network. In this way packet sent between the host and the emulator go through the real network. It works just like it normally works with a remote machine.

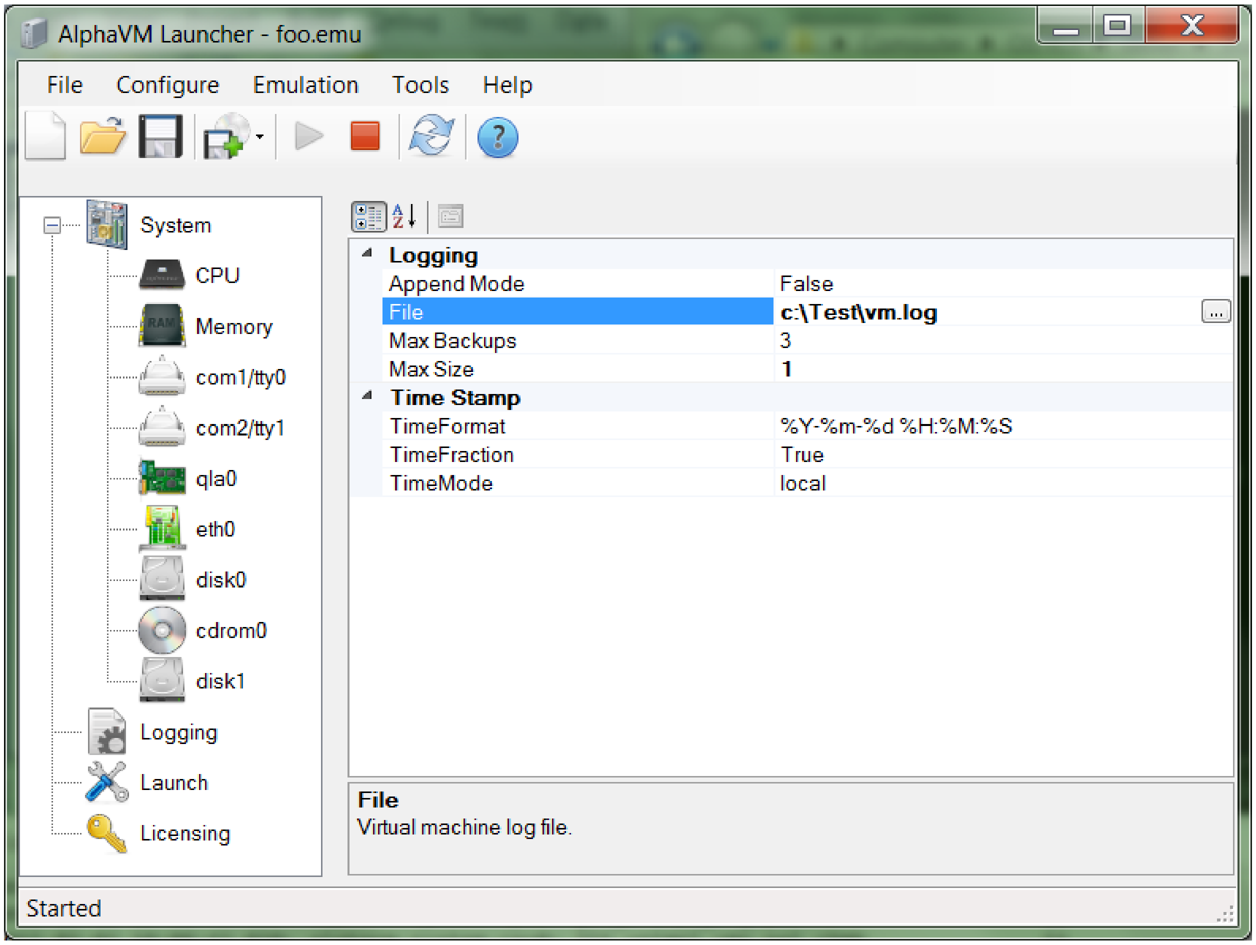
Another solution involves a virtual network within your system to communicate between the host and the emulator. It can be achieved by means of Microsoft Network Bridge. The given solution is tested on Windows 7. All you have to do is to create the bridge and to add your host NIC (e.g. “Local Area Connection”) as a single NIC to it. You should still use your real NIC in the emulator (not the bridge).

Create the bridge as follows:

- Open Control Panel/Network and Sharing Center/Network Connections
- Select two NICs: your NIC (e.g. Local Area Connection) and any other NIC.
- Right click on selection and choose “Bridge Connections”.
- The bridge is created. You can throw the second NIC out of the bridge in the bridge properties available via the right click.

3.11 VM logging configuration

Virtual machine produces log, which is saved to log file. The logging pane enables configuration of where and how the log file is written. To view the log file use the Tools/VM Log menu item. When reporting a problem with the product, please send us this log file.



Logging	
Append Mode	False
File	c:\Test\vm.log
Max Backups	3
Max Size	1
Time Stamp	
TimeFormat	%Y-%m-%d %H:%M:%S
TimeFraction	True
TimeMode	local

File
Virtual machine log file.

Configuration properties:

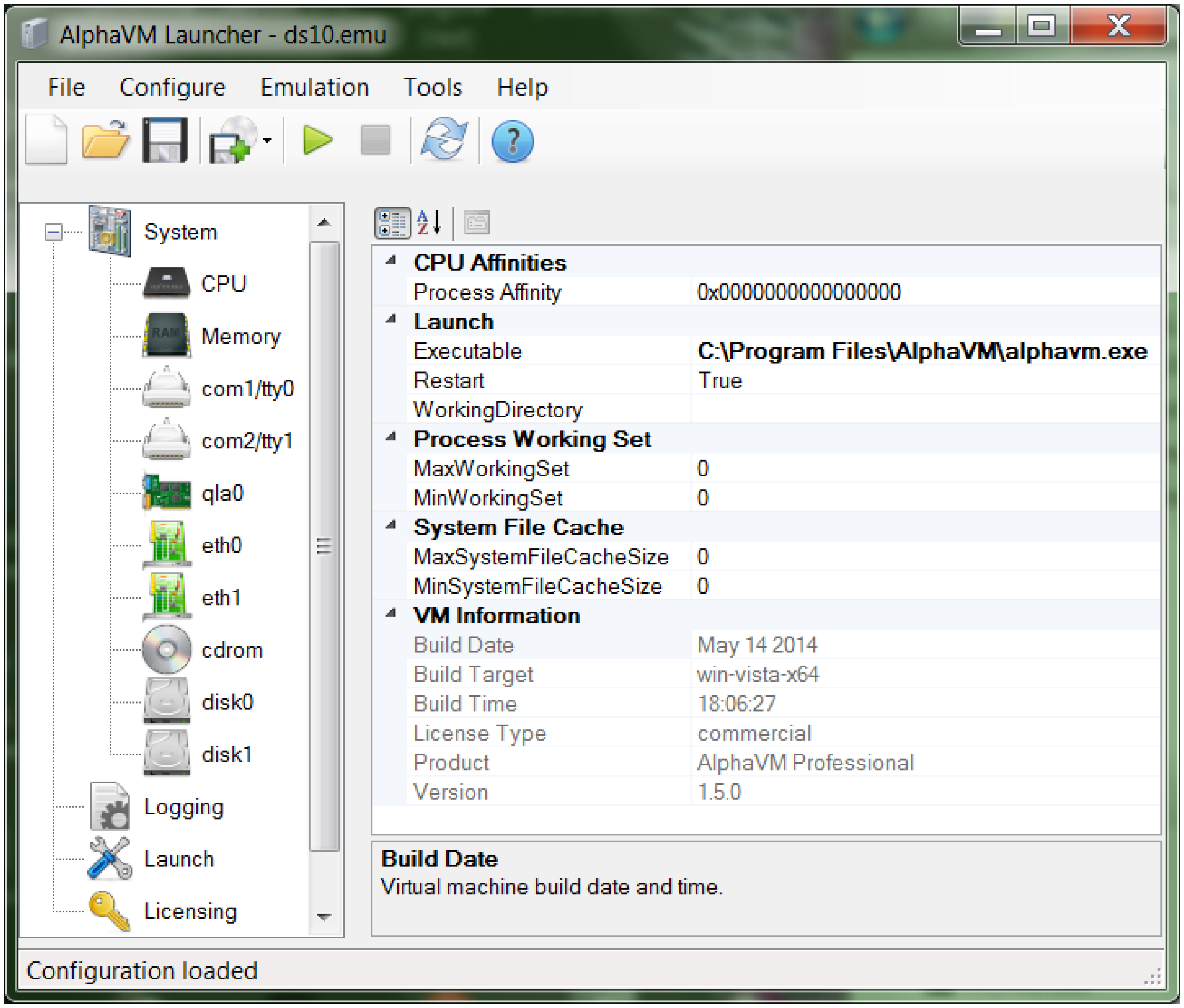
- **File** specifies the file where the VM log is written. The default value is "vm.log". By default, if the path is not provided, the system uses the path of the current configuration file.
- **Append** specifies whether the log file is appended or truncated on every run. The default value is false (truncate every time). Note that in append mode the file can become huge over time. Note also that when you get a problem with the emulator, you should save the log file before restarting of the emulation process, otherwise the log of the erroneous run will be lost. We recommend to use non-append mode in conjunction with non-zero MaxBackups to save the log files from the previous VM runs.
- **MaxBackups** specifies the number of of file backups maintained by the virtual machine. The backups have the form of <logfile>.<version>. Newer versions have higher version numbers. For example, when the log file is specified as c:\Test\vm.log, the emulator will create 3 backups: c:\Test\vm.log.1, c:\Test\vm.log.2, c:\Test\vm.log.3. The default value is 3. The emulator creates a backup each time the log is opened in non-append mode. If the maximal size of the log file is specified, the old log is saved as a backup and the new log is opened.
- **MaxSize** specifies the maximal size of the log file in megabytes. When the size is reached, the log file is closed and the new log file is created. If MaxBackups is not zero, the old log file will be

saved as a backup. Essentially this logging method creates a ring of log files. This method ensures that the logging on the server would never exceed the size of the log file and its backups.

- **TimeMode** specifies the time logging mode. By default the local time stamp is printed.
    - **None** - no time stamp
    - **Counter** microsecond tick counter is printed. This value can be used when a lot of tracing is produced to minimize the time needed to obtain the timestamp.
    - **UTC** – log UTC timestamp. The actual time format is specified by **TimeFormat**.
    - **Local** – log local time stamp. The actual time format is specified by **TimeFormat**.
- **TimeFormat** specifies the format of the timestamp for UTC and local modes. The format specification is the same as for strftime() function. Use the drop-down list to see some common formats.
- **TimeFraction** specifies whether to log time fraction. Time fraction is appended in microseconds to the time stamp in the format .NNN.

3.12 VM launching configuration

The Launch configuration pane enables specification of the virtual machine to launch and of its properties.


AlphaVM Launcher - ds10.emu

CPU Affinities	
Process Affinity	0x0000000000000000
Launch	
Executable	**C:\Program Files\AlphaVM\alphavm.exe**
Restart	True
WorkingDirectory	
Process Working Set	
MaxWorkingSet	0
MinWorkingSet	0
System File Cache	
MaxSystemFileCacheSize	0
MinSystemFileCacheSize	0
VM Information	
Build Date	May 14 2014
Build Target	win-vista-x64
Build Time	18:06:27
License Type	commercial
Product	AlphaVM Professional
Version	1.5.0

Build Date
Virtual machine build date and time.

Configuration loaded

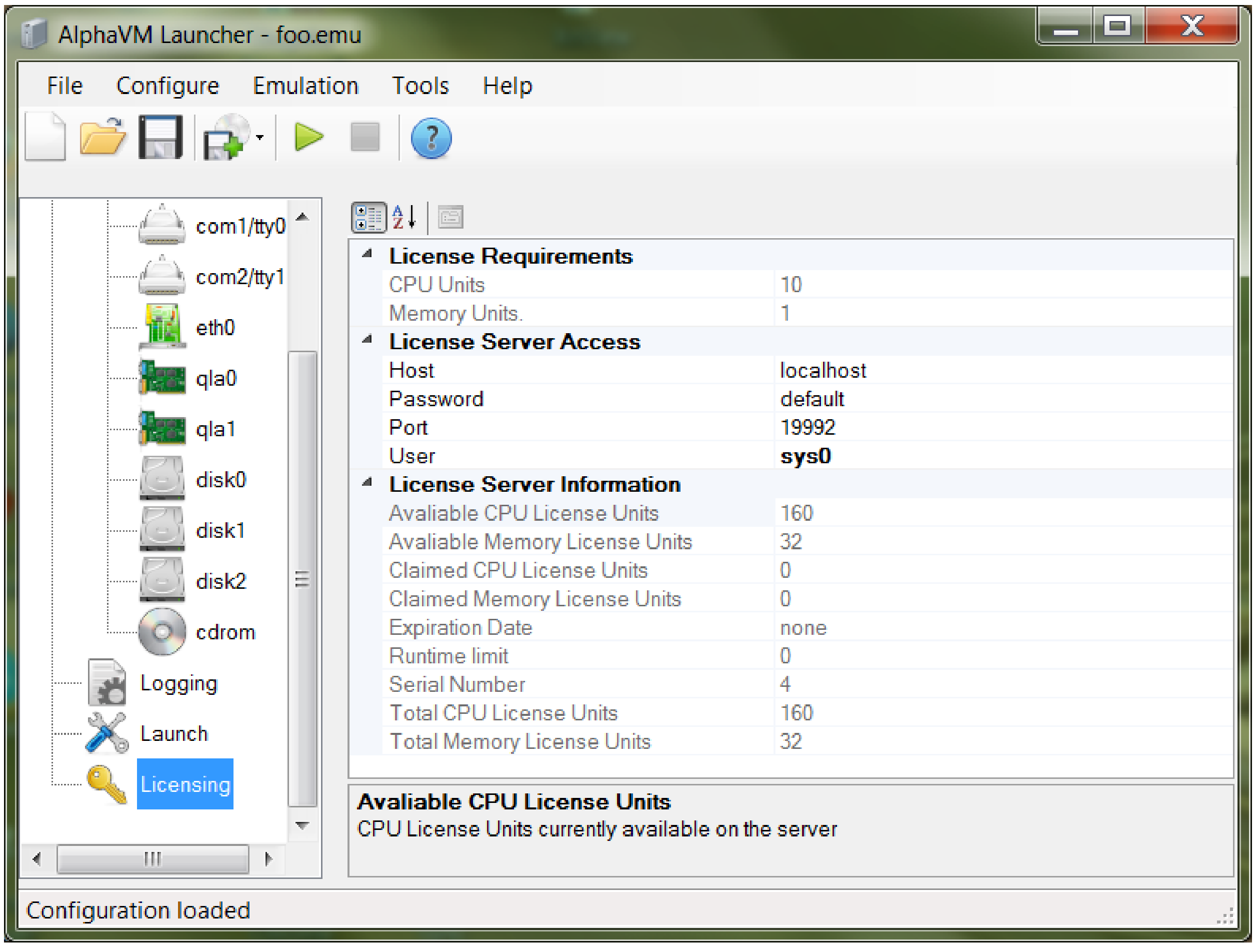
Configuration properties:

- **Executable** specifies the VM executable. You can change the executable in order to provide an alternative virtual machine, which can be useful when experimenting with different versions. The default value is the main product virtual machine executable, for instance, “C:\Program Files\AlphaVM\alphavm.exe”.
- **WorkingDirectory** specifies the working directory for the virtual machine. The working directory determines where files with relative filenames are located. If this property is empty, the path of the configuration file will be used as a default working directory. The default value is empty.
- **Restart** specifies whether to restart the VM if it exits. This option is used only by the EmuVMSrv service that manages automatic startup of the VMs.
- **Process Affinity** specifies a CPU affinity mask to be used by the VM process. Each CPU in the mask specifies whether the VM can run on the corresponding host CPU. This feature allows limiting the amount of the CPU resources used by the VM. The default value is zero, which means that the VM can run on any available CPU.

- **MinWorkingSet** and **MaxWorkingSet** specify the minimal and maximal working set limits. These are advanced settings. Do not change them unless you are sure what you are doing. Wrong settings can badly affect the emulator and the system performance. The default value is zero, which means that the virtual machine sets the limits automatically. Working set limits can be changed to tune the VM performance in case the system defaults do not work well. Working set is the amount of physical memory used by the process, in our case the VM. Too low working set limit can cause VM page faults on the emulated memory access, which can disturb timing of the emulated CPU. Too high working set limits can lead to lack of resources for the host system, which degrades the whole system performance including the VM.
- **MinSystemFileCacheSize** and **MaxSystemFileCacheSize** specify the limits for Windows file cache. These setting are system-wide settings. The values are in megabytes. The emulator can adjust them at startup. Note that the settings do not survive the host OS reboot. This is an advanced setting. The default values are zero, which means that the system settings are not changed. The recommended size for the file cache can be around 20% of the host RAM.
- **VM Information** fields show the currently selected virtual machine properties.

3.13 Licensing information

The licensing configuration node contains information related to licensing of the product.



License Requirements	
CPU Units	10
Memory Units	1
License Server Access	
Host	localhost
Password	default
Port	19992
User	**sys0**
License Server Information	
Avaliable CPU License Units	160
Avaliable Memory License Units	32
Claimed CPU License Units	0
Claimed Memory License Units	0
Expiration Date	none
Runtime limit	0
Serial Number	4
Total CPU License Units	160
Total Memory License Units	32

Avaliable CPU License Units
CPU License Units currently available on the server

Configuration loaded

Properties:

- **Host** is the IP address of the system running the EmuVM licensing service. When using a USB dongle, this is normally *localhost*. For evaluation set the evaluation server IP provided by EmuVM.
- **Port** specifies a port number used to connect to the licensing service. Use 19991 with the evaluation license server. Use 19992 with a USB dongle server.
- **User** is a username used to connect to the licensing service. For evaluation, use the user name provided by EmuVM. When using a USB dongle it is usually sys0 unless another name is provided by EmuVM.
- **Password** is a password used to authenticate the user at the licensing service. When using a USB dongle, please use *default*. Otherwise, use the evaluation password provided by EmuVM.
- License requirement properties are read-only. They show the amount of units required by the current configuration of the emulator.
- License Server Information group of properties are read-only. They show the information about the currently connected licensing server. These properties are updated when you switch to the Licensing configuration node in the left panel. If you change the licensing information, please select another node (for instance logging) and then back to Licensing.

3.13.1 Configuring for evaluation

The AlphaVM evaluation can be done using a remote EmuVM server. You will receive the server IP address, port number, username and password to be used. The EmuVM evaluation server uses the port 19991.

Please make sure the outgoing port is open at your firewall and ati-virus software. Please first use ping to check the availability of the server.

3.13.2 Configuring with USB dongle on the local machine

The dongle service is called keylok_service.exe. It is available in the \Program Files\AlphaVM directory. The AlphaVM installer installs and starts the service. The service appears as EmuVMLicense in the Windows Service manager. You do not have to do anything special to start the service. Configure your emulator as follows:

- Host=localhost,
- Port=19992,
- User=sys0,
- Password=default.

3.13.3 Configuring with USB dongle on a remote machine

If you wish to run the service on a remote machine, you can do it in two ways. The simplest is just to install AlphaVM-Pro on that machine. The installer will install and start the service. The emulator on that machine will not be unused; it will not use any license units.

Alternatively, you can copy just the service executable keylok_service.exe to the machine where you wish to have the dongle plugged. You will have to install and start the service as follows

```
keylok_service --install
```

```
keylok_service --start
```

Service c can be uninstalled as follows:

```
keylok_service --stop
```

```
keylok_service --uninstall
```

In either case configure the Host address of the remote license server to refer to the machine where you have the license server and the dongle.

3.14 Configuration of multiple instances

It is possible to run several VM instances on a single host system. AlphaVM instances can be run from the launcher GUI, command line or as a service. Each instance must have a unique configuration file. You must take care that:

- No single configuration is launched twice

- There is no multiple use of resources private to each instance.

The following steps are needed to configure several instances

- Make a separate directory for each system configuration.
- Place the configuration file for each system in the corresponding directory.
- Place the private disk and tape images in the corresponding directory.
- Set unique MAC addresses for each network card in each configuration.
- Make sure the serial line configuration use unique ports.
- Set CPU affinities in such a way that different instances use different host CPUs. CPU affinity is a bit mask where each bit represents one host CPU core or hyper-thread. When a bit is 1, the corresponding core is used to run the corresponding instance of AlphaVM. The table below contains the affinity setting examples.
- For AlphaVM-Pro: set the licensing information for each instance. The information about license settings will be provided when you purchase the product.

In particular, take care that, if you run an instance as a service, you do not launch it from the GUI launcher.

4 Emulator operation

4.1 Running a VM from the GUI launcher.

4.1.1 Starting the emulation

When the configuration is done, you can start the emulator by means of the Emulation menu or by the toolbar buttons.

4.1.2 Stopping the emulation

Please do not stop the emulator by means of the user interface stop button unless it is necessary. This corresponds to an abnormal system power failure and can cause troubles with the guest operating system or other guest software currently running in the emulator. Instead, shutdown the guest system and use SRM **power** command to "power down" the emulated system.

4.2 Running a VM from command line

Sometimes it is more convenient to run the virtual machine from the command line than from the EmuLaunch user interface. On Linux there is no launcher yet, so the only option is to run from the command line.

The launcher not only starts the VM itself, but also the terminal emulators, if configured. When running the VM from command line, the user has to connect the terminal emulators manually.

The VM is started as follows:

```
alphavm.exe <config-file>
```

Here it is assumed that alphavm.exe is either in the PATH or in your current directory. Here is a full example of the command line:

```
"C:\Program Files\AlphaVM\alphavm.exe" c:\Test\foo.emu > foo.log 2>&1
```

Normally the configuration file is created by the Launcher. When running VM directly, the user has to write the configuration file. Alternatively, one can modify a file created by the launcher.

To see an example of a configuration file use Tools menu/ View configuration as text.

4.3 Running a VM as a service

AlphaVM-Pro can be run in a context of a Windows service. There is a special service – EmuVMSrv. It is installed by the installer to manage the VMs. Multiple instances can be started as a service.

There is a special EmuVMSrv configuration file "\Program Files\AlphaVM\emuvmsrv.cfg". Each line in this file specifies a full path to the VM configuration to be run. Usually it is a file that just contains one line. For example:

```
C:\Test\foo.emu
```

A line can be empty. A line starting with the # character is ignored (i.e. it is a comment).

A VM configuration can be created as usually by the GUI.

Initially emuvmsrv.cfg is empty. If it is empty, the EmuVMSrv service stops. When the emuvmsrv.cfg is changed, restart the service to take the effect. Currently the service does not automatically rescan the configuration file.

The service log is stored in "\Windows\system32\emuvm-server.log". This filename can be changed in "emuvm-server.cfg".

When you are running multiple VMs on a single Windows host, you have to consider that the instances may have a resource conflict, if you do not take care of it. See Configuration of multiple instances for the details.

Note that all instances running in a service and all instances running interactively have to be considered when thinking multiple instances. In particular, note that an instance, that runs automatically, should not be run interactively at the same time.

The VM configuration Launch section contains a parameter called **Restart**. The EmuVMSrv service uses it to check what to do if the service stops.

EmuVMSrv does not start the terminal emulators that are normally started by the GUI launcher. You have to connect the terminal emulators manually.

5 Usage example

5.1 OS installation on a new disk

This is a general sequence of installing of an OpenVMS, Tru64 or Linux on the emulated system.

Step 1: Create an empty disk by means of Tools/Make disk

Step 2: Configure the *disk0* to use the just created empty disk image.

Step 3: Configure the *cdrom* to map to your ISO file. Alternatively, use \\.\Cdrom instead of the disk image to use the real CD .

Step 4: Save configuration to a file, say vms83.emu.

Step 5: boot from *cdrom*: **boot dka400**

Step 6: Follow the OS installer sequence as usually. The target disk for the installation is DKA0.

Step 7: When the installation is completed, you can boot from the new system: **boot dka0.**

6 Migration

A real system can be replaced by the emulator software. Firstly, the emulator should be configured to reflect the real system as close as possible. Secondly the software should be transferred to the emulator.

6.1 Migration by copying disks

The simplest way of migration is by copying the real system disks to disk images and then using these disk images to run the emulation. Thus, the whole OS, software and data are copied. The new system behaves in the same way as the old one.

Unfortunately, this method does not always work. Currently we cannot emulate all kinds of Alpha systems and all kinds of peripheral devices. Some OSs and applications are flexible and can run on a different hardware configuration without changes. Others require more or less complicated reconfiguration.

6.1.1 Copying disks using a Live Linux CD

When a system is booted from a disk, this disk cannot be modified while being copied. To avoid such problems you can boot a Linux system form so called Live CD (for instance, Gentoo LiveCD). In this case you get a booted Linux system that does not use any of you OpenVMS or Tru64 disks. This Linux system can be used to copy your disks by means of the dd command. You will have to use a storage on the network to store the resulting disk images.

When copying disks please use the whole disk devices like /dev/sda, rather than partition devices (like /dev/sda1)

Please note that Tru64 can be very sensitive to configuration changes. When the copied disk image is booted in the emulator it may fail due to difference in the configuration. In this case, you can boot the generic kernel and reconfigure/rebuild your kernel as usually.

See a detailed example on emuvm.com/migrate_vms.php.

6.1.2 Migration of OpenVMS using backup /image

The usual way to migrate OpenVMS is to use backup /image copies of the disks. The following command can be used to make such backups:

```
$ mount dka100: /over=id

$ backup /image/verify dka100: dka500:[000000]foo.sav/sav
```

You can use the command to backup your system disk.

The following commands can be used to restore disk images:

```
mount dka100: /foreign

backup /image/verify dka500:[000000]foo.sav/sav dka100:
```

The migration process can be outlined as follows:

1. Make backup /image backups of all disks in your system and make them available via the network.
2. Install AlphaVM and create N+1 empty disk images. Add the disk images to the emulated system. One disk will be used for a freshly installed copy of OpenVMS. The other disks will be used to restore your original disks. The AlphaVM disk images can be larger than the original disks.
3. Install a fresh copy of OpenVMS on AlphaVM and configure the network to access the disk backups.
4. Restore the disk backups from the files to the empty emulated disks.
5. Boot from the restored system disk.

It is advised that your fresh system disk is made large enough to contain any of the *.sav files (or all of them). It this case you can restore from a local copy rather than from a DECNET remote copy. It is possible to use TCPIP to ftp files and you do need to configure DECNET.

6.1.3 Copying disks on OpenVMS

On OpenVMS a proper disk image can be created by means of backup /physical. Please note that the physical image has the same size as the original disk. Therefore you need to have enough storage to store the resulting file. Please note that you can use a network path for the destination file.

6.1.4 Copying disks on Tru64

On Tru64 a proper disk image can be created by means of the dd command. Please note that the physical image has the same size as the original disk. Therefore, you need to have enough storage to store the resulting file. Please note that you can use a storage available via the network as the result, for instance NFS.

6.2 Migration by reinstalling software

When it is impossible or inconvenient to copy disks, the software can be installed on the emulator in the usual way. These are the steps to be done:

- Install the OS and its layered products.
- Install and configure the application software.
- You may need to copy data from the old system.