

Avanti Virtual Alpha User Guide

for the Avanti Virtual Alpha suite

Version 5.1.0



Migration Specialties Europe

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Avanti Virtual Alpha User Guide

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Introduction

VIRTUAL
ALPHA

1 Introduction

This manual describes how to install and use the Avanti product, including configurations previously known as FreeAXP or AvantiFlex. Avanti emulates an AlphaServer 400.

Avanti can be used without a license key when the selected configuration requires zero license units. Paid license keys enable configurations that require additional units.

Neither zero-cost operation nor a paid license includes manufacturer support. Annual paid support can be purchased separately for any Avanti installation, including one that requires no license key. The zero-cost configuration is provided without warranty; paid licenses carry only the defect warranty stated in the applicable EULA.

For community assistance, visit VSI's [Hardware Emulators forum](#).

1.1 Avanti Links

Avanti information and downloads are available from the [Migration Specialties Europe website](#). For community assistance, visit VSI's [Hardware Emulators forum](#).

1.2 Document Conventions

This document uses the following conventions:

1.2.1 Product References

Throughout this manual, Avanti Virtual Alpha is the full name of the product and Avanti is used as its short name. The former FreeAXP and AvantiFlex names are used only when a historical or upgrade distinction requires them.

1.2.2 Size Designations: K, M and G

Some parameters used by the configuration utility designate file or buffer sizes. The suffixes K, M, and G are used to designate Kilo, Mega, and Giga. For example, to set the autocreate size of a disk to 4 gigabytes, the user would enter 4G in the autocreate_size box.

1.3 Migration Specialties Products & Services

Product	Description
Avanti	AlphaServer 400 emulator; zero-unit configurations require no license key
OpenVMS Consulting	OpenVMS consulting and programming services
Tru64 UNIX Consulting	Tru64 UNIX consulting and programming services

Quick Start

VIRTUAL
ALPHA

2 Quick Start

This section describes the basic steps required to get up and running with Avanti.

- 1) Download and install the Avanti software: [Installation](#) 
- 2) If the configuration requires license units, install the license key: [3.3 Avanti Licensing](#) 
- 3) Launch the Configuration Utility: [4.1 Avanti Configuration Utility](#) 
- 4) Configure a virtual Alpha system containing at least one...
 - a) Serial Port: [4.1.7.5 Serial Ports: OPA0/tty00 – TTA0/tty01](#) 
 - b) Disk Controller: [4.1.7.6.1 SCSI Controllers: KZPAA and KZPCA](#) 
 - c) Disk Drive: [4.1.7.6.1.1 Image File](#) 
 - d) CD-ROM: [4.1.7.6.1.3 CD-ROM](#) 
 - e) NIC: [4.1.7.6.2 NIC](#) 
- 5) Save the configuration file: [File](#) 
- 6) Load a Tru64 UNIX or OpenVMS installation CD in the CD-ROM device.
- 7) Launch Avanti and install Tru64 UNIX or OpenVMS.

2.1 Porting Services

Migration Specialties provides comprehensive fee-based Tru64 UNIX and OpenVMS porting services. We are available to help build and port to virtual Alpha systems. Contact us for additional information at camiel@migrationspecialties.nl.

2.2 Critical Factors Impacting Avanti Operation

This section highlights factors critical to reliable operation of an Avanti virtual system.

2.2.1 Unplanned Process Termination

Avanti processes run one of two ways: as a user mode process or as a service. If a user mode session is terminated, the Avanti process disappears with it. If a Windows system is rebooted, the Avanti service will be terminated. Either way, the virtual Alpha is crashed.

Recommendations:

- When running Avanti as a user process, disable auto-logout of the user process.
- When running Avanti as a service, disable Windows automatic updates and reboots.

2.2.2 VMware and DECnet

If DECnet is in use and Avanti is running on a VMware VM, the port group assigned to Avanti must have the following features enabled:

- Promiscuous mode
- MAC address changes

- Forged transmits

See [6.8 VMware NICs](#)  for more details.

Installation and Licensing



3 Installation and Licensing

3.1 Installing Avanti

Note: Avanti cannot be installed while Avanti or a compatible earlier-version process is active. The installer checks for active instances during installation. If an instance is running, an error box similar to the one shown will be displayed.



3.1.1 Security

Avanti installation kits utilize Microsoft Windows digital signatures. These signatures allow Windows to detect corrupt installation kits. If Windows objects to installing a kit, check with Migration Specialties or obtain a new installation kit from a trusted source before continuing the installation.

3.1.2 Prerequisites

Avanti requires the following minimum O/S and hardware.

3.1.2.1 Operating Systems

Avanti supports 64-bit (x64) Windows hosts. The minimum supported client and server baselines are:

- Windows 8 x64 or later
- Windows Server 2012 x64 or later

The release notes distinguish exact retained host evidence from legacy family-level reports. The only exact retained result currently listed is scoped to a Windows 11 lifecycle and core-affinity test; it is not complete release-package validation. Other listed families remain historical reports whose exact editions and builds were not retained. Complete package compatibility must be established separately for each release.

3.1.2.2 Antivirus Recommendation

Endpoint-security and antivirus scanning can affect Avanti performance and, in historical reports, process stability. If you suspect interference, inspect the security product's logs and policy before changing any protection. If the investigation confirms interference and your organization's security policy permits an exception, configure the narrowest available process or executable-path exception for the Avanti executable (dec.exe). Do not disable endpoint protection or broadly exclude the Avanti installation directory, data directories, or disk container files (.vdisk).

3.1.2.3 Hardware

Avanti requires the following minimum host hardware. Faster hardware will yield better emulator performance.

- Dual core processor (3GHz or faster recommended)
- 8GB memory
- 2 NICs

3.1.2.3.1 Sizing Host Memory

Avanti requires the program code + base Alpha memory + Alpha shadow memory + JIT memory + asynch threads + IO buffers to run each Avanti instance. This allocation comes out of the physical memory of the host system. Physical memory in a physical host system is usually divided between the number of physical processors in the system. Cores are not allocated memory, they can access all of the memory assigned to the physical processor that they are on, and can access memory assigned to the other physical processors over a slightly slower internal bus. As long as the system has enough physical memory, there should be no problems in running Avanti. If there isn't enough physical memory, operations slow down as the system pages physical memory to virtual memory on disk.

Avanti utilizes host memory as follows:

- **Configured Memory:** One-for-one mapping of virtual Alpha memory to host memory. An Avanti system configured to use 1GB of memory will utilize up to 1GB of host memory.
- **Shadow Memory:** One-for-one mapping of shadow memory to host memory. Avanti pre-processes Alpha instructions, optimizing them to achieve better performance upon execution. These optimized instructions are referred to as shadow code. Shadow code is retained in host memory as long as the Alpha code remains in emulated memory.

Shadow memory matches the memory configured for an Avanti instance. An Avanti system configured with 1GB of memory will utilize up to 1GB of host memory for shadow memory.

- **JIT Memory:** Default maximum reservation is 2GB or ½ of physical memory, whichever is less. The reserved address range can be limited with the `jit_memory` advanced configuration option (see [4.1.8.3 Alpha \[+\] ⁵²](#)).

Avanti reserves JIT memory as follows:

- Reserve the configured JIT address range.
- Commit the first block. This is normally 4MB and may be larger when Windows grants a larger large-page size.
- If commit fails:
 - Release the reserved address range.
 - Reserve and commit the entire configured JIT buffer at once. This can immediately consume commit charge equal to the full `jit_memory` reservation.
- If that fails, error out
- The emulator will quit and there will be an error in the log file stating that the JIT buffer could not be allocated.

Note: If running on a Windows host system equipped with more than 32GB of memory and the following error is encountered, set the jit_memory parameter to 2GB.

Unable to reserve JIT buffer area: error 87: The parameter is incorrect.

Optimum host memory on a Avanti virtual Alpha system configured with 1GB of virtual memory would break down as follows:

Memory	Avanti	Host
Host O/S		4GB
Avanti Configuration	1GB	1GB
Shadow Memory	1GB	1GB
JIT	2GB	2GB
Total		8GB

All the caveats of a Windows paging file apply. For most situations, and our testing supports this, a host system with 8GB of memory and a properly configured Windows paging file would be more than adequate to support a 1GB Avanti configuration. Only in situations where very high demand is put upon the Avanti virtual Alpha would maximizing physical memory be required

3.1.3 Rights

Avanti should be installed from an Administrative account. Users will need administrative rights to run the Avanti configuration utility and to launch Avanti from the command line or a batch procedure.

3.1.4 Installation Restrictions

- Avanti cannot be installed if another instance of Avanti is running. All instances of Avanti must be shut down before a new installation can be made.
- Avanti cannot be installed on a 32-bit Windows system.

Installing a new version replaces the previous version; running different versions side by side on one host is not supported. If Avanti reports an incompatible or interrupted process-database update, stop all Avanti processes, including service instances, before restarting the installed version.

3.1.5 Installation Steps

- 1) The installation package can be downloaded from:

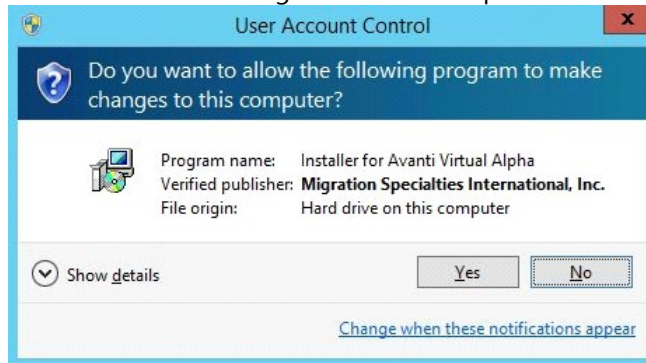
<https://www.migrationspecialties.nl>

- 2) Run the installation program as an administrator. Right click the installation program, then select "Run as administrator" from the pop-up menu.

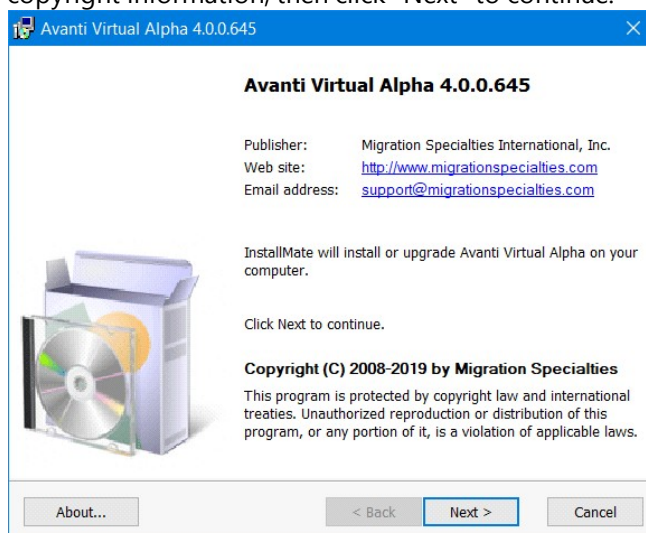
Note: Failure to run the installation as an administrator may result in no access to network devices.

Installation Program: decsetup_nnn.exe (where nnn is a version number)

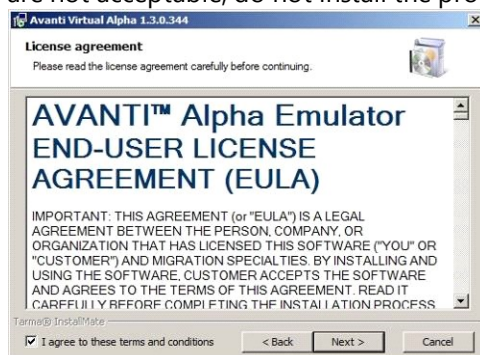
- 3) Installation Warning: When the installation is started, Windows may display a User Account Control message. Click "Yes" to proceed with the installation.



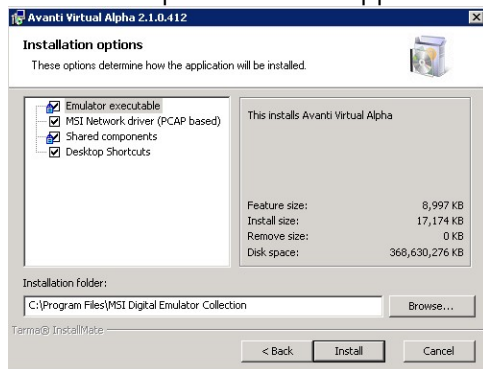
- 4) Information Window: Next, an informational window will appear. Note the copyright information, then click "Next" to continue.



- 5) License Window: Next, the Avanti license window will be displayed. The eminently fair and reasonable license terms should be read. Check the "I agree to these terms and condition" box and click "Next" to continue the installation. If the license terms are not acceptable, do not install the product.

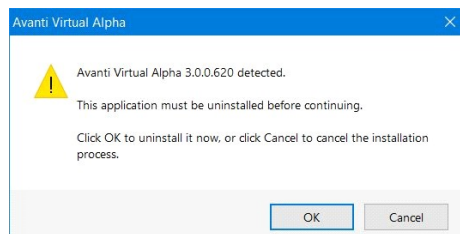


6) Installation Options: Next to appear is the Installation Options window.



The window lists the following components:

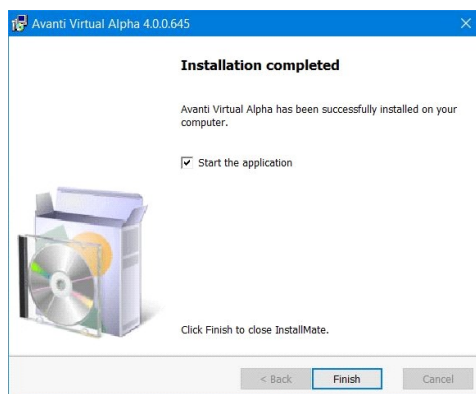
- Emulator executable: The virtual Alpha program. Emulator installation is required and cannot be unchecked.
- MSI Network driver: Installs Avanti's MsiPcap network backend. Installation is optional and selected by default. Npcap is the preferred backend for new configurations and is installed separately. When a compatible Npcap installation is available, Avanti selects it automatically by default; set use_npcap_driver=false in the process-wide VLC properties to select MsiPcap. If this component is omitted, an emulated NIC requires a compatible Npcap installation. See [6.1 PCAP Drivers](#).
- Desktop Shortcuts: Adds desktop shortcuts for PuTTY and the Avanti Configuration Utility.
- Installation folder: Allows a different installation folder to be specified.



Previous Installation Warning: If a previous version of Avanti is installed on the system, a warning box will be displayed. Click "OK" to de-install the previous version of Avanti and install the current version or click "Cancel" to abort the installation process.

As the previous version of Avanti is de-installed, a command window may flash past. This is normal.

Active Instance Abort: If Avanti or a compatible earlier-version process is running, the installation will abort with a Cancel/Retry dialog.



Installation Completed: The Avanti installer will complete the installation. A progress bar and two command windows will briefly display during the installation process. When the installation is finished, a completion window will be displayed. The completion window contains a check box offering to launch the Avanti configuration utility. The default is to launch the utility. The [Virtual Alpha Configuration](#) chapter describes the utility in detail. Click "Finish" to exit the installation process.

3.1.6 Installation Details

Installation Folder

By default, the installer creates the following folder on most English-language installations of Windows. Avanti components are installed in this folder. The Installation Options window allows the user to change the default installation folder.

Product	Default Installation Folder
Avanti	C:\Program Files\MSI Digital Emulator Collection

Firewall Exception

Installation and repair configure an inbound Windows Firewall allow rule for the installed dec.exe on Domain and Private networks only. Public networks are not included automatically. If remote console access is needed on a Public network, an administrator must create a separate, appropriately restricted rule in Windows Firewall with Advanced Security. Do not add Public access to the installer-managed rule: repair restores that rule to Domain and Private. If a non-Windows firewall is deployed, configure the required access there too. Organizational policy or other blocking rules may override the local exception.

The managed rule is named Avanti (installer) followed by a path-specific identifier, in the Avanti installer-managed rules group. Upgrade and repair disable old inbound allow rules named Avanti for this exact executable path, retaining their disabled records. Rules for other paths and separately named administrator rules are left unchanged. Uninstall removes only this installation's managed rule. The firewall helper uses Windows PowerShell 3.0 or later and supports the Windows 8 / Windows Server 2012 baseline.

If firewall setup or cleanup fails, Setup reports a warning and continues; this does not confirm that the intended rules are in place. Check administrator rights, the Windows Firewall service and organizational policy. Inspect the rules in Windows Firewall with Advanced Security, then retry with Repair or configure access manually. After an uninstall warning, remove any obsolete rule for this executable yourself. Firewall changes are not rolled back with a failed installation, and an interrupted operation may leave

partial changes. Review the rules after a failed or interrupted setup. If Setup reports a timeout, the helper may still be running; let it finish before retrying or changing rules.

Product	Default Firewall Entry
Avanti	C:\Program Files\MSI Digital Emulator Collection\dec.exe

Installation Log File

InstallMate normally writes the setup log to the installing account's %TEMP% folder. If setup runs with another administrator's credentials, check that account's temporary folder rather than your own. On a typical English-language Windows installation the folder is C:\Users\<username>\AppData\Local\Temp; the actual path may differ.

At the end of a setup session, InstallMate normally renames the log using this pattern:

```
PackageName-yyyymmddThhmmss-type.log
```

The date is year, month, then day; the time is hour, minute, then second. PackageName identifies the installation package, and type identifies the session, such as Install, Remove, or Register. Locate the log by its package name and timestamp instead of assuming a fixed filename.

Before the final rename, the log is named PackageName.log for a new installation or Setup.log for other sessions. Check these names too when diagnosing an interrupted setup. Supplying /log:logpath on the installer command line overrides the final log destination.

3.2 De-installing Avanti

Avanti can be de-installed from Windows using the Control Panel function Programs and Features.

When Avanti is de-installed, all configuration files created using the Configuration Utility are retained. Files created outside of the installation directory are also retained.

3.3 Avanti Licensing

Avanti can run without a license key when the selected configuration requires zero license units. Configurations that require additional units use an Avanti license key stored in the Windows registry. Only one Avanti license key is permitted per host system.

A license key may contain any number of units. Existing Version 4 registry keys remain usable subject to their unit, expiration, and update-eligibility limits. See the [Avanti SPD](#) for more information.

3.3.1 Enabling Licensed Features

Avanti uses the same installation kit for configurations that require zero units and configurations that require a license key. To enable a configuration that requires additional units, install an eligible key containing at least the displayed unit count in the Windows registry. Units already claimed by other running Avanti processes on the host also count against the available capacity; each new paid start checks whether enough units remain. No product conversion or separate software installation is required.

3.3.2 Avanti Version and License Key Information

The Avanti log file header contains Avanti version and license-key information. The log file can be opened with any text editor, such as Microsoft Notepad. The [temporary-license example](#)^[23] and [permanent-license example](#)^[24] explain the current Version 4 header fields using synthetic customer data.

To inspect the key currently installed on the host, open the Avanti Configuration Utility and choose Help -> Show License Key. This is a read-only operation and does not normally require administrator rights. The dialog lists the key's serial number, generation, version, customer, units, and any expiration or support date, and reports whether the key is valid or why it could not be validated. A valid key does not by itself guarantee that enough units are free for another running configuration.

The configuration utility reads the current registry key each time you choose Show License Key. In contrast, a running emulator's log describes the key and remaining-day count captured when that process started. Replacing or removing the registry key does not rewrite that startup information or change an already running process's admitted unit claim.

The configuration utility's license-unit status uses a snapshot read when the utility opens. It refreshes that snapshot when you choose Help -> Show License Key or confirm an install/removal attempt, including an unsuccessful attempt. Canceling leaves the snapshot unchanged. The regular screen-update timer does not reread the registry. If another utility changes the key, or the local date changes while the utility remains open, choose Show License Key to refresh the displayed eligibility. The status is guidance, not a reservation of units: the emulator always validates independently at its next start.

Supported registry-based Avanti license keys use Version 4. Version 3 registry keys have expired and are no longer supported.

3.3.2.1 Temporary License Header Example

The following synthetic example shows the license-related portion of an Avanti log header for a current Version 4 key with a finite lifetime:

```
License key used at startup: s/n 4243r2 (v.4)      10 units
    Licensed to Example Customer
    Days remaining at startup: 30
    Valid for releases up to 2027-9-30
```

- **Days remaining at startup: 30**
 - The encoded termination date is the final local calendar day on which the key may authorize a new emulator start. A process started on that final valid day records zero days remaining. This startup count is not a live countdown. A process that has already started remains authorized until it exits; a later paid start is refused from local midnight after the termination date unless another eligible key is installed.
- **Valid for releases up to 2027-9-30**
 - This is a separate restriction: the key can run a release only when the release date encoded in that software is on or before this support date. A maintenance patch may retain the encoded release date of the version it patches.

Days remaining is the difference between local calendar dates, accounting for month lengths and leap years. It is not a count of elapsed 24-hour periods; daylight-saving changes do not change the final valid date.

The serial number, generation, key-format version, licensed customer, and unit count have the same meanings as in the permanent-key example.

3.3.2.2 Permanent License Header Example

The following synthetic example shows the license-related portion of an Avanti log header for a current Version 4 key that has no expiration date:

```
License key used at startup: s/n 4242r7 (v.4)      25 units
Licensed to Example Customer
Valid for releases up to 2027-9-30
```

- **s/n 4242r7 (v.4)**
 - Serial number 4242, generation 7, in the supported Version 4 registry-key format.
- **25 units**
 - The optional-feature capacity carried by the key.
- **Valid for releases up to 2027-9-30**
 - The key can run an Avanti release when the release date encoded in that software is on or before this support date. A maintenance patch may retain the encoded release date of the version it patches. This line does not itself state that a support agreement is currently active.

A permanent key omits the `Days remaining at startup:` line and permits perpetual use of each release eligible under its support date, subject to the license agreement.

3.3.3 Installing, Updating, or Removing a License Key

Avanti uses a registry-based license key to enforce license compliance. Customers may need to update their license key under the following circumstances:

- A paid support agreement renewal.
- A demonstration key is about to expire.
- A demonstration key is being upgraded to a permanent license.
- A permanent key is being updated with additional license units.

A license key for a new or updated license will be provided by Migration Specialties via e-mail. Each license key is unique to the license for which it is generated.

The license key will look like the permanently expired example below. Copy every line:

```
== Paste from here ==>
exRoWhPhjYXPEPdqiAw
kqiO+oXLmcad+BsQca/d
0cIUqDQbdHfS8wRZfbpj
z3hr5koOMnacQsUEeS7y
x7468BVGJOn56lQgEQRZ
8Cozppw.sv1.AXqs0xm_
lZxNCWUF8ysIn4Xcaf5d
eiKQG2722OeVIRUx_4yy
iEaCKvWuMV004V6uSiXS
jhYmKdSGhQOX3TQ8TwQ
<== to here ==
```

To install the license key, open the Avanti Configuration Utility with administrator rights, and go to Help -> Install License Key. Paste the complete key into the dialog and

choose OK, or choose Cancel to leave the installed key unchanged. After a successful installation the utility displays the installed key's details. An invalid key or a failed registry operation produces a warning instead.

Avanti opens an installed license key read-only when displaying or validating it, so an administrator-installed key can be used when the emulator is run by a standard user. If Windows denies access, the key has the wrong registry value type, or the stored text is malformed, Avanti reports that condition separately from an absent key. The configuration utility verifies an install or removal and attempts to restore the previous registry value if verification fails. Malformed stored strings can be replaced or removed when their original bytes can be read for rollback. License changes from configuration utilities are serialized; if another utility holds exclusive access, close other license editors and retry with administrator rights. Do not edit the value with external registry tools during an install or removal.

A configuration requiring license units validates the installed key only when the emulator starts. A running instance keeps its admitted unit claim until shutdown or process exit; later key replacement, removal, read failure, expiry, or changes to update eligibility do not interrupt it. Restart that instance to use a different key. The emulator's license information describes the key used at startup, including any remaining-day count at that time; the configuration utility displays the currently installed key. A zero-unit configuration does not read or require a key at startup.

Avanti also validates the shared host accounting data before using it. If a running instance finds that data inconsistent, abandoned, or incompatible, it records a quarantine warning in the emulator log and keeps its already-admitted guest running without further accounting access. New instances are refused while the unusable shared mapping exists. Stop every Avanti instance on the host, including services, and then restart the required instances; after the final holder exits, Windows removes the mapping and the next start creates a fresh one. Do not terminate a guest merely to dismiss the warning unless you are ready for that coordinated restart.

The utility refreshes its license-unit status after a confirmed install or removal attempt, even if the operation fails. It does not poll for changes made elsewhere; use Help -> Show License Key to read the current key and refresh the status explicitly. Cancel does not reread or change the key.

Removing a License Key

Open the Avanti Configuration Utility with administrator rights and choose Help -> Remove License Key. Choose OK to confirm removal, or Cancel to leave the key unchanged. If removal fails, the utility displays a warning. After removal, use Help -> Show License Key to verify that no key is installed; removal does not open a separate success dialog.

Removing the key does not uninstall Avanti, delete configuration files, or stop running emulators. A later start that requires license units needs an eligible installed key and sufficient available units; a zero-unit configuration can still start without a key. When transferring a license to another host, shut down the licensed emulator instances on the old host and remove its key before installing the key on the new host. If failure or inaccessibility of the old host makes removal impossible, you may install the key on another host only if you ensure that no attempt is made to run Avanti on the old host while the key remains installed there. If the old host later becomes accessible, remove the key before any attempt to start Avanti on that host, as required by the license agreement.

Why Update a Permanent License Key?

A permanent license has no termination date, so why update the key? Renewing support can provide a key with a later support date, which is the key's update-eligibility

date. Avanti compares that date with the release date encoded in the software, not necessarily the date on which the software was distributed. A maintenance patch may retain the encoded release date of the version it patches, so a key eligible for the original version is also eligible for that patch. A renewed key is required only when the software's encoded release date is after the key's support date.

Virtual Alpha Configurations



4 Virtual Alpha Configurations

Avanti virtual Alpha configurations are easily created using the Avanti Configuration Utility. Multiple configurations can be created and stored on a system. Avanti configurations support the following virtual hardware.

- 1 CPU supporting the EV4, EV5, and EV6 instruction sets.
- Two virtual or physical serial ports, one of which is the console port.
- 32MB to 3GB.
- 1 - 3 NICs.
- 1 – 3 disk controllers supporting up to 45 disk devices, including multiple physical CD-ROM drives or hard drives.
- 1 – 5 Digiboard controllers for OpenVMS only, each supporting up to five virtual or physical serial ports. The Configuration Utility does not support these controllers; add them by manually editing the configuration file as described in [7.2 5-Port Serial Card Support \(OpenVMS\)](#).

The selected hardware determines the required license-unit count. A configuration that requires zero units runs without a license key and includes:

- 1 CPU supporting the EV4, EV5, and EV6 instruction sets.
- Two virtual serial ports, one of which is the console port.
- 32MB to 128MB.
- 1 - 2 NICs.
- 1 KZPAA controller with up to 7 targets or 1 KZPCA controller with up to 15 targets, including one physical CD-ROM or DVD-ROM drive.

4.1 Avanti Configuration Utility

The Avanti Configuration Utility provides an intuitive GUI interface to define virtual Alpha hardware. Configurations are stored in ASCII text files that are easily transferred to other systems. This chapter describes the Avanti Configuration Utility in detail.

4.1.1 Avanti Configuration Files

The Avanti Configuration Utility generates a text file containing a script that defines the desired hardware configuration for a virtual Alpha system. This script can be viewed and modified using any text editor. Manually modifying a script may introduce errors that prevent the emulator from launching. Existing configuration scripts are automatically parsed for manual modifications and errors by the Configuration Utility when opened.

A configuration file must contain exactly one top-level control block and may be nested no more than 32 levels. Files larger than 16 MiB or containing embedded NUL bytes are rejected. These checks apply to hand-edited files as well as files opened in the Configuration Utility.

Manually Modified Configuration Files

There are cases where manually modifying a configuration file is required. Adding a 5-port serial card is one example. Entering debug options under the guidance of a Migration Specialties support specialist is another. The Configuration Utility detects

configuration files that have been manually modified with options that are not accessible through the GUI when the file is open and issue a warning message. Using the Configuration Utility to update manually modified configurations is not advised.

Updating Avanti Path Names

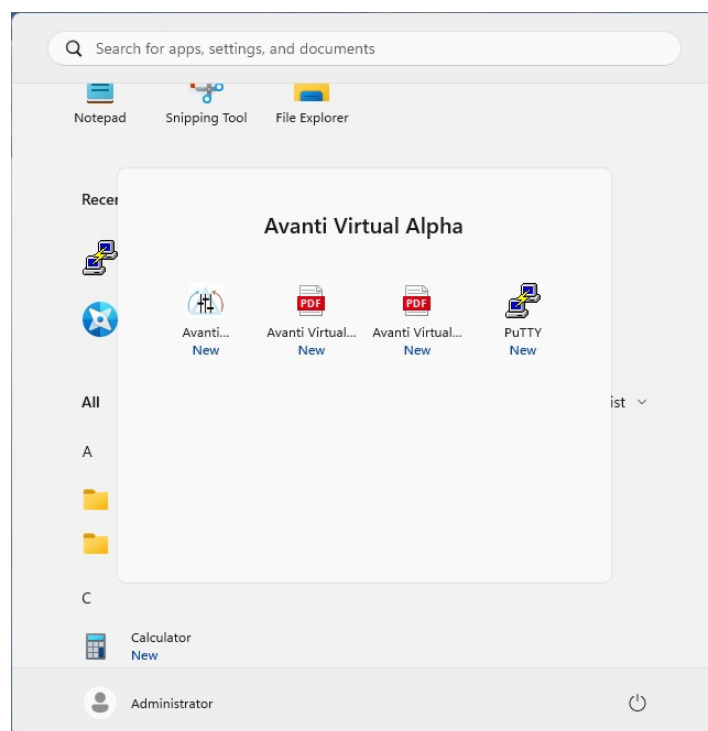
When moving an Avanti configuration file to a new location, the path names embedded in the file may change. Using the Configuration Utility to update each path reference in the configuration file can be a tedious process. The path names can be easily updated in one operation by opening the configuration file using a text utility such as Notepad and employing its Replace function. Manual modification such as path name changes are not flagged by the Configuration Utility GUI.

4.1.2 Specifying Sizes

Some configuration properties define element sizes. For example, a user may want to define a 4-gigabyte virtual disk. Avanti supports single character suffixes to indicate size magnitudes. To define a 4-gigabyte disk, the user would enter 4G. The following table lists accepted size suffixes.

Suffix	Size	Value
K	Kilo	1,024
M	Mega	1,024K
G	Giga	1,024M

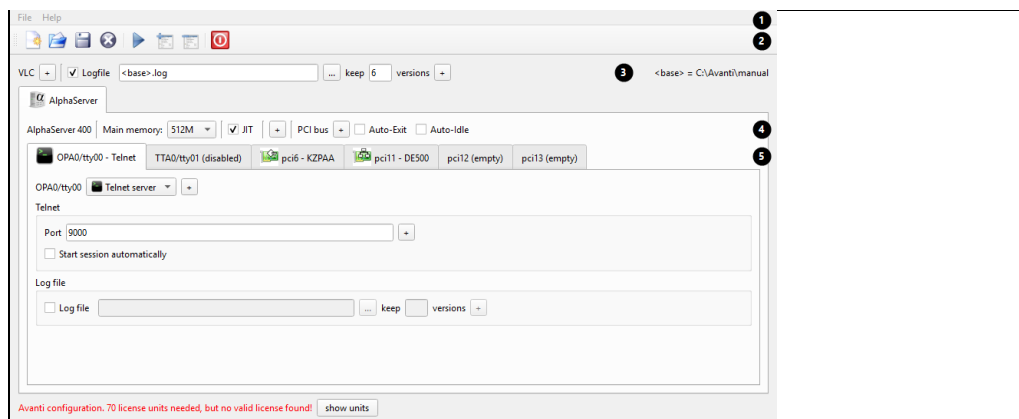
4.1.3 Running the Configuration Utility



Launch the Avanti Configuration Utility from Windows Start. On Windows 11, open All apps, then Avanti Virtual Alpha, and select Avanti Configuration Utility. On Windows versions with a Start screen, select its Avanti Configuration tile.

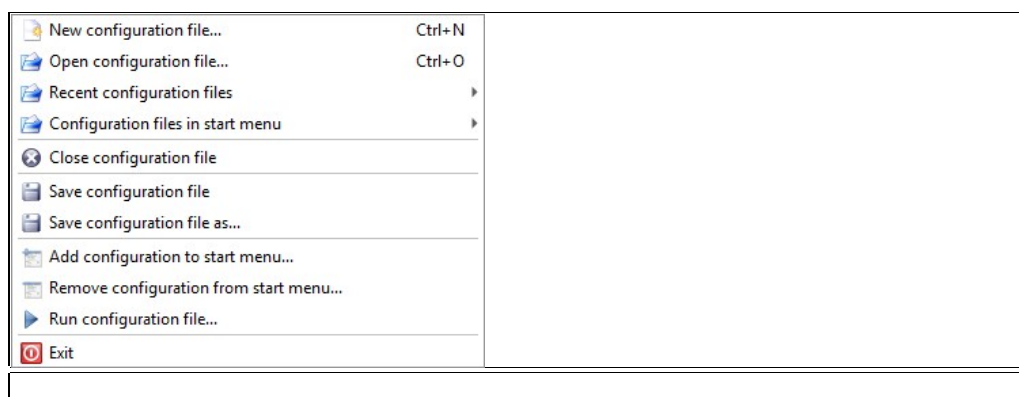
Note: Administrative rights are required to run the Avanti configuration utility.

4.1.4 Configuration Utility Layout



- 1) Menu Bar containing drop-down menus
- 2) Tool Bar containing configuration shortcut buttons. Hovering over a button will display a pop-up description. The tool bar can be removed by right clicking in the bar and unchecking the toolbar box.
- 3) VLC Section provides access to basic emulator parameters.
- 4) Virtual Alpha Base Settings covering memory, JIT, NVRAM, and TOY settings.
- 5) Virtual Alpha Component Tabs defining PCI bus components such as serial ports, disk controllers, and NICs.

4.1.5 File Menu



The File menu provides functions to create, edit, and save virtual Alpha configurations.

Note: When selecting a function, if a configuration file is already open and has been modified, the utility will prompt to save the current file before executing the selected function.

New configuration file...

Opens a new configuration. The configuration utility will show a new configuration with default settings and no disk assignments.

Open configuration file...

Opens an existing configuration file. A file selection box will open to allow selection of the desired configuration file.

Recent configuration files

Opens a recently edited configuration file. A selection list appears of recently edited configuration files to choose from.

Configuration files in start menu

Presents a list of virtual Alpha configurations that have been saved to the Start menu. If a configuration is clicked, the associated configuration file is opened in the Configuration Utility.

Close configuration file

Closes the present configuration file.

Save configuration file

Saves the current configuration file. If the file is new, the utility will prompt for a file name.

Versioning: By default, Avanti retains 4 versions of each configuration file. If a configuration file is present when a Save is executed, it is renamed <base>.cfg;-1. On a subsequent save, it would become <base>.log;-2, and so on.

Save configuration file as...

Opens a file browser window to save the configuration file under a new name.

Add configuration to start menu...

Adds the current configuration file as a shortcut to the Start menu. Avanti configuration shortcuts are stored under Start> All Programs> Avanti Virtual Alpha> Configurations.

Remove configuration from start menu...

If present, all shortcuts associated with the current configuration file are removed from the Start menu.

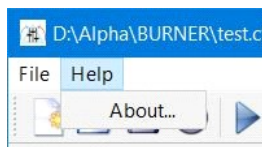
Run configuration file...

Runs the current configuration file.

Exit

Exits the Configuration Utility.

4.1.6 Help Menu



About...

Displays product, copyright, and version information.

4.1.7 Virtual Alpha Components

A virtual Alpha is constructed of virtual hardware components. The Configuration Utility provides the means to define the components required to build a working system. A basic system would include memory, a console, and a disk controller. If network connectivity is desired, a NIC is required.

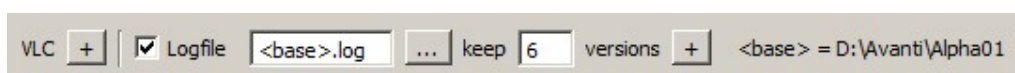
4.1.7.1 Advanced Features



The [+] buttons seen on various configuration screens provide access to advanced Avanti features. Advanced features are normally not utilized in Avanti configurations. [4.1.8 Advanced Configuration Features](#) describes advanced features in details.

4.1.7.2 <base>

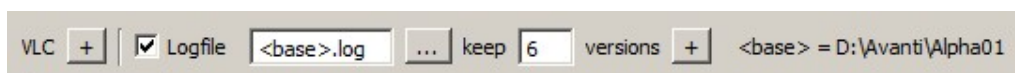
<base> will show up in the log file, TOY, and NVRAM file name fields. <base> is comprised of the path and file name under which an Avanti configuration file is saved. For example, if a configuration file is saved as D:\Avanti\Alpha01.cfg, <base> will equate to D:\Avanti\Alpha01. This information is displayed on the far-right side of the configuration screen on the VLC line.



When a new configuration is created, <base> is not assigned a value until the configuration file is saved. Until the configuration file is saved, the <base> definition area will show the following text:

<base> will be defined when file is saved.

4.1.7.3 VLC



The VLC line defines basic emulator parameters.

Logfile

Checking the Logfile box enables emulator logging. By default, the log file name will be <base>.log. The user has the option to modify the file name and location via the file name field and browse [...] button.

Keep

By default, Avanti retains 6 log files. If a log file is present when Avanti is launched, it is renamed <base>.log;-1. On a subsequent Avanti launch, it would become <base>.log;-2, and so on. The user can increase or decrease the number of log files retained using the keep field.

4.1.7.4 Virtual Alpha Base Settings



Virtual Alpha Base Settings covering memory, JIT, Auto-Exit NVRAM, and TOY settings.

Main Memory

Main memory defines the amount of memory assigned to the virtual Alpha system. Available memory is selected from a drop-down list.

Avanti supports configuring 32MB to 3GB of main memory regardless of the guest operating system. Digital UNIX and Tru64 UNIX can use up to 1GB; this guest limit does not reduce the emulator's 3GB configuration capacity. A zero-unit configuration includes up to 128MB, and larger selections require the license-unit count shown below.

Units are based on configured memory, not the amount the guest can use. Memory is mapped to match the three memory banks available in a real AlphaServer 400. The user need only specify the total memory desired in the Memory field.

A hand-edited main-memory value must be between 32MB and 3GB inclusive and must be an exact multiple of 16MB. Numeric values contain one or more decimal digits and may have a K, M, G, or T suffix; memory suffixes use powers of 1024. Suffixed terms may be concatenated, so 1G512M means 1536MB. The configuration-file reader removes whitespace outside quoted strings before interpreting values; for example, an unquoted 1 2 8 M is read as 128M. Whitespace inside quoted numeric values, signs, bare or consecutive suffixes, trailing text, and values that overflow the supported numeric range are rejected.

Total Memory	Bank 1	Bank 2	Bank3	License units
32MB	16MB	16MB	-	0 units
48MB	16MB	16MB	16MB	0 units
64MB	32MB	32MB	-	0 units
96MB	32MB	32MB	32MB	0 units
128MB	64MB	64MB	-	0 units
192MB	64MB	64MB	64MB	10 units
256MB	128MB	128MB	-	10 units
384MB	128MB	128MB	128MB	10 units
512MB	256MB	256MB	-	10 units
768MB	256MB	256MB	256MB	20 units
1024MB (1.0G)	512MB	512MB	-	20 units
1536MB (1.5G)	512MB	512MB	512MB	30 units
2048MB (2.0G)	1024MB	1024MB	-	40 units
3072MB (3.0G)	1024MB	1024MB	1024MB	60 units

Attempting to run a configuration with more memory than the installed key permits results in a license error.

JIT

Checking the JIT box enables Just-In-Time compilation. JIT is a performance enhancement that requires 60 license units. Attempting to run JIT without enough units results in a license error.

Auto-Exit

If checked, upon a normal OpenVMS or Tru64 UNIX shutdown, the emulator will terminate completely instead of stopping at the firmware prompt (> > >). Historical OpenVMS guidance uses Ctrl-P from the console session to interrupt a running guest and return to SRM; that path has not been revalidated for 5.1.0, so use it only with console access and confirm that the SRM prompt is visible before entering firmware commands. Under Tru64 UNIX, init 0 initiates the guest shutdown; with Auto-Exit enabled, the emulator can then terminate rather than remain at SRM.

Versions of Avanti prior to version 4.0.0 do not support the Auto-Exit feature. Remove Auto-Exit from the Avanti configuration before running an older Avanti version.

Auto-Idle

By default, Avanti utilizes one host CPU running at 100% to emulate the Avanti Alpha CPU.

With the Auto-Idle option selected, Avanti will idle the host CPU when the guest Tru64 UNIX or OpenVMS O/S is not busy.

Auto-Idle is not enabled by default. The Auto-Idle check box must be selected in the Avanti configuration file to enable the Auto-Idle feature

Some existing OpenVMS systems contain third-party Charon or HP Idle utilities. Avanti does not distribute or qualify a particular version of those utilities for 5.1.0. Do not enable Auto-Idle and a guest idle utility together unless that exact combination has been tested; remove or disable the guest utility before selecting Auto-Idle for a new configuration.

Auto-Idle changes how the emulator waits when it recognizes a guest idle loop. The result depends on the guest and workload. If enabling it causes unacceptable I/O latency or performance degradation, clear the option and restart Avanti.

4.1.7.4.1 Removing Charon and HP Idle Utilities (OpenVMS Only)

This historical procedure is retained for an OpenVMS system that already contains a third-party Charon or HP Idle utility. Avanti does not distribute these utilities, and this procedure has not been independently exercised with every package or OpenVMS version for Avanti 5.1.0. Back up the system, confirm the registered product identity, and prefer current instructions from the utility supplier.

1. Verify the Idle Utility is present.

```
$ PRODUCT SHOW PRODUCT IDLE
```

2. Remove the utility with the following command.

```
$ PRODUCT REMOVE IDLE
```

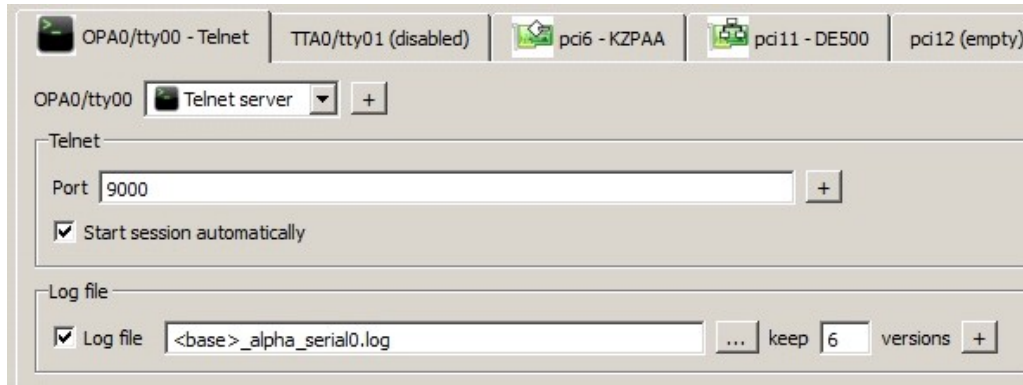
3. Reset the SYSGEN parameter CPU_POWER_MGMT.

Reset CPU_POWER_MGMT only if the third-party utility changed it and the supplier's removal instructions require that reset. Do not overwrite an independently configured value merely because the IDLE product was present.

```
$ MCR SYSGEN
SYSGEN> USE CURRENT
SYSGEN> SET CPU_POWER_MGMT 0
SYSGEN> WRITE CURRENT
SYSGEN> EXIT
```

Restart OpenVMS if required by the product-removal or parameter-change instructions. This procedure concerns guest software; it does not enable or disable Avanti's separate Auto-Idle configuration option.

4.1.7.5 Serial Ports: OPA0/tty00 – TTA0/tty01



Avanti supports two serial ports. The OPA0/tty00 – TTA0/tty01 tabs provide the means to define each port. A drop-down box allows the user to define a virtual serial port via Telnet server, connect it to a physical serial port via Physical port, or capture serial-printer output via [4.1.7.5.3 Print to File](#). The ports will appear as OPA0 and TTA0 on OpenVMS systems and tty00 and tty01 on Tru64 UNIX systems.

In a hand-edited configuration file, these two base ports must be named exactly `serial0` and `serial1`, and each name may occur at most once under the PCI-bus definition. A port omitted from the file still exists as an idle onboard UART, but has no host-side connection. Avanti rejects an empty, signed, malformed, overflowing, duplicate, or above-limit base-port identifier before startup. When updating an older hand-edited file, remove duplicate definitions and rename any retained base ports to `serial0` or `serial1`. The separately documented five-port ISA cards continue to use their own `serial0` through `serial4` children.

Tip: Migration Specialties recommends enabling both virtual serial ports when building, modifying, or troubleshooting an Avanti configuration. Having two serial access points to a virtual Alpha system is useful in case one session locks up or network problems block standard telnet access.

Note: Match the baud rate and other communication settings at both ends. Historical reports associated mismatched settings with an apparently hung port, but that exact failure signature was not reproduced in the Avanti 5.1.0 validation.

Log File

Checking the Log file box enables serial port logging. Data appearing on the serial port will also be written to an ASCII log file. By default, the log file name is `<base>_VirtualAlphaName_serial#.log`.

VirtualAlphaName: The name of the virtual Alpha definition as it appears on the definition tab.

serial#: `serial0` or `serial1`, depending upon the serial port being logged.

Note: Caution should be used when logging serial port activity. A heavily used port will produce a large log file, which may impact disk resources on the host system.

Keep

By default, Avanti retains six serial log files. If a serial log file is present when Avanti is launched, it is renamed `<base>_VirtualAlphaName_serial#.log;-1`. On a subsequent

Avanti launch, it would become <base>_VirtualAlphaName_serial#.log;-2, and so on. The user can increase or decrease the number of serial log files retained using the keep field.

4.1.7.5.1 Telnet Server

Selecting the Telnet server option allows the user to define a virtual serial port.

Port

Port defines the TCP port number assigned to this Telnet listener. Enter an integer from 1 through 65534; a configuration-file telnet block must specify port explicitly. The configuration utility supplies initial assignments starting with 9000, which can be changed in the Port field. Connect locally to 127.0.0.1 and that port number.

Tip: If running multiple instances of Avanti on a single host, don't forget to assign each virtual serial port a unique port number.

By default, allow_remote is false: Avanti binds the listener only to the IPv4 loopback address 127.0.0.1. A firewall exception does not make a loopback-only listener remotely accessible. To allow remote connections, enable allow_remote in the Advanced section of the Telnet Port [+] dialog. This binds to all host IPv4 interfaces, not to a selected interface. Remote access also depends on the applicable host firewall and network rules.

Telnet traffic is not encrypted, and this listener does not provide its own user-authentication gate. Guest operating-system login controls do not protect access to firmware console functions. Enable remote access only where the network exposure is acceptable, particularly for the console port (OPA0/tty00); leave allow_remote false when remote access is unnecessary.

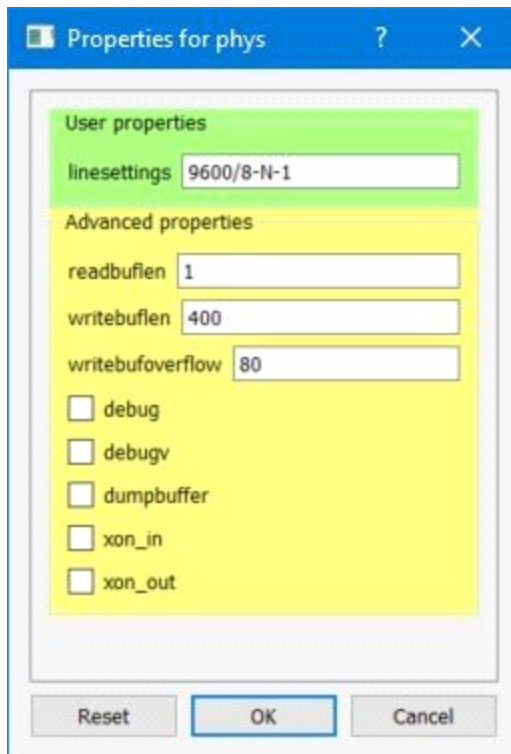
A client that cannot keep up with emulator output is disconnected when its pending Telnet output exceeds 256 KiB or a socket send makes no progress for five seconds. This protects the emulator from slow or stalled readers. A CTS-W-SLOWCLIENT message in the emulator log identifies this disconnect; reconnect the terminal and check its receive path or network connection if it recurs.

Start Session

Start session automatically controls whether Avanti launches a terminal program during emulator initialization. It does not enable or disable the Telnet listener. Clearing the box leaves the listener available for a manually started client and clears its action command. See [4.1.8.5.1 Telnet Port \[+\]](#)^[55] for custom commands and [5.10 Launching Avanti Without the Console](#)^[66] for service operation.

4.1.7.5.2 Physical Port

Selecting the Physical port option permits a physical COM port on the host server to be assigned to a virtual Alpha system. Physical serial ports require license units.



device

Select or enter the host COM device in the physical-port selector, for example \\.\COM1 or \\.\COM10. There is no default device. Avanti opens it for exclusive read/write access: another application or emulator cannot use that same COM port simultaneously. The host account must be able to open the device.

The [+] button beside the physical-port selector opens the ext_serial settings below. They are separate from the emulated port's [incoming-buffer settings](#)⁵⁴. Configure these host settings before starting Avanti; guest UART baud-rate changes do not reconfigure the physical COM port.

linesettings (default: 9600/8-N-1)

Use baud/data-parity-stop, without spaces. For example, 9600/8-N-1 selects 9600 baud, eight data bits, no parity and one stop bit. Accepted baud rates are 110, 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200, 128000 and 256000. Data bits are 5 through 8; parity is N (none), O (odd), E (even), M (mark) or S (space); stop bits are 1, 1.5 or 2. Only five data bits allow 1.5 stop bits, and five data bits cannot use two stop bits. The Windows driver and attached hardware must also support the selected combination.

The value host preserves the current host baud/data/parity/stop settings. It does not leave every COM option unchanged: Avanti still applies its xon_in and xon_out settings and its I/O error/timeout policy. The value guest is not implemented. That value, incomplete or malformed settings, and unsupported combinations produce diagnostics and retain the host line settings rather than applying the requested format; check the startup log for the actual configured settings. Enter line settings in the complete documented format, and keep both ends of the connection consistent.

xon_in and xon_out (both default: false)

xon_in enables Windows-driver receive flow control: the driver sends XOFF/XON to ask

the attached device to stop/resume sending input. `xon_out` enables transmit flow control: XOFF/XON received from the attached device pauses/resumes output to that device. These directions are relative to the host COM port. They use the driver's existing control characters and receive thresholds, not Avanti's buffer-size values. Enable them only when the peer uses compatible software flow control; these characters can otherwise interfere with binary protocols. These options do not configure RTS/CTS or DTR/DSR hardware flow control.

writebuflen (default: 400; range: 10 through 10000)

writebufoverflow (default: 80; range: 5 through 10000)

These byte counts are added together to size each of two Avanti output buffers; the defaults give 480 bytes per buffer. One buffer can be written while the other collects output. The two settings are not independent pause/resume thresholds, and neither changes the Windows driver's queue sizes. Excess output can still produce a physical serial port output buffer overflow and data loss; increasing buffer sizes is not a guarantee against a stalled receiver. Leave the defaults unless investigating a specific workload.

debug and debugv (both default: false)

`debug` enables additional physical-port diagnostic messages in the emulator log. `debugv` independently enables the verbose diagnostic call sites; it does not require `debug` to be true. Neither is a complete serial byte transcript. Logging can add substantial volume and overhead; use it temporarily for diagnosis. Normal startup and error messages may appear with both settings false.

Legacy controls: readbuflen and dumpbuffer

These remain visible for compatibility, but do not provide the behavior their old descriptions suggested. `readbuflen` (default 1, range 1 through 15) is validated and stored but is not used by the current physical read loop. `dumpbuffer` (default false) has no active buffer-dump call site. Leave both at their defaults; do not use them to tune read latency or capture serial data.

4.1.7.5.3 Print to File

Print to File captures output from an emulated serial port and writes each completed print job to a text file on the Windows host. Each configured Print to File session requires 10 license units.

In the Avanti Configuration Utility, open the OPA0/tty00 or TTA0/tty01 tab and select **Print to file**. Specify the following values. The adjacent [+] dialog exposes the same three properties; it does not add further Print to File settings.

Directory

The required existing host directory in which completed print jobs are written. Select a fully specified path; relative paths such as `.` are not accepted. The emulator process, including a service account when applicable, must have permission to create and replace files in this directory.

Naming rules

An optional text file that derives an output filename from the print data. Leave this field empty to name jobs from the local completion time. An unreadable or invalid rule file prevents the emulator from accepting the configuration.

End job after

The period of serial-port inactivity that ends a print job, in milliseconds. The valid range is 100 through 3,600,000 ms; the default is 500 ms. Enter decimal digits, or use decimal K and M suffixes; for example, `1K` is 1,000 ms. Choose a value longer than ordinary

pauses within one job. Before stopping Avanti, allow the configured interval to pass so the last job can be written.

Output behavior

Carriage returns and lone line feeds are written as Windows CR/LF line endings. A form feed is represented by three CR/LF sequences. Avanti keeps at most 1 MiB in its private active-job buffer and spools longer jobs to a temporary host file. The temporary file is removed when the job completes or the session closes. The job remains one output file, and naming rules can search its complete contents. Ensure the Windows temporary-file location has enough free space for long jobs. When the inactivity interval expires, Avanti writes the job. Without a naming-rule file, or when a configured rule file does not select a filename, the default filename is `YYYYMMDD HHMMSSmmm.txt`, where `mmm` is the completion time in milliseconds. If that automatic name already exists, Avanti appends `-1`, `-2`, and so on, and creates the first available name atomically. A rule-derived filename replaces an existing file with the same name, so rules should include fields that make each job name unique. If a rule produces an invalid filename, Avanti records a warning and writes that job under a collision-safe default filename instead.

If a file cannot be opened, written, flushed, or closed, Avanti records a `CPF-E-OUTPUT` message, retains accepted print data and the selected filename, and retries after five seconds. Correct directory, permission, free-space, or filename problems before the retry. If temporary spooling fails and the 1 MiB memory limit is reached, Avanti records `CPF-E-SPOOL` and discards further input until spooling succeeds or the job completes; check free space and permissions at the Windows temporary-file location. Invalid rules report `CPF-F-RULE`; an unreadable rule file reports `CPF-F-RULEFILE`.

Naming-rule syntax

Blank lines and lines whose first non-space character is a semicolon are ignored. Use one TAB character per nesting level; spaces do not define nesting. Rule names and options are not case-sensitive. Quoted text may contain spaces.

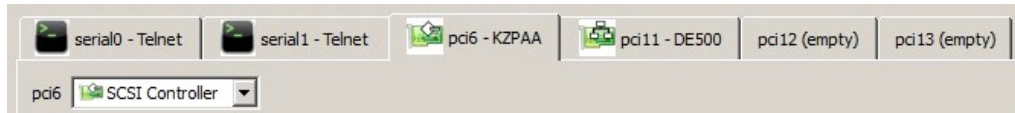
- `if "text"` runs its child rules only when the print data contains the text. Searches begin at the matched text.
- `set N "text"` assigns literal text to field `N`.
- `find N "text"` finds text and assigns the following field to `N`. Add `skip N` to skip fields, `down N` to move down lines, or `fields N` to capture multiple whitespace-separated fields.
- `find N "text" vmsdate` reads a VMS date and time whose day has one or two digits, such as `2-APR-2025 18:51:20` or `12-APR-2025 18:51:20`, and reformats it as `YYYYMMDD HHMMSS`.
- `filename "template"` selects the output filename and finishes rule processing. Insert field `N` with `%N%`, or right-pad its output field with spaces to a minimum width with `%N:width%`. Every referenced field must have been set. The result must be one ASCII Windows filename of at most 255 characters, not a path: directory separators, drive prefixes, relative-directory components, alternate data streams, control characters, non-ASCII bytes, reserved DOS device names, and other Windows-invalid filename characters are rejected so output remains in the configured directory.

The following rule names a job from the first word after `User:` and otherwise uses a fixed fallback. The two indented lines must begin with one TAB character.

```
if "User:"
    find 1 "User:"
```

```
filename "print-%1%.txt"
filename "print-unknown.txt"
```

4.1.7.6 PCI Slots

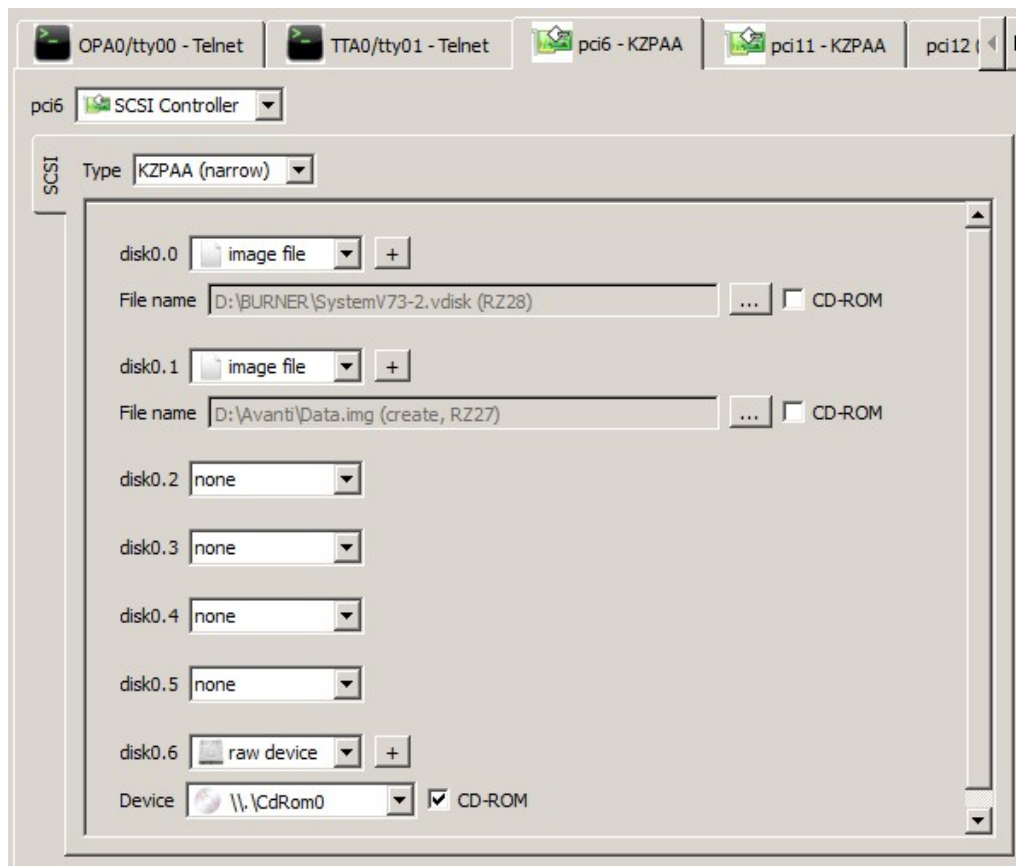


Avanti supports up to four PCI slots. The slots appear as tabs in the Configuration Utility. The PCI tabs are labeled pci6, pci11, pci12, and pci13, which are the same PCI slot id's in use on a real AlphaServer 400. On the real server, pci6 is reserved for the SCSI controller integrated on the main board. Each PCI slot can be assigned a SCSI controller or a Network card via a drop-down menu at the top of the tab. Not all PCI slots need to be assigned to build a working virtual Alpha system.

Each Alpha has one dc21071da PCI bus; additional bus blocks are rejected. The four configurable slots are pci6, pci11, pci12 and pci13. Each accepts one NIC or SCSI controller. At most three NICs and at most three SCSI controllers are supported, with no more than four cards in total; DE435 and DE500 cards share the NIC limit. Empty slots are allowed. The ISA serial-card positions isa2, isa3 and isa4 share space with pci13, pci12 and pci11 respectively and cannot be used together with the corresponding PCI slot.

Hand-edited identifiers must use a lowercase pci prefix and a complete unsigned decimal slot number. Leading zeroes retain their decimal meaning; pci6 and pci006 identify the same slot and cannot coexist. Invalid identifiers, duplicate slots, excess cards of either type, and the listed ISA/PCI conflicts prevent configuration loading. The editor refuses a conflicting card selection before removing the previous card. To migrate an older file, preserve its device and backing-file settings while assigning an unused supported slot, or remove an unwanted card. Moving a card can change guest device names, boot selections and network configuration; review those settings before restarting. License-unit charges are unchanged.

4.1.7.6.1 SCSI Controllers: KZPAA and KZPCA



Avanti supports two types of SCSI controllers: the 7-target KZPAA narrow controller and the 15-target KZPCA wide controller. Up to three SCSI controllers can be defined in an Avanti configuration. The first controller is included in a zero-unit configuration regardless of whether it is a KZPAA or KZPCA; each additional controller requires license units.

Tip: The supported KZPCA matrix starts at OpenVMS V7.1-2 and Digital UNIX/Tru64 UNIX V4.0F. V4.0E has not been qualified for KZPCA. Use KZPAA with earlier or unqualified guest releases.

Type

Type allows the selection of the KZPAA (narrow) or KZPCA (wide) controller via a drop-down menu. When changing a KZPCA to KZPAA, the configuration utility warns if targets 8 through 15 are populated. Continuing removes those target definitions from the configuration; it does not delete their backing image files. Record their settings or move them to valid targets before accepting the change.

The current configuration utility does not expose a SCSI-controller [+] dialog. In a hand-edited configuration, the recognized legacy `act_kzpca` property must remain false; setting it to true does not convert a KZPAA and prevents the controller from starting. The `debug` property is a diagnostic-build hook and normally has no effect in a production build. Leave both properties at their false defaults.

In a hand-edited configuration, name each SCSI device `disk<bus>.<target>`, using complete unsigned decimal numbers and a lowercase disk prefix. Both controllers expose bus 0. KZPAA accepts targets 0 through 6; KZPCA accepts 0 through 6 and 8 through 15. ID 7 is reserved for the controller. Each address may contain only one file-backed disk, RAM disk, CD/DVD-ROM, tape image, or raw device. Leading zeroes retain

their decimal meaning, so disk0.1 and disk00.01 are the same address and cannot coexist on one controller. The same target may be used on a different controller.

Malformed, overflowing, out-of-range, reserved, or duplicate SCSI addresses now prevent the configuration from loading. Correct the identifier or assign the duplicate device an unused supported target before restarting. Preserve each device's backing-file or raw-device settings; Avanti does not silently discard a duplicate device. Guest device names and boot selections may need updating after a target is changed. Existing license-unit rules are unchanged.

Disk0.n

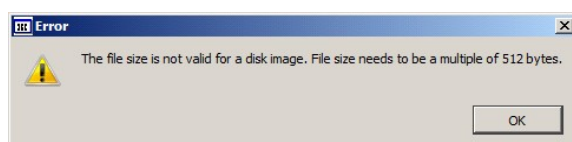
Disk0.n displays the disk image file or raw device associated with a disk on the virtual Alpha. For example, the picture above depicts the following disk definitions.

Definition	Virtual Alpha Device	Image file or Raw Device	File or Device String
disk0.0	DKA0	Image	D:\Avanti\System.img
disk0.1	DKA100	Image	D:\Avanti\Data.img
disk0.6	DKA600	Raw	\\.\CdRom0

Note: When using the KZPCA wide controller, disk numbering jumps from disk0.6 to disk0.8. This is normal and is due to the SCSI controller itself occupying slot 7.

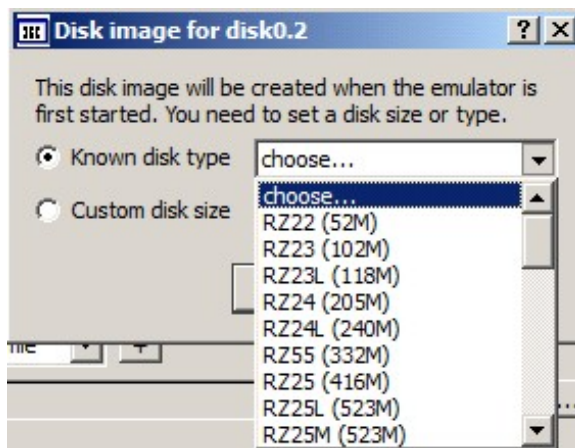
4.1.7.6.1.1 Image File

Image files are Windows container files that encompass the image of Alpha disks. These show up as virtual disks on the virtual Alpha system. Image files can be created by Avanti, copied from another Alpha emulator, or ported from a real Alpha system. By default, Avanti assigns a .img extension to disk image files.



Note: Image files need to be sized in multiples of 512 bytes to ensure they are properly recognized by Avanti. The configuration utility will display an error and will not map an image file with an invalid size.

To assign an existing disk container file to a virtual disk, select image file in an unused disk location and click the browse button [...]. Navigate to the desired host system folder and select the desired disk image file.



Avanti can create new image files, essentially creating new virtual disks, on startup. To create a new virtual disk, select image file in an unused disk location and click the browse button [...]. Navigate to the desired host system folder and type in the new disk file name. A disk type selection box will be displayed, as shown here. If a custom disk size is required, click the Custom disk size button and enter the desired size in Megabytes (M) or Gigabytes (G).

4.1.7.6.1.2 RAM Disk

A RAM disk loads an entire disk image into host memory and presents it as an Avanti SCSI disk. It occupies one target on its SCSI controller but carries no per-device license-unit charge. Because its data is memory-resident while Avanti runs, it is useful for disposable data such as OpenVMS pagefiles or Tru64 UNIX swap.

The backing image must already exist, must not be empty, and must have a size that is an exact multiple of 512 bytes. Avanti must be able to read the complete image before the RAM disk starts. A size-query, open, failed-read, or short-read error aborts startup and leaves the backing file unchanged.

The Configuration Utility does not currently display or create RAM-disk targets. Add a `ramdisk` component to an unused `disk<bus>.<target>` entry by editing the configuration file while Avanti and the Configuration Utility are closed. The mandatory `image` property must name the fully specified backing-image path. Avanti also needs enough available host memory and commit capacity to allocate the complete image in addition to the configured guest memory.

When `write_back=true`, Avanti loads the backing image at startup and stages the complete image during a graceful stop or an explicit guest `SYNCHRONIZE CACHE` command. It replaces the backing file only after the staged write and flush succeed; an open, failed-write, short-write, or replacement error makes the save fail and leaves the previous backing file in place. An abnormal termination can lose changes that have not yet been written. When `write_back=false`, runtime changes are never persisted to the backing image, including on `SYNCHRONIZE CACHE`.

Optional properties are `vendor`, `model_num`, `rev_num`, and `serial_num` for the guest-visible SCSI identity; `cdrom` for read-only CD-ROM behavior; `tcq` and `disconnect`; and `heads`, `cylinders`, and `sectors` for an exact geometry override. Leave `read_only=false`; a non-CD-ROM RAM disk cannot use it as an independent read-only mode, while `cdrom=true` always forces runtime read-only behavior. When `model_num` is empty, Avanti selects its default vendor, model, and revision, replacing any separate vendor or `rev_num`; set `vendor`, `model_num`, and `rev_num` together when overriding the automatic identity. Heads and sectors may be 0 through 255; cylinders

may be 0 through 65,535. A complete nonzero override is used only when `heads * cylinders * sectors` equals the image byte size divided by 512; otherwise Avanti derives the geometry. Leave all geometry values zero to use automatic geometry. Enable tagged command queueing only with disconnect enabled. The `debug` property is reserved for a purpose-built diagnostic version and has no effect in an ordinary Avanti build.

If set, `serial_num` may be at most 255 bytes.

A RAM disk is not equivalent to durable storage. Keep authoritative data on storage with an appropriate independent backup and recovery plan.

4.1.7.6.1.3 CD-ROM

Checking the **CD-ROM** box will define the device as a CD-ROM. Image files with an `.iso` extension are automatically assumed to be CD-ROM devices. A zero-unit configuration includes one raw CD-ROM or DVD-ROM device. Avanti mounts a configured CD-ROM read-only. Separate Avanti processes can reference one host optical drive, but Avanti does not coordinate their media state or concurrent access; this arrangement is not qualified for 5.1.0. Prefer a separate image path or copy for each emulator when concurrent access matters.

4.1.7.6.1.4 Raw Device

Raw devices give the guest direct access to a physical disk, CD-ROM, or DVD-ROM drive on the Windows host. Available devices are listed in the **Device** drop-down box. The Configuration Utility omits physical disks that it detects are in use by Windows or whose disk identity it cannot determine. If a disk is missing, run the utility as administrator and check the Windows storage driver and device permissions before retrying. Never expose a disk that is mounted or otherwise in use by Windows or another application: concurrent access can corrupt the disk.

Select **CD-ROM** for optical media. Avanti then presents the device as read-only removable media. If an optical drive is unexpectedly absent from the Device list, check Windows device permissions and enumeration. Avanti normally requires administrator rights to open a physical device. Existing configuration files may use a Windows device path beginning with `\\.\` or `\\?\`; use the Device list for new configurations.

A raw disk requires license units. A zero-unit configuration includes the first physical CD-ROM or DVD-ROM when its device path uses the canonical `\\.\CDROMn` form produced by the Device list. An extended `\\?\` path does not qualify for this allowance. Additional physical optical drives or any raw disk require at least 10 units.

The raw-device `[+]` dialog contains these settings:

vendor, model_num, rev_num, serial_num

Set the guest-visible SCSI inquiry identity. When `model_num` is empty, Avanti selects its default vendor, model, and revision, replacing any separate vendor or `rev_num` value. Set `vendor`, `model_num`, and `rev_num` together when overriding the automatic identity. Use a distinct serial number of at most 255 bytes when guest software distinguishes devices by serial number.

tcq (default: false)

Enable tagged command queueing. This is required for an OpenVMS cluster quorum disk and requires disconnect to remain enabled.

disconnect (default: true)

Allow the disk to disconnect and later reselect during long SCSI operations so another target can use the bus.

write_through (default: true)

Open the raw device with Windows write-through caching. Leave this enabled. Disabling it risks data loss if the host stops unexpectedly. A guest SYNCHRONIZE CACHE command waits for earlier writes and asks Windows to flush the raw-device handle; a flush failure is reported to the guest.

lock_cd_tray (default: true)

For an optical drive, ask Windows to lock the tray while Avanti is accessing the medium and unlock it after the drive becomes idle. A host drive or driver may decline the request.

heads, cylinders, sectors (default: 0)

Override the guest-visible disk geometry only when all three values describe exactly the physical device size in 512-byte blocks. Heads and sectors may be 0 through 255; cylinders may be 0 through 65,535. Leave all three at zero to derive a geometry automatically; an incomplete or mismatched override is ignored.

debug (default: false)

Reserved for a purpose-built diagnostic version supplied by Migration Specialties. This setting has no effect in an ordinary Avanti build.

4.1.7.6.1.5 Tape Image

Tape image files are Windows container files that contain the image of Alpha tapes. These show up as virtual tape devices on the virtual Alpha system. Tape image files can be created by Avanti, copied from another Alpha emulator, or ported from a real Alpha system. By default, Avanti assigns a .vtape extension to tape image files. Virtual tape devices require license units.

The vtape format utilized by Avanti is fully compatible with the vtape format used in SimH. Avanti virtual tape devices default to a DEC DLT2000 device type.

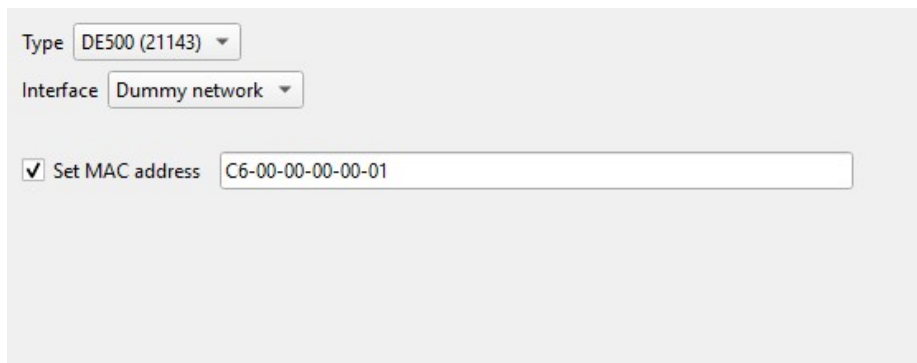
A truncated tape image or a record whose leading and trailing lengths disagree is not a valid continuation of the recorded data. If a tape command reports end of data on an image that should contain more records, preserve the image for diagnosis and restore a complete copy; do not rely on repeated SPACE or READ commands to skip the damaged record. A host write failure, including insufficient disk space, is reported to the guest as a tape I/O error.

Note: By default, Avanti puts no configured limit on the size of a vtape file. Continuously appending to a tape can therefore fill the host system disk; available host storage and filesystem limits still apply.

To assign an existing tape file to a virtual tape device, select tape image in an unused disk location and click the browse button [...]. Navigate to the desired host system folder and select the desired tape image file.

Avanti will create a tape image file at startup if the file does not already exist. To create a new virtual tape, select tape image in an unused disk location and click the browse button [...]. Navigate to the desired host system folder and type in the new tape file name. When Avanti is started, an empty tape file will be created.

4.1.7.6.2 NIC



Avanti supports up to three NICs; the first two are included in a zero-unit configuration. NICs can be defined as the DE435 or the DE500 using the 21140 or 21143 chip sets. [6 Networking Avanti](#)^[78] discusses network configuration in more detail.

Tip: OpenVMS recognizes the DE435 and DE500 (21143) NIC types. The DE500 (21140) NIC type is only recognized by Digital UNIX/Tru64 UNIX.

Type

Type allows the user to choose between the following NIC types. DE435 selects the 21040 model; the two DE500 choices select the 21140 or 21143 model shown. Changing the type retains the other explicitly configured NIC settings.

NIC	Recommended Usage
DE435	- OpenVMS version 6.1-1H1 and higher. - Digital UNIX version 3.2C and later.
DE500 (21140)	Digital UNIX/Tru64 UNIX version 4.0 through 4.0E.
DE500 (21143)	- OpenVMS version 7.2 and higher. - Digital UNIX/Tru64 UNIX version 4.0F and later.

Interface

Avanti provides NIC interface options in a drop-down list:

Dummy network: Leaves the virtual NIC present in the emulated system but disconnected from any packet backend. Outbound packets are discarded and no packets are received. Each Dummy network NIC is independent; Dummy network does not connect virtual NICs to one another. This is useful for retaining an unused NIC in the guest configuration or as a placeholder before selecting a live network.

Host NIC: All host interfaces visible through the selected PCAP backend are displayed in the drop-down list. Selecting one connects this virtual NIC directly to that host interface. Make an explicit selection before starting the emulator; the configuration-file placeholder `adapter = ask` is replaced with the first enumerated interface when the Configuration Utility can do so. If a previously stored interface is unavailable, the utility retains it as an invalid selection so that you can choose a replacement.

Note: If a host adapter is added while Avanti or the Configuration Utility is running, close both programs and reopen the Configuration Utility to rescan. If it remains absent, follow [6.2 Adding a Host NIC](#)^[79] for backend-specific recovery.

Set MAC Address

Leave Set MAC address unchecked to let Avanti derive an address automatically. Checking it enables the MAC address field and stores a stable explicit address. Manually setting a MAC address is useful in the following situations:

- The generated MAC address causes a network conflict with another device.
- Software on the virtual Alpha system requires a specific MAC address.
- One host NIC is being shared between multiple Avanti instances.
- When running Avanti under Windows hosted on a virtual machine such as VMware.

Enter six two-digit hexadecimal octets in the form C6-00-00-xx-xx-xx. A colon can be used in place of each hyphen. The first octet must identify an individual rather than multicast address; C6 is a locally administered individual-address prefix. You are responsible for assigning a different complete address to every virtual NIC that can be active on the same network. Never run two instances concurrently with the same explicit address.

Note: The MAC address field will not accept an invalid MAC address. Trying to type or cut and paste an invalid MAC address will result in nothing being entered in the MAC address box.

For optional diagnostic counters, see [4.1.7.6.2.1 NIC Configuration-File Settings](#)^[47]. Host packet-driver selection is process-wide through [use npcap_driver in VLC](#) ^[50] [\[+\]](#).

4.1.7.6.2.1 NIC Configuration-File Settings

The following setting applies to both de435 and de500 NIC blocks. It supplements the Type, Interface and Set MAC Address controls described under [4.1.7.6.2 NIC](#)^[46]. Those controls manage the type, adapter and mac properties. The current NIC panel does not display a [\[+\]](#) button for stats. To change the setting, stop the emulator, keep a backup of its configuration file, and edit the existing NIC block. The new value takes effect on the next emulator start.

stats (default: 0; range: 0 through 3600 seconds)

Sets the interval for logging receive/transmit counters for this emulated NIC. Use a whole number of seconds. Zero disables this periodic log output; a positive value requests a report at that interval. For example, stats = 60 requests a report approximately once per minute. Reporting is checked periodically by the emulator, so the interval is not an exact scheduling guarantee.

Reports use the DE500 label for both NIC types and include receive, receive-buffer-full, lost-receive and transmitted counters. They are diagnostic counters, not a capture of packet contents or a measurement of guaranteed network throughput. Logging does not require an interactive NIC monitor to be open, but a positive stats interval also limits that monitor's refresh rate: stats = 60 updates it approximately once per minute, and stats = 3600 can leave it unchanged for an hour. Zero disables periodic logging without imposing that delay on the monitor. Frequent reports increase log volume; restore stats to 0 after troubleshooting if the output is no longer needed.

Example line to add inside an existing de435 or de500 NIC block (not a complete configuration):

```
stats = 60;
```

4.1.7.6.2.2 Single Avanti Instance and MAC Addressing

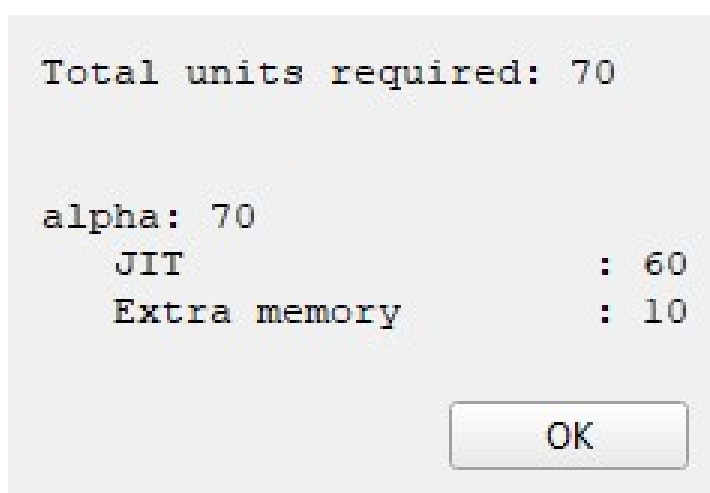
By default, Avanti assigns a unique MAC address to each virtual Alpha NIC in a single Avanti instance. The addressing scheme uses the host NIC MAC address as a base address to generate the virtual NIC addressing. As long as the generated MAC addresses do not conflict with another network device, there should be no need to manually configure MAC addressing.

4.1.7.6.2.3 Multiple Avanti Instances and MAC Addressing

If running multiple instances of Avanti, it is recommended that each instance be assigned its own host NIC. If this is the case, then the MAC addressing scheme described in [4.1.7.6.2.2 Single Avanti Instance and MAC Addressing](#) holds true and manual MAC assignments should not be necessary.

If multiple instances of Avanti share a single host NIC, then the MAC addressing scheme will assign each instance the same set of MAC addresses. This will lead to network address conflicts and block network access on all but the first instance. If a single host NIC is to be shared between Avanti instances, then manual configuration of the MAC addresses on each instance is required to ensure proper network functionality.

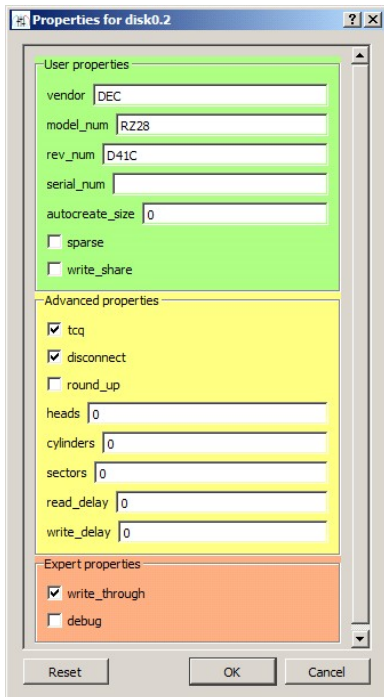
4.1.7.7 Show Units



At the bottom of each Avanti configuration window, the total number of required license units is displayed. A configuration requiring zero units runs without a license key; configurations requiring additional units need a key with at least that many units. Clicking the [show units] button provides a detailed list of the charged components.

The image above shows the License Unit Calculation box for an example configuration requiring 70 units: 60 for JIT and 10 for memory above the included amount. The same 70-unit total appears at the bottom of that configuration window.

4.1.8 Advanced Configuration Features



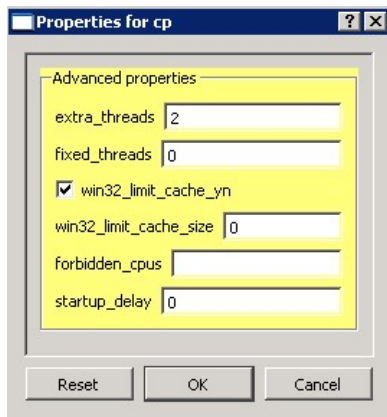
This section describes the advanced configuration features available via the advanced dialog boxes in the Configuration Utility. Advanced features are normally not utilized in Avanti configurations. They are available for special situations to tune features or troubleshoot problems.



Advanced dialog boxes are accessed by clicking the plus button next to specific configuration items. Items in each dialog box are labeled and color-coded as User properties (green), Advanced properties (yellow), and Expert properties (red).

User properties	Properties that can be safely modified and pose little danger to the virtual Alpha. These include things like log file names and terminal emulator launch strings.
Advanced properties	Advanced properties have the potential to adversely impact the virtual Alpha. These properties should only be modified by a knowledgeable user.
Expert properties	Expert properties will destabilize or disable the emulator if misused. Expert properties should only be modified under the guidance of Migration Specialties or a qualified support specialist.

4.1.8.1 VLC [+]



extra_threads (default: 2; range: 0 through 256)

Adds this many worker threads to the actor framework's automatic count. The automatic count also includes the framework's blocking actors and host CPU cores not reserved by another Avanti process. The resulting total must be between 1 and 256 and exceed the blocking-actor count; Avanti rejects a configuration outside these limits. This setting has no effect when `fixed_threads` is nonzero. Normally retain the default; changing the count can affect scheduling overhead and I/O responsiveness.

fixed_threads (default: 0; range: 0 through 256)

A nonzero value replaces the automatic calculation with exactly this many actor-framework worker threads. It must exceed the number of blocking device actors so at least one worker remains available for their handshakes. Zero selects the automatic calculation described for `extra_threads`. Normally retain zero unless troubleshooting a specific workload.

win32_limit_cache_yn (default: false)

False leaves the Windows system file-cache working-set limits unchanged. True applies the `win32_limit_cache_size` as a system-wide hard maximum while this Avanti process is running, then restores the prior limit state when it shuts down normally. This advanced compatibility option can help when sustained emulated-disk I/O causes the Windows file cache to consume enough memory to degrade system performance, but an unsuitable limit can itself reduce performance. Monitor the entire host when evaluating it.

Because the setting affects Windows globally rather than only Avanti, enable it in no more than one simultaneous Avanti process. Leave it false in every other Avanti configuration on that host.

win32_limit_cache_size (default: 0; increment: 128M)

When `win32_limit_cache_yn` is true, this value sets the system file-cache working-set maximum. Zero selects 25% of physical memory. A nonzero value must be a multiple of 128 MB; for example, 512M selects 512 MB. Start with zero, observe memory use and application performance under a representative workload, and change the value only when measurements justify it. If enabling the limiter makes performance worse, set `win32_limit_cache_yn` back to false.

forbidden_cpus

Reserves CPUs, blocking the emulator from using specific host CPU cores. Cores are numbered starting at zero (0). For example, a 4-core system has CPUs 0 – 3.

If blocking multiple CPUs, separate each CPU ID with a comma. An entry of 0,1 on a 4-core system would prevent Avanti from using CPU cores 0 and 1, effectively treating the machine as a 2-core system. Use unique unsigned decimal IDs; spaces around an ID or

comma are allowed, but signs, other characters, empty entries, and duplicate IDs are rejected. A blank value excludes no CPUs. The configuration-file reader removes whitespace outside quoted strings, so an unquoted 1 2 is read as 12. Whitespace inside a quoted ID is retained and rejected; use commas to separate IDs. IDs must be within 0 through 255 and identify CPUs present on the host; this numeric limit does not expand the supported host topologies.

Note: This is a global setting that applies to all Avanti instances running on the host machine. It takes its value from the first emulator that is started, so every configuration used concurrently on one host should specify the same `forbidden_cpus` value.

cpu_core_preference (default: automatic)

Selects the preferred Windows CPU-core class for this emulator's Alpha-CPU thread. Use `automatic` or `performance` to prefer the highest available Windows efficiency class, or `efficiency` to prefer the lowest available class. Enter exactly `automatic`, `performance`, or `efficiency` in lowercase. If the preferred class is unavailable or exhausted, Avanti falls back through the remaining eligible classes instead of refusing startup. On supported Windows hosts that do not report efficiency classes, all three values retain physical-core and processor-topology ranking without a class preference.

This option is a placement hint within the CPUs already allowed by Windows process/job affinity and `forbidden_cpus`. It does not reserve a physical core from Windows or other applications and does not guarantee guest performance, host power use, or energy savings. Avanti still preserves a separate eligible I/O CPU for each instance, and the option does not change license-unit requirements.

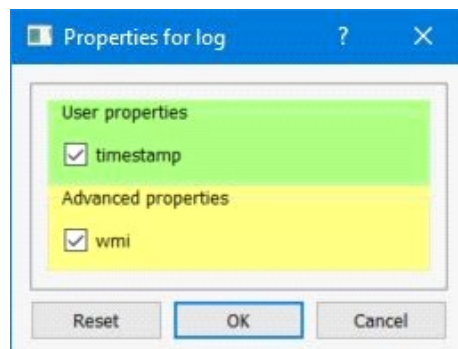
startup_delay (default: 0)

Delays the emulated Alpha CPU start by this many whole seconds after Avanti has initialized and started its device framework. Zero starts the CPU without an intentional delay. This can sequence multiple separately launched Avanti processes or allow host resources to settle; it is not a readiness check for another service.

use_npcap_driver (default: true)

Selects the host packet-driver backend for every NIC in this Avanti process. `True` uses a compatible Npcap installation when available and falls back to the bundled Migration Specialties `msipcap` driver when Npcap cannot be loaded. `False` prevents subsequent Npcap loading and selects `msipcap`. Set this to `false` if Npcap is installed for another application but its license does not permit use by Avanti. When changing the value in the Configuration Utility, every NIC Interface list is refreshed for the selected backend; reselect any adapter shown as invalid. To opt out before the Configuration Utility first loads a default-true configuration, follow the text-editing procedure under [6.1 PCAP Drivers](#). Avanti does not install Npcap or grant a license to use it.

4.1.8.2 Logfile [+]



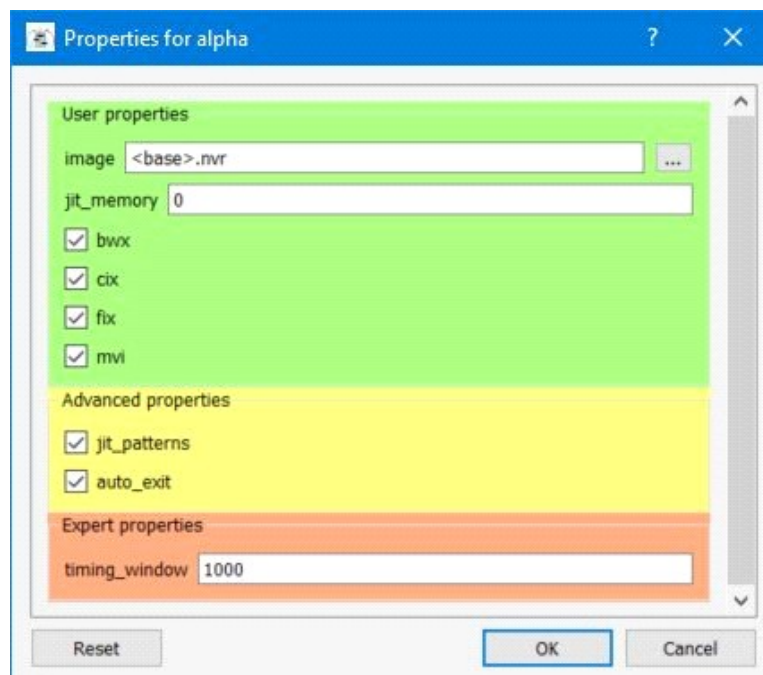
timestamp (default: true)

Prefixes each nonempty output line, including the first, with the host's local time in the format YYYYMMDDHHMMSS.mmm followed by a colon and a space. Blank lines are not prefixed. Both carriage return and line feed start a new line; a CR/LF pair does not add a second timestamp. Set timestamp to false to omit these output-line prefixes. This does not remove the separately written log header or its file-open date.

wmi (configuration-file setting; default: true)

This setting controls collection of Windows version and processor information for the log header. It is hidden in the current configuration utility, so it is not a checkbox in the Logfile [+] dialog. If host-information collection causes startup delays, stop the emulator and set wmi = false; inside the existing logfile block. This suppresses that optional host-information section, not the entire header, licensing information or file-open date.

The current [+] dialog exposes timestamp. File name and version count have separate controls beside it; see [11.1.1 Avanti Log File](#)^[126] for their defaults, retention behavior and file-sharing precautions. Older screenshots may show a wmi checkbox that is no longer exposed.

4.1.8.3 Alpha [+]

The Alpha [+] dialog exposes the configuration-file settings below. Settings marked harmful should normally remain at their defaults. Main Memory, JIT, Auto-Exit, and Auto-Idle also have controls in [4.1.7.4 Virtual Alpha Base Settings](#)^[32]; Auto-Idle is the only one repeated in this dialog.

image (new-configuration value: <base>.nvr; omitted-property fallback: nvram.img)

Pathname of the 16KiB NVRAM image. This file is the equivalent of non-volatile RAM on a physical Alpha and retains firmware settings such as boot parameters. The configuration utility gives a new configuration an image alongside the configuration file; a hand-edited configuration that omits this property uses nvram.img.

jit_memory (default: 0, increment: 64M, maximum: 2G)

Maximum address space reserved for translated JIT code when JIT is enabled. Zero automatically selects half of physical host memory, rounded down to a 4MB boundary

and capped at 2GB; if host-memory discovery fails, zero selects 2GB. Avanti normally commits the reserved range incrementally in blocks of at least 4MB. If the first block cannot be committed, Avanti releases that reservation and retries by reserving and committing the entire configured buffer at once; this fallback can immediately consume the full commit charge.

Note: If running on a Windows host system equipped with more than 32GB of memory and the following error is encountered, set the `jit_memory` parameter to 2GB.

Unable to reserve JIT buffer area: error 87: The parameter is incorrect.

bwX (default: true)

Advertises and enables the Alpha Byte/Word Extension (BWX). Disable it only when intentionally testing an EV4-only software path; guest software that requires BWX will no longer run.

cix (default: true)

Advertises and enables the Alpha Count Extension (CIX). Disable it only for deliberate compatibility testing; guest software that requires CIX will no longer run.

fix (default: true)

Advertises and enables the Alpha Floating-point Extension (FIX). Disable it only for deliberate compatibility testing; guest software that requires FIX will no longer run.

mvi (default: true)

Advertises and enables the Alpha Motion Video Instructions (MVI). Disable it only for deliberate compatibility testing; guest software that requires MVI will no longer run.

jit_patterns (default: true)

When JIT is enabled, recognizes selected Alpha instruction sequences and translates each recognized sequence as a unit. This setting has no effect while JIT is disabled.

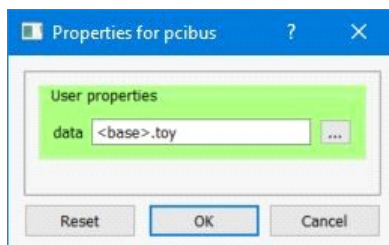
auto_idle (default: false)

This is the same setting as the Auto-Idle check box in Virtual Alpha Base Settings, not a second idle mechanism. See that topic for its behavior and performance guidance.

timing_window (default: 1000; range: 1 through 1000000)

Scales the emulator's host-timer calibration window, with 1000 representing the normal 1.0 factor. Changing it alters the timing loop and effective timer-resolution floor and can cause clock inaccuracy or poor responsiveness. Retain 1000 unless directed to change it for a diagnosed timing problem.

4.1.8.4 PCI bus [+]



data (new configurations: <base>.toy)

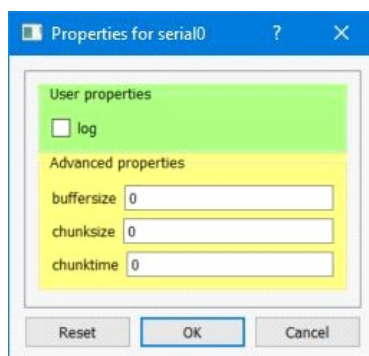
Full path to the TOY image file. This file replaces the Time-Of-Year RAM on a legacy Alpha, storing configuration settings such as Time-of-Year and the time offset between the host system and the virtual Alpha. The Configuration Utility expands `<base>` to the path and filename under which the configuration is saved, without its `.cfg` extension. Keep a separate TOY file for each configuration.

On first launch, the TOY file does not yet exist; Avanti reports a warning and starts with uninitialized clock state. After the guest initializes or changes that state, a controlled emulator exit writes the file. An unwritable path reports an error and the updated TOY state is not preserved. If a hand-edited configuration omits `data` entirely, the emulator instead uses the relative fallback `toy.bin`; specify a fully qualified per-configuration path rather than relying on that process-working-directory fallback.

Runtime-only compatibility setting

A hand-edited runtime configuration may contain `shadow_on_disk`. Its default true value eagerly prepares the emulator's instruction-shadow representation for code loaded from disk; false disables only that eager optimization. It does not change disk or TOY contents. The Configuration Utility does not recognize this runtime-only property and cannot open a configuration that contains it. Leave the property absent to use the true default, or remove an explicit value before opening the configuration in the utility.

4.1.8.5 Serial Ports (OPA0/tty00, TTA0/tty01) [+]



These settings control incoming-data buffering and retry timing, not the baud rate of a physical COM port. Zero buffer values select automatic defaults; they do not disable buffering. The effective timing also depends on whether the port has a physical serial connection, as described under `chunktime` below.

The [+] settings apply to the selected emulated i16550 port, including an individual port on an additional serial card. Incoming bytes first enter a larger queue, then move into a smaller buffer from which the guest reads them. These are not the physical host COM driver's buffers.

log (default: false)

Write diagnostic text records for guest serial output to the main emulator log. Records are emitted at a carriage return, line feed, or when the internal text buffer fills. NUL bytes are omitted, line terminators are not preserved as data, and an unfinished final line may not be recorded. This is useful for correlating low-volume console messages, not a byte-for-byte transcript or separate capture of input keystrokes. For a separate serial-output file, use [7.1.2 Serial Port Logging](#). Neither option guarantees capture of guest input that the guest does not echo.

buffersize (default: 0, automatic)

Capacity in bytes of the larger incoming queue. A positive value sets that capacity explicitly. Zero selects 16 bytes when this port has a physical serial connection, or 16777215 bytes otherwise. The implementation reserves one additional ring-buffer slot; the startup diagnostic reports allocated sizes, one larger than usable capacities. Choose a practical size that fits available host memory. If this queue fills before input can be transferred, Avanti reports a serial port buffer overrun and drops input that does not fit; it does not guarantee lossless delivery or wait for space.

chunksize (default: 0, automatic)

Capacity in bytes of the smaller guest-facing input buffer. A positive value sets that

capacity explicitly. Zero selects 1 byte with a physical serial connection, or 9 bytes otherwise. The effective chunksize must not exceed the effective buffersize, including when one value remains automatic; for example, buffersize=4 with automatic chunksize is invalid without a physical connection. A chunk is a buffer refill, not a packet boundary or a promise that the guest reads that many bytes at once.

Both size settings accept nonnegative whole-byte values and binary K/M/G/T suffixes; for example, 1K means 1024 bytes. Zero means automatic, not an empty buffer. Leave the defaults unless there is a specific need to tune input buffering. Larger buffers consume more host memory and do not solve a persistently slower receiver.

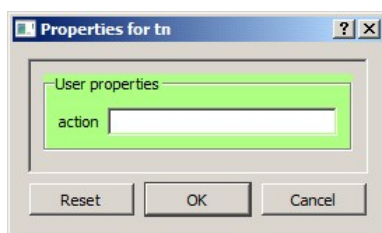
chunktime (default: 0; range: 0 through 2147483647)

Retry delay in milliseconds when queued input cannot yet fit in the smaller input buffer. It is not a guaranteed character transmission rate. A nonzero value is used as specified. With zero, a port without a physical serial connection substitutes 10 milliseconds if either buffersize or chunksize is also zero; otherwise no additional timer delay is requested. The upper limit prevents integer overflow, not a recommendation to use long delays: an excessive setting can make pending serial input appear unresponsive.

Configuration-file compatibility setting

commsync (default: true) is hidden from the [+] dialog but remains active in the emulated UART. It enables modem-status-change indications after line-control or modem-control register writes. It is not a host baud-rate, buffering, or throughput control. Leave it at its compatibility default unless investigating a specific guest-driver requirement.

4.1.8.5.1 Telnet Port [+]



action (configuration-file default: empty)

The program and arguments used to launch a terminal during emulator initialization. An empty action launches nothing; it does not stop the listener. Specify the client address and port explicitly: Avanti does not append them to a custom command. Use only a trusted command, since opening an emulator configuration with a nonempty action launches that program when the emulator initializes. The complete command is limited to 999 bytes; a longer value is rejected rather than run in truncated form.

Tip: If running multiple instances of Avanti on a single host, don't forget to assign each virtual serial port a unique port number.

Checking Start session automatically writes a PuTTY command using the installed PuTTY path and the current port, replacing any existing action. For example, the action field might contain:

```
"C:\Program Files\Common Files\MigrationSpecialties Shared\putty.exe"
telnet://127.0.0.1:9000
```

That path is illustrative; use the actual installed path. Quote a program path containing spaces. The action field contains the command itself, not an extra surrounding configuration-file string. When editing the configuration file instead, enclose the full value in quotes and double any embedded quotes, as in this example:

```
action = ""C:\Program Files\Common Files\MigrationSpecialties
Shared\putty.exe"" telnet://127.0.0.1:9000";
```

After accepting a custom nonempty action, Start session automatically is shown checked. Clearing that checkbox erases the command; checking it again restores the generated PuTTY command, not the former custom command. After changing Port, check a custom action yourself: the utility replaces occurrences of a colon followed by the old port number, but does not understand arbitrary client command-line syntax.

allow_remote (default: false)

This Advanced setting controls the listener address, independently of action. False listens only on 127.0.0.1; true listens on all IPv4 interfaces. Review the access and security implications in [4.1.7.5.1 Telnet Server](#)^[36] before enabling it.

4.1.8.5.2 Device (Physical serial port) [+]

The current host-COM selector, line-settings, flow-control, buffering, and diagnostic-setting contract is maintained in [4.1.7.5.2 Physical Port](#)^[37]. That reference also identifies legacy controls which remain visible but have no active runtime effect.

4.1.8.6 SCSI Disk [+]

Properties for disk0.0

User properties

vendor: DEC

model_num: RZ298

rev_num: 0016

☒ write_share

serial_num:

autocreate_size: 0

☐ sparse

Advanced properties

☐ tcq

☒ disconnect

☐ round_up

heads: 0

cylinders: 0

sectors: 0

read_delay: 0

write_delay: 0

Expert properties

☒ write_through

☐ debug

Reset OK Cancel

Specific disk information can be defined for emulated disks under Avanti. This is particularly useful to support older versions of Tru64 UNIX.

vendor

Disk vendor name. An empty vendor defaults to DEC.

model_num

Disk model name.

rev_num

Disk firmware revision. When model_num is empty, Avanti selects its default vendor, model, and revision, replacing any separate vendor or rev_num value. Set vendor, model_num, and rev_num together when overriding the automatic identity.

write_share (default: false)

Allow another process on the same Windows host to open the image file for writing. This changes only the host file-sharing mode; it does not coordinate cluster members or protect an unclustered filesystem from corruption. Use it only for an exact, validated guest-cluster configuration.

Warning: Using the write_share feature to share disks with non-clustered Avanti instances is not recommended. Doing so may result in disk corruption.

serial_num

Disk serial number, at most 255 bytes. If left blank, Avanti will generate a unique serial number for each disk and CD device.

Note: OpenVMS, Tru64 UNIX V3.x, and Tru64 UNIX V4.x ignore serial number settings. Tru64 UNIX V5.x requires unique serial numbers for all disk and CD devices.

autocreate_size (default: 0)

If the disk container file is missing when the emulator starts, a nonzero value tells Avanti to try to create it at this size, up to 2 TiB. Avanti stages the image and publishes it only after creation succeeds; an existing file that cannot be opened is not overwritten. The size must be a multiple of 512 bytes. Use K, M, G, or T for binary multiples of 1024; for example, 4G creates a 4-gibibyte image. Leave this at 0 for an existing image so an open failure is reported rather than treated as a request to create the file.

sparse (default: false)

When Avanti creates a new image, request a Windows sparse file. A sparse image initially consumes less host storage and grows as guest data is written, but later writes may take longer. This setting has no effect when opening an existing image; if the host file system rejects the sparse request, Avanti creates an ordinary allocated image instead.

tcq (default: false)

Advertise tagged command queuing (TCQ) support to the guest. TCQ also requires disconnect to be enabled. Historical OpenVMS cluster configurations used this option on quorum disks, but that requirement has not been revalidated for every supported guest release; follow the installed guest's documentation and validate the exact cluster.

Warning: Historical field reports state that TCQ interfered with some Tru64 UNIX installations. This has not been reproduced across the Avanti 5.1.0 guest matrix. Leave TCQ disabled during installation unless the exact guest release and storage configuration have been validated with it enabled.

disconnect (default: true)

Allow the disk to disconnect and later reselect during large SCSI I/O operations. This is normal SCSI behavior and lets other devices use the bus while this disk's operation is in progress. TCQ requires disconnect to remain enabled.

random_access (default: true)

Tell Windows that the image will be accessed randomly. Leave this enabled for normal disk and CD-ROM images.

round_up (default: false)

If a writable existing image is not a multiple of the 512-byte sector size, permanently append zero bytes up to the next 512-byte boundary before mounting it. Avanti aborts the mount if Windows cannot complete and verify the change. Leave this disabled for ordinary disk images. The new-image dialog rejects an incorrectly sized existing image, so this compatibility option is mainly for carefully reviewed hand-edited configurations. Back up the host file before enabling it.

heads, cylinders, sectors (default: 0)

Override the disk geometry reported to the guest. Heads and sectors may be 0 through 255; cylinders may be 0 through 65,535. Leave all three values at 0 to calculate a geometry automatically. An override is used only when $\text{heads} \times \text{cylinders} \times \text{sectors}$ exactly equals the image size in 512-byte blocks; otherwise Avanti logs a warning and calculates the geometry.

read_delay (default: 0)

Request an additional delay after each successful image read, expressed in microseconds, up to 2,147,482,648. Zero adds no delay. Ordinary timing rounds a nonzero request up to a whole millisecond, so 1 through 1000 request 1 millisecond and 1001 through 2000 request 2 milliseconds.

write_delay (default: 0)

Request an additional delay after each successful image write, with the same range, microsecond input, and whole-millisecond rounding as read_delay.

write_through (default: true)

Enable write-through caching. Changes are written directly to the raw disk or container file. If write through is disabled, there is a risk of losing data if the host system goes down unexpectedly. A guest SYNCHRONIZE CACHE command waits for earlier writes to complete and for Windows to flush the backing handle; a host flush failure is reported to the guest.

debug (default: false)

Reserved for a purpose-built diagnostic version supplied by Migration Specialties. This setting has no effect in an ordinary Avanti build.

4.1.8.7 SCSI Tape [+]

The screenshot shows a window titled "Properties for disk0.2". It contains three main sections of properties:

- User properties** (green background): Includes text input fields for `vendor` (DEC), `model_num` (DLT2000), `rev_num` (8D3C), and `serial_num` (CX708T0950).
- Advanced properties** (yellow background): Includes checkboxes for `advanced_behavior` (unchecked) and `disconnect` (checked), and input fields for `read_delay` (0) and `write_delay` (0).
- Expert properties** (orange background): Includes a checkbox for `debug` (unchecked).

At the bottom of the dialog are three buttons: "Reset", "OK", and "Cancel".

Specific tape drive information can be defined for emulated tapes under Avanti. This is useful to support older operating systems, less common tape drives, or non-DEC tape drives.

vendor

Tape drive vendor name. An empty vendor defaults to DEC.

model_num

Tape drive model name.

rev_num

Tape drive firmware revision. The normal DLT2000 identity uses vendor DEC and revision 8D3C. If `model_num` is explicitly empty, Avanti selects the default vendor, model, and revision and replaces any separate vendor or `rev_num`; set vendor, `model_num`, and `rev_num` together when overriding the identity.

serial_num

Tape drive serial number, at most 255 bytes.

advanced_behavior (default: false)

Return additional DLT2000XT-like inquiry and sense data used by some guest tape drivers. This is a guest-compatibility option, primarily for Tru64 UNIX; it does not change the tape-image format or capacity.

disconnect (default: true)

Allow the tape drive to disconnect and later reselect during long SCSI operations. This is normal SCSI behavior and lets another target use the bus while the tape operation is in progress.

read_delay (default: 0)

Request an additional delay before each tape read, expressed in microseconds, up to 2,147,482,648. Zero adds no delay. Ordinary timing rounds a nonzero request up to a

whole millisecond, so 1 through 1000 request 1 millisecond and 1001 through 2000 request 2 milliseconds.

write_delay (default: 0)

Request an additional delay before each tape write, with the same range, microsecond input, and whole-millisecond rounding as read_delay.

debug (default: false)

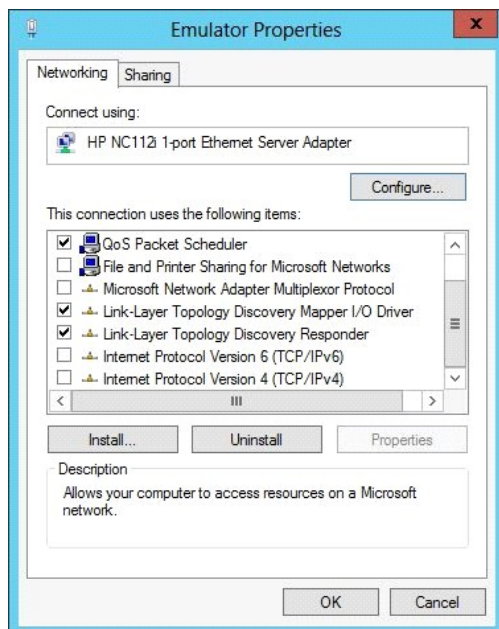
Reserved for a purpose-built diagnostic version supplied by Migration Specialties. This setting has no effect in an ordinary Avanti build.

Running Avanti

**VIRTUAL
ALPHA**

5 Running Avanti

5.1 Host Network Configuration



On systems using wired NICs, open the Properties box of the NIC assigned to Avanti and uncheck all items assigned to the NIC. This will prevent Windows from trying to share the NIC with Avanti. This action is not recommended for virtual NICs hosted by VMware.

For users running Avanti on a system equipped with a wired and wireless NIC, such as a laptop, assigning Avanti the wired NIC will provide more stable network performance.

5.2 Avoiding Avanti Crashes

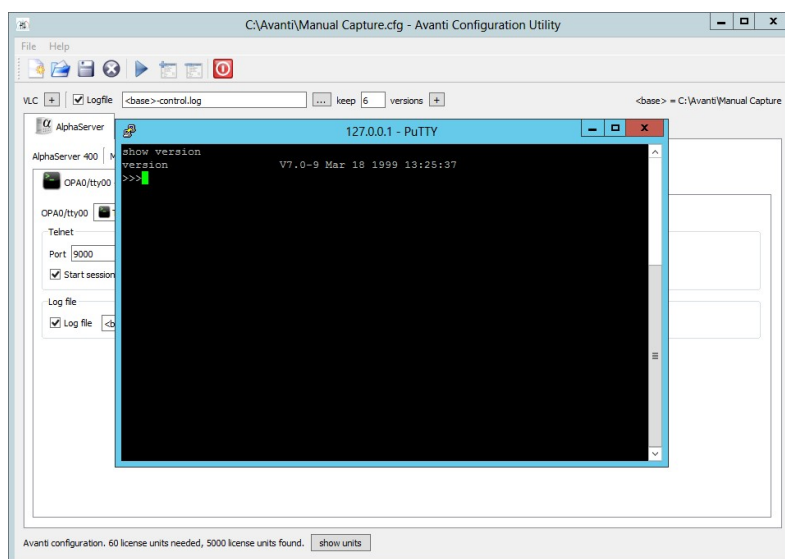
If a user logs out of Windows with a local Avanti instance running, or if Windows is shutdown with one or more Avanti instances running, the Avanti instances will crash. This is equivalent to pulling the plug on a physical Alpha system and crashing the OpenVMS or Tru64 UNIX operating system. All of the potential problems and caveats of an OpenVMS or Tru64 UNIX hardware crash apply when Avanti is terminated in this fashion.

Avanti Warning on Windows Shutdown

Avanti blocks Windows shutdown and sign-out to avoid inadvertently crashing an Avanti instance. If a local Avanti instance is running when a Windows user attempts to log out, or if Avanti is running anywhere when a Windows shutdown is issued, the logout/shutdown process will pause and a "The following applications block Windows shutdown" message is issued.

Warning: Terminating an Avanti instance without first shutting down the guest O/S is equivalent to pulling the plug on a legacy Alpha server.

5.3 Launching Avanti



Avanti can be launched interactively from the Configuration Utility using the Run button, or from a command line. Avanti can also be run as a Windows service, which is covered in [5.13 Installing Avanti as a Service](#)^[70]. Launching Avanti is equivalent to powering up a real Alpha system.

The emulator program displays an Avanti icon in the notification area of the Windows taskbar. It checks its virtual hardware and configured devices. If a disk image file has been misnamed or a NIC has changed, the emulator displays an error, waits for acknowledgement, and exits. If the configuration is valid, the configured serial console session opens, the SRM console firmware loads, and the three-chevron prompt (>>>) appears. The example shows the console in PuTTY after a SHOW VERSION command.

Once the console prompt appears, the virtual Alpha is ready to boot a supported O/S. The two most common O/S run on Alpha systems are Tru64 UNIX and OpenVMS.

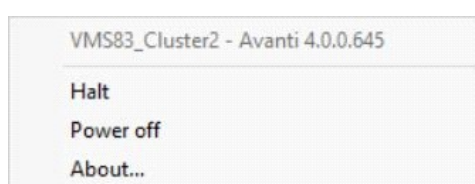
5.4 Avanti Control Icon



When Avanti is launched as a local process, an Avanti control icon is added to the notification area of the Windows task bar. Each instance of Avanti generates its own icon. Right clicking the Avanti icon display a control menu. The control menu provides the same halt and power off functions that a real Alpha system would offer via its front panel.

Note: No Avanti control icon is displayed when Avanti is run as a service.

Avanti Control Menu



First Line

Displays the name of the Avanti configuration file associated with the Avanti instance. It also shows the version of Avanti in use. Hovering over the Avanti icon will also provide this information via a tooltip.

Halt

Provides the same function as the Halt button on Alpha hardware. The emulator interrupts operating system execution and displays the console prompt (>>>) in the console window. The Halt option also writes debug information to the Avanti log and crash dump files, which is useful to isolate issues such as a hung emulator.

Power off

Provides the same function as the power button on Alpha hardware. When selected, a confirmation box is displayed. Using Power off or Exit from the console prompt will shutdown the Avanti instance and remove the related Avanti icon from the notification area.

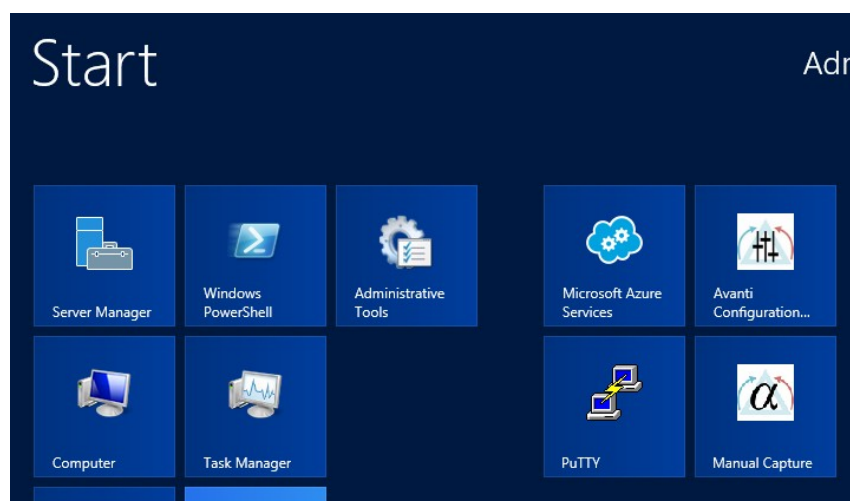
Warning: Powering off a running Avanti instance is equivalent to crashing real hardware. Data loss may occur and the TOY and NVRAM settings may be lost.

About

Display information about the current version of Avanti.

Tip: During the Avanti installation process, the Avanti notification icon is marked as "Only show notifications". This is a Windows default. To have the Avanti icon always visible when an Avanti instance is running, right-click the Start button, select Properties, select the Taskbar tab, click the Customize button in the Notification area section, and select "Show icon and notifications" for the Avanti icon.

5.5 Launching Avanti from a Shortcut



Create a Start shortcut from the Avanti Configuration Utility using the File> Add configuration to start menu... command. See [4.1 Avanti Configuration Utility](#) for a description of the utility. Select the configuration's shortcut from Start to launch it. The shortcut is stored in Avanti Virtual Alpha> Configurations; on Start-screen versions of Windows, it may appear directly as a tile, as shown here.

Note: When accessing a physical device like a CD-ROM, Avanti needs to run from an account with administrator rights.

5.6 Launching Avanti Manually

Avanti virtual Alpha systems can be launched manually from a command window. The configuration file needs to be declared in the command line using the `/CONFIGURATION_FILE=` parameter. The following command line would launch the Alpha01 configuration file.

```
"C:\Program Files\MSI Digital Emulator Collection\dec.exe"  
/CONFIGURATION_FILE="C:\Alpha\Alpha01.cfg"
```

Note: The above command would appear on a single line.

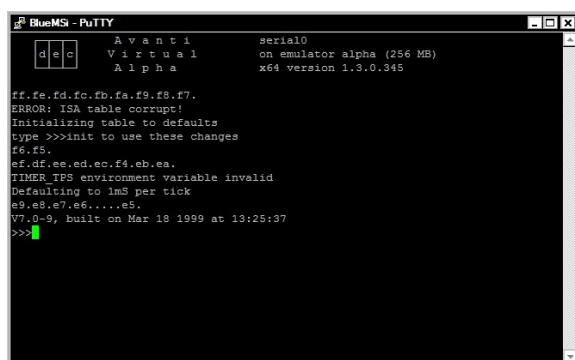
Note the use of quotes in the command and parameter strings to ensure the file names are correctly passed to the emulator. This is particularly important when passing file names containing blanks.

5.7 Launching Avanti from a Batch File

The following batch file would launch Avanti.

```
rem Alpha01.bat  
rem Batch file to launch Avanti Alpha01 virtual Alpha  
configuration.  
  
echo on  
start "Avanti" "c:\Program Files\MSI Digital Emulator  
Collection\dec.exe"  
/config="d:\VirtualAlpha\Alpha01.cfg"  
exit
```

5.8 First Launch Messages



```
BlueMSI - PuTTY  
Avanti Virtual Alpha Serial0  
on emulator alpha (256 MB)  
x64 version 1.3.0.345  
ff.fe.fd.fc.fb.fa.f9.f8.f7.  
ERROR: ISA table corrupt!  
Initializing table to defaults  
type >>>init to use these changes  
f6.f5.  
ef.df.ee.ed.ec.f4.eb.ea.  
TIMER_TPS environment variable invalid  
Defaulting to 1mS per tick  
e5.e8.e7.e6....e5.  
V7.0-9, built on Mar 18 1999 at 13:25:37  
>>>
```

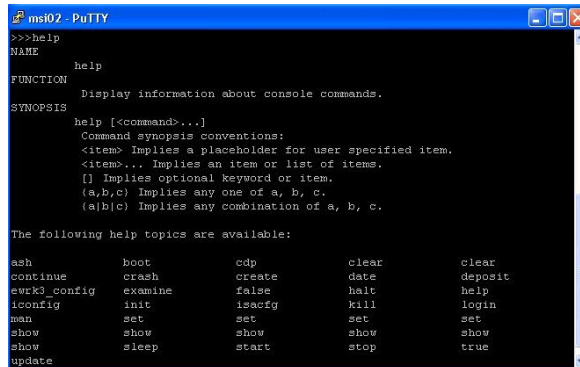
Historical first-launch guidance records the following messages before the TOY and NVRAM state files have been initialized. The current 5.1.0 validation did not reproduce this exact first-launch transcript; preserve the console output and configuration if a different diagnostic appears.

```
ERROR: ISA table corrupt!  
Initializing table to defaults  
type >>>init to use these changes
```

```
TIMER_TPS environment variable invalid  
Defaulting to 1mS per tick
```

A controlled **EXIT** from the console has been validated to save NVRAM boot variables to the configured **.nvr** file. Avanti writes the configured **.toy** file during the orderly state-save path only after the guest has initialized or changed the emulated clock. A later launch using retained state files normally restores the state that was actually saved. Do not treat recurrence of either message as harmless without checking that the configured paths are writable and retained.

5.9 Console Operations



```
msi02 - PuTTY
>>>help
NAME
    help
FUNCTION
    Display information about console commands.
SYNOPSIS
    help [<command>...]
Command synopsis conventions:
<item> Implies a placeholder for user specified item.
<item>... Implies an item or list of items.
[] Implies optional keyword or item.
(a,b,c) Implies any one of a, b, c.
(a|b|c) Implies any combination of a, b, c.

The following help topics are available:

ash          boot          cdp          clear         clear
continue    crash         create       date          deposit
ewrk3_config examine      false       halt          help
iconfig     init         isacfg      kill          login
man         set          set         set           set
show        show         show        show          show
show        sleep       start       stop          true
update
```

Once the system console prompt appears (>>>), the retained AlphaServer 400 console firmware provides the SRM environment used to inspect devices and boot a guest. Selected console variables, device paths, and boot procedures are validated elsewhere in this guide. That evidence does not establish that every physical AlphaServer 400 function, timing characteristic, diagnostic, or limitation is reproduced. Use legacy hardware documentation as a historical command reference and follow Avanti-specific guidance wherever the virtual configuration differs.

Type HELP at the console prompt to view the help text supplied by the retained firmware. Available commands can depend on the firmware and configured virtual hardware; the displayed help is authoritative for that running configuration.

5.10 Launching Avanti Without the Console

Like a real Alpha system, it is possible to launch Avanti without a console if the console boot parameters are properly configured.

Note: Launching Avanti as a service requires that firmware parameters be properly set and the console and TTA0/tty01 "Start session automatically" options be disabled. See [5.13 Installing Avanti as a Service](#) ⁷⁰ for details.

5.10.1 OpenVMS Auto Boot

At the SRM console prompt, configure an OpenVMS system disk for automatic boot as follows. Replace DKA0 with the actual system-disk device when necessary.

```
>>> SET AUTO_ACTION BOOT
>>> SET BOOT_OSFLAGS 0
>>> SET BOOTDEF_DEV DKA0
>>> EXIT
```

EXIT closes Avanti cleanly and writes the console variables to the configuration's NVRAM file. The next launch uses the saved device and flags and boots automatically. This sequence has been validated with the exact curated OpenVMS V7.0 KZPAA system; it is standard SRM configuration guidance rather than qualification of every OpenVMS release or system-disk layout.

5.10.2 Tru64 Auto Boot

At the SRM console prompt, configure a Tru64 UNIX system disk for automatic boot as follows. Replace DKA0 with the actual system-disk device when necessary.

```
>>> SET AUTO_ACTION BOOT
>>> SET BOOT_OSFLAGS A
>>> SET BOOTDEF_DEV DKA0
>>> EXIT
```

EXIT closes Avanti cleanly and writes the console variables to the configuration's NVRAM file. The next launch uses the saved device and the A boot flag and boots automatically.

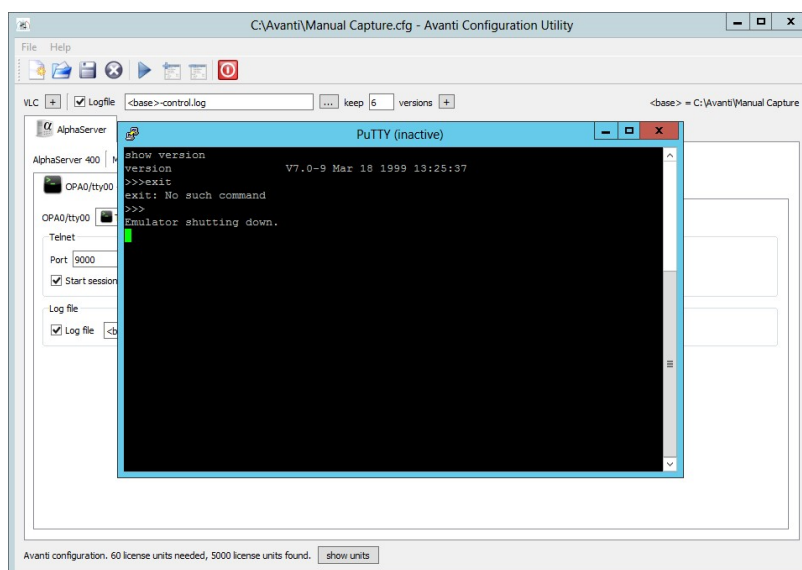
Tru64 UNIX normally restricts root to terminals permitted by the installed release's security configuration. Retain console recovery, use a named account and privilege elevation where the installed release supports them, and follow its security administration guide. Do not edit `/etc/securettys` merely as a generic Avanti setup step; enabling remote root access expands the system's attack surface.

5.10.3 Ambiguous Boot Device

Historical retained-firmware behavior allows an abbreviated SRM device name only when it identifies one device uniquely. A full designation can include its complete path, such as `dka100.1.0.1.8`. Ambiguity is most likely when selecting DKA100, DKB100, or DKC100 on a wide controller that also exposes DKA1000, DKB1000, or DKC1000. If BOOT or SET BOOTDEF_DEV reports an ambiguous device, verify the designation before continuing.

Use SHOW DEVICE to identify the intended disk and prefer the complete device designation. The retained-firmware workaround is to add a dot to the shorter unit, for example BOOT DKA100. with the dot as part of the token. If the console does not accept that form, use the complete designation rather than experimenting on a production boot definition.

5.11 Exiting Avanti



Shut down the guest operating system before leaving Avanti. Historical OpenVMS guidance uses Ctrl-P from the console session to return to SRM when necessary; that path and every guest shutdown variant have not been revalidated for 5.1.0, so confirm that the guest has stopped disk activity and that the SRM prompt is visible.

At the SRM prompt, type EXIT. With the retained firmware used by Avanti 5.1.0, the console returns the complete line `exit: No such command`; Avanti recognizes that response and enters its orderly shutdown and state-save path. Confirm completion by observing that the emulator process exits or the console session disconnects. If the response is absent and the process remains running, do not assume that state was saved or treat an abrupt host-process termination as an equivalent shutdown. The curated OpenVMS V7.0 and Tru64 UNIX V4.0G runs validate NVRAM boot-variable persistence through this path. TOY-file persistence is conditional on the guest having initialized or changed the emulated clock and on a writable configured path; those runners did not deliberately mutate and compare the TOY file.

5.11.1 Avanti Auto Exit

Avanti can be configured to auto exit after an OS shutdown by setting the `auto_exit` parameter in the configuration files. See [4.1.7.4 Virtual Alpha Base Settings](#) ³² for details.

5.12 Multiple Avanti Instances on a Single Host

Avanti supports multiple instances running on a single host system, with one emulated Alpha per configuration file and one Avanti process per file. Files containing multiple Alpha systems are rejected. To migrate an old multi-system file, create a separate configuration for each Alpha, preserve its required session definitions, and check file paths and host port assignments for conflicts.

Version 5.1.0 no longer provides configurable internal Ethernet segments. If Alphas in an older multi-system configuration communicated through one, connect each virtual NIC to an appropriate common external Ethernet network after splitting the systems into separate configuration files. Check that every guest NIC has a unique MAC address on the resulting Ethernet network, including addresses assigned by DECnet, and that guest

network addresses do not conflict. If the old network was isolated, use an appropriately isolated external network rather than unintentionally exposing it to the production LAN. Verify communication between all former peers before putting the split configurations into service; using the same host adapter is not by itself proof that the adapter, driver, and network pass traffic between them.

Each Avanti instance requires the following:

- One host CPU
- A unique configuration file
- Sufficient units remaining in the installed host-wide license pool

Running another Avanti instance on the same host carries no separate base license charge. Optional-feature units used by concurrently running instances are drawn cumulatively from the installed host-wide pool. Avanti requires that one host CPU be dedicated to the host O/S. Thus, a 4-core system could conceivably support three instances of Avanti. Use of hyperthreading is not recommended, as it may introduce instability to the emulator.

Suspending or pausing an instance does not release its claimed units or dedicated cores. Normal shutdown returns those resources; if an instance exits without completing cleanup, Avanti reclaims its claim when a subsequent database check confirms that the owning Windows process has exited. A new startup performs this check before requesting resources. If Windows does not permit Avanti to establish whether an owner is still alive, the claim is retained to prevent double allocation; stop the affected instances, including service instances, before restarting them if resources remain unavailable.

Each new instance requiring units must fit within the currently installed valid key's capacity after subtracting every running instance's claim. Replacing a key does not add its capacity to that of the previous key. A lower-capacity replacement cannot interrupt running instances, but prevents new paid starts if their combined claims would exceed that lower capacity. A rejected start leaves the existing claims and capacity counters unchanged. Zero-unit starts neither require a key nor change the paid capacity.

The periodic heartbeat and process-cleanup checks use elapsed host uptime, independently of calendar-clock adjustments. After a long suspension or host sleep, a due check runs without replaying every missed interval. A live process retains its claim regardless of the time elapsed.

Running multiple virtual Alphas under Avanti requires robust host hardware. Sufficient CPUs, additional memory, and a fast I/O bus will be required to achieve adequate performance. The following table provides minimum host system configuration guidelines.

CPU	3/2: 3 host CPU per 2 Avanti instances
Memory	4GB for Windows + 2GB for JIT + 2 * Avanti Memory. See 3.1.2.3.1 Sizing Host Memory ^[17] for additional information.
Disks	• One disk dedicated to Host O/S. • At least one disk per Avanti instance.

5.12.1 Overloading a Host System with Multiple Avanti Instances

As a rule, two host CPUs per Avanti instance are recommended. This ensures sufficient host system resources are available to handle peak application loads on the emulators, particularly I/O loads. If sufficient CPUs are not available to the host, it will begin to utilize one or more CPUs dedicated to the Avanti instances. This will adversely impact overall performance of the Avanti instances. Implementing Avanti instances on a host system at a greater than 1 – 2 ratio of Avanti to host CPUs is a process that should be done carefully and monitored closely.

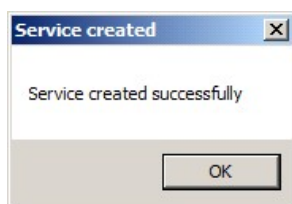
5.13 Installing Avanti as a Service

Avanti can be installed as a service to automatically start when the host system boots. When installed as a service on a supported Windows host, Avanti enables the Automatic Delayed Start option by default.

When installing Avanti as a service, considering the following:

- The Avanti configuration must be set up to auto boot. See [5.10 Launching Avanti Without the Console](#) for details on auto booting.
- No control icon is displayed when Avanti is run as a service. The Avanti service can be stopped and started from the Windows Services management console.
- Stopping the Avanti service crashes the virtual Alpha system. Always halt the Avanti guest O/S before stopping the Avanti service
- Clear Start session automatically for the serial ports (including OPA0/tty00 and TTA0/tty01) so the service does not try to launch an interactive terminal program without a user desktop. This clears action; it does not disable the Telnet listeners. They remain available for manually started clients. Leave allow_remote false for local-only access; an existing true setting still exposes the listener on all IPv4 interfaces, subject to firewall and network rules. Review [4.1.7.5.1 Telnet Server](#) before allowing remote access.
- Enable the Avanti auto_exit feature. See [4.1.7.4 Virtual Alpha Base Settings](#) for details.

5.13.1 Avanti Service Creation



To install Avanti as a service, execute the following command from an administrator Windows cmd session:

```
"C:\Program Files\MSI Digital Emulator  
Collection\dec.exe" /CONFIGURATION=D:\vAlpha\Alpha1.cfg /INSTALL
```

Substitute your virtual Alpha configuration file path for D:\vAlpha\Alpha1.cfg.

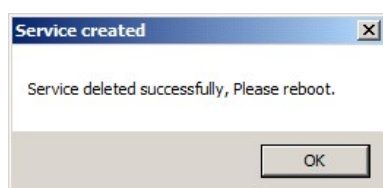
Before installing the service, the system administrator must place its configuration file in an administrator-controlled directory and set file and directory permissions so ordinary

users cannot change or replace it. The service runs under LocalSystem and reads this file at startup; a configured Telnet action can launch a program with the service account's privileges. Keep the configuration and any referenced command under trusted administrative control.

A successful install will display a Service created successfully message. The /INSTALL qualifier will create a service entry named Avanti_Alpha1 set for automatic startup on the next system boot. The service can be started immediately by going to the Services manager (Start> Administrative Tools> Services), right clicking the Avanti entry, and selecting Start.

Multiple instances of Avanti can be installed as a service. Each instance must have a unique configuration file name and unique serial port number assignments (see [4.1.7.5 Serial Ports: OPA0/tty00 – TTA0/tty01](#)³⁵).

5.13.2 Avanti Service Removal



To remove an Avanti instance running as a service, open a Windows cmd session in an administrator session. Execute the following command to remove the service entry:

```
"C:\Program Files\MSI Digital Emulator  
Collection\dec.exe" /CONFIGURATION=D:\vAlpha\Alpha1.cfg /UNINSTALL
```

A successful uninstall will display a Service deleted successfully. The service will be marked for removal on the next Windows shutdown.

5.14 Virtual Host Environments

Avanti is a normal Windows application and is expected to run in a virtual machine whose guest operating system and assigned resources meet Avanti's Windows host requirements. No particular hypervisor is required.

Virtual networking can require additional hypervisor configuration. The virtual switch and host adapter must accept frames for the emulated NIC's MAC address; promiscuous mode, forged-transmit acceptance, or MAC spoofing may be required. Follow the applicable networking notes in this guide when the guest cannot communicate through the virtualized adapter.

5.14.1 NIC Configuration

If DECnet support is desired under a virtual host, the NIC must be configured to support promiscuous mode. See [6 Networking Avanti](#)⁷⁸ for additional information about networking Avanti.

5.14.2 Allocating CPU Resources

Avanti requires at least two allowed host logical processors: one affinity claim for the Alpha-CPU thread and at least one remaining processor for I/O work. The Alpha-CPU thread can run at 100% while Avanti is active. Its affinity claim does not reserve a physical core from Windows or other applications. Plan adequate VM resources to support this requirement.

It is important to allocate sufficient CPU resources on a VM to support Avanti. If a VM manager throttles CPU resources to a VM hosting Avanti, poor performance and slow clock speeds resulting in time drift will occur. Recommend best practice is to put a CPU reservation on the Avanti host VM such that two full CPUs are always available to the Avanti system. I.e.: if running on a VM host equipped with 3.0GHz CPUs, reserve 6000MHz of CPU to the host.

5.14.2.1 Allocation of Virtual Alpha CPUs

Avanti pins its single emulated Alpha CPU thread to one Windows logical processor selected from the host-wide Avanti CPU pool. Concurrent instances receive distinct logical-processor affinity claims. Affinity restricts where a thread may run; it does not grant exclusive ownership against Windows or other applications. A logical processor may be a hardware thread on a physical core, so affinity alone does not isolate shared physical-core resources.

When Windows supplies complete processor-topology and efficiency-class information, Avanti prefers unused physical cores, spreads claims across processor topology domains, and applies the per-emulator `cpu_core_preference` setting within the existing process/job affinity and `forbidden_cpus` boundaries. Automatic and performance prefer the highest available Windows efficiency class; efficiency prefers the lowest. If a preferred class is unavailable or exhausted, selection falls back through other eligible classes. On supported Windows families that do not report efficiency classes, all three settings retain physical-core and topology ranking without a class preference.

The preference is a placement hint. It does not reserve a physical core and does not guarantee performance, host power use, or energy savings. Windows and other applications can still use the selected hardware, and host firmware, the Windows scheduler, workload, thermal limits, and virtualization can affect results.

Avanti respects the process affinity allowed by Windows, including job-object restrictions, and never expands it to the full system mask. Its I/O threads use the remaining CPUs allowed to that instance. Admission must leave at least one eligible I/O CPU for every registered instance; these I/O CPUs may be shared. A request is rejected if it would take another instance's last eligible I/O CPU, even if other CPUs remain free outside that instance's allowance. Existing `forbidden_cpus` exclusions continue to apply to the host-wide pool.

Version 5.1.0 requires one active Windows processor group. Hosts with multiple active groups, failed CPU discovery, empty allowances or insufficient eligible CPUs are rejected with a diagnostic. Configure CPU restrictions before starting Avanti. If Windows subsequently removes an instance's claimed logical processor or all of its eligible I/O CPUs, stop and restart that instance with sufficient allowed CPUs. A thread-affinity operation that cannot be completed is reported as an error instead of being ignored.

Failed affinity updates restore earlier thread masks and leave database claims uncommitted. If Windows prevents restoration, the shared database is invalidated and all Avanti instances must be stopped before restarting. The updated database protocol requires stopping every instance, including services, before installing this version. These CPU-scheduling checks do not change license-unit prices, key validity or the startup-only license policy.

5.14.3 General VM Resource Management

Care must be taken not to overload the VM host hardware supporting the Avanti instance. An overloaded host will result in poor performance on the Avanti system which can lead to VMS bug checks.

5.15 Avanti Performance

No specific tuning is required to run OpenVMS or Tru64 UNIX on Avanti. Use of the fastest available host hardware will help improve overall performance. Using quality host hardware components will improve overall system reliability.

Alpha CPU's process commands sequentially. There is no known method of distributing CPU commands across multiple host CPUs that provides performance gains.

Utilizing a low-performance host system, overloading the amount of memory available to the virtual Alpha system, and excessive I/O will have negative performance consequences, just as on a real AlphaServer. Tuning the O/S may help rectify the situation. If not, consider using a more powerful host system or reducing the workload. For greater emulation performance, enable JIT; this option requires 60 license units.

A common problem when Avanti is hosted in a VM such as VMware is over commitment of the VM host hardware. I.e. Running too many VMs on a single host. Ensure adequate resources are allocated to the VM hosting Avanti.

5.15.1 CPU Instruction Sets

In addition to the standard Alpha EV4 instruction set, the Avanti CPU also supports the BWX, CIX, FIX, and MVI instruction set extensions. These instructions were not natively supported on the EV4 CPU. They were introduced on the EV56, EV6, and EV68 series Alpha CPUs. Native EV4 systems running code generated for EV5 and EV6 processors would trap to the operating system and emulate these instructions. Adding the instructions to Avanti's emulated EV4 CPU allows the instructions to be processed "natively", resulting in improved performance.

For example, Python is compiled by default for the EV56 processor. Most of what the Python interpreter does is string manipulation and it uses the byte/word-extension instructions to do so. These instructions do not exist on an EV4 system, so each of these instructions takes a TRAP, firmware passes the trap to VMS, and VMS emulates the instructions. This is very slow, both on real and virtual EV4 hardware.

The addition of the EV56 instruction set to Avanti eliminates the EV4 performance issue.

5.15.2 Memory

Avanti supports configuring 32MB to 3GB of main memory regardless of the guest operating system. Digital UNIX and Tru64 UNIX can use up to 1GB; this is a guest-operating-system limit, not a separate emulator configuration limit. Select an amount appropriate to the guest rather than assuming it can use all configured memory. See [4.1.7.4 Virtual Alpha Base Settings](#)^[32] for valid settings and license-unit bands.

Section [3.1.2.3.1 Sizing Host Memory](#)^[17] provides tips on ensuring adequate memory in the host system.

5.15.3 Disk I/O

Avanti allows simultaneous access to up to 45 virtual disks. A zero-unit configuration can use up to seven targets with an included KZPAA controller or up to fifteen targets with an included KZPCA controller. These disks can all exist as container files on a single physical disk on the host system. If an application running under Avanti puts high I/O loads on multiple virtual Alpha disks, the host system physical disk controller can be saturated, which in turn will adversely impact performance on Avanti and the host system. To alleviate this problem, spread virtual disks across multiple physical disks and controllers.

Note: Virtual disks that are hosted on a RAID controller should not have this issue.

5.15.4 Using CDs and DVDs

Avanti can expose either a host optical drive or an existing image file as a read-only emulated CD-ROM. Image-backed media avoids dependence on a physical drive and can improve repeatability and performance, but the result depends on the host storage path and guest workload. The current OpenVMS compatibility evidence includes installation from image media; it is not a performance comparison with physical media.

Create images with a tool that produces an unmodified sector-for-sector image appropriate for the source media, and retain the original media until the image has been verified in the guest. Earlier Avanti guidance named ImgBurn as one example. That third-party tool is not included with or qualified for Avanti 5.1.0, so its availability, licensing, and suitability must be assessed independently.

5.15.5 TCQ and Performance

Avanti's TCQ option is disabled by default. When enabled, it advertises tagged-command support to the guest and requires disconnect support on the same disk. Historical field guidance used TCQ for OpenVMS quorum disks and reported both small performance improvements on some OpenVMS and Tru64 UNIX workloads and interference with some Tru64 UNIX installations. Those guest-family-wide claims are not current Avanti 5.1.0 benchmarks or compatibility results. Enable TCQ only when required by the installed guest or an exact tested configuration, and measure the target workload rather than assuming a performance improvement.

5.15.6 Floating Point Calculation Performance

Applications heavily dependent upon floating point calculations will not perform well on emulators such as Avanti. Floating point calculations are handled quickly in special hardware on real legacy Alpha systems, but must be emulated in software on virtual systems.

5.15.7 Hyperthreading

If there are enough physical cores to run the desired workloads, system performance can be increased by disabling hyper-threads, which will give a speed boost to the physical cores since they no longer have to co-schedule the hyper-threaded virtual cores.

5.15.8 Parking Cores

Parking cores is a feature that allows the BIOS or Windows decides not to run all of the cores in a system, usually for power, performance, or cooling reasons. Parking cores can impact Avanti performance, as it overrides Avanti's affinity requests. Ensure that there

are no BIOS or Power Manager settings reducing power to the CPUs or forcing Turbo Boost mode to be enabled if maximum Avanti performance is desired.

5.15.9 Avanti Clock

A legacy Alpha system uses hardware to maintain accurate time. An Alpha emulator must achieve the same clock accuracy using software. Doing so is not a straight forward task.

On a real AlphaServer, two mechanisms are used to keep track of time. One is the clock interrupt, which interrupts the processor 1024 times per second, the other is the cycle counter, which is an internal processor register that increments at the rate of the processor's clock (i.e. 100,000,000 times per second for a 100 MHz CPU).

Avanti performs the timing work in the Alpha CPU emulation thread rather than dedicating another host CPU to a continuously running clock thread.

When the CPU thread starts, it samples the resolution of the Windows system clock and calibrates initial instruction-batch and timer-increment values. During execution it advances an internal timeline with instruction batches, samples Windows system time after bounded batches, and adjusts further advancement when that timeline falls outside the sampled window. When the emulated cycle counter is enabled, Avanti derives its increments from that internal timeline.

The CPU thread also records the internal time for the next periodic interrupt. The implementation advances that deadline at a nominal 1024 Hz rate and requests an interrupt when the internal timeline passes it.

This design continually relates emulated time to the Windows civil clock, but it does not guarantee zero drift on every host, workload, or power-management configuration. No current cross-host, varying-load, long-duration benchmark establishes the former universal no-drift claim. Measure clock behavior for time-sensitive workloads on the intended host.

Warning: The Avanti clock depends on the Windows civil clock. Moving Windows time forward while Avanti is running can make the emulated timeline advance rapidly toward the new sample; moving it backward can delay further clock advancement until the sampled time catches up. Do not change Windows time while Avanti is running. Stop Avanti first, change the host time, restart Avanti, and verify guest time before resuming a time-sensitive workload. For more details, read on.

5.15.9.1 Avanti Clock Dependency

The guest uses the emulated battery-backed time-of-year (TOY) clock to establish civil time and periodic timer interrupts to advance its running clock. The exact guest commands and read/write sequence depend on the installed operating-system release.

As described in [5.15.9 Avanti Clock](#)⁷⁵, on the emulator, we have to emulate both the battery backed clock chip and the timer interrupt.

When the guest writes a different TOY time, Avanti adjusts an in-memory offset from the current Windows time. A normal state save writes that offset and the emulated TOY registers to the configured .TOY file. Later TOY reads use the current Windows time plus the restored offset. A guest time-setting command therefore does not immediately rewrite the .TOY file; preserve the offset by shutting Avanti down normally.

For periodic interrupts and the cycle counter, the Alpha CPU thread calibrates instruction batches against Windows system-time samples. It advances an internal timeline during instruction execution, bounds it against later Windows samples, and

requests the next interrupt at the nominal 1024 Hz deadline. There is no separate 100 Hz clock-correction thread in the current implementation.

This mechanism assumes that Windows civil time progresses normally. A large forward change can make Avanti advance its internal timeline rapidly toward the new sample. A backward change can prevent further advancement while the internal timeline remains ahead of Windows. The exact guest-visible effect depends on when the change occurs and has not been qualified as a supported time-adjustment procedure.

In short, do not change Windows time while Avanti is running. Stop Avanti first, change the host time, restart Avanti, and verify guest time before resuming a time-sensitive workload.

5.15.10 Charon Idle Loop/Powersaver Driver

Avanti's built-in Auto-Idle feature provides an available guest-idle alternative under OpenVMS and Tru64 UNIX without installing a guest driver. It is disabled by default. See [4.1.7.4 Virtual Alpha Base Settings](#)^[32] for details.

The remainder of this topic is retained for systems that already contain third-party Charon or HP Idle software. Avanti does not distribute these utilities, and no particular utility version has been independently qualified for Avanti 5.1.0. Consult the utility supplier's current documentation and validate the intended workload before retaining or changing it.

Alpha CPU's were designed to run at 100% all the time. They do not have a reduced power mode like more modern Integrity and X86 processors. The exception is the processor used in the Tadpole, a laptop version of the Alpha. A hook was added to the firmware to signal the processor when VMS was not busy and temporarily pause the CPU by putting it into a low power state.

Historical documentation attributes the Idle Loop to SRI (now Stromasys) and later calls it the Idle Powersaver Driver. The linked third-party documentation, which may change independently of Avanti, describes its own workload restrictions:

<https://stromasys.atlassian.net/wiki/spaces/DocCHAXPSMAv2240W/pages/34603068/Idle+Powersaver+Driver>

Historical field reports found that the third-party driver could reduce performance for applications with high I/O throughput and low CPU use. This is not a current cross-version benchmark. If such a system shows a material regression, test without the driver or use Avanti Auto-Idle instead. The historical removal command, issued from the OpenVMS SYSTEM account and followed by the restart required by the utility's documentation, is:

```
$ PRODUCT REMOVE IDLE
```

Earlier field guidance also used the OpenVMS LOAD_SYS_IMAGES parameter to suppress SYS\$IDLE at boot. Parameter meanings and defaults can vary by guest version; do not change this system-wide bit solely from this historical note. See [4.1.7.4.1 Removing Charon and HP Idle Utilities \(OpenVMS Only\)](#)^[34] for the retained removal procedure.

Networking Avanti

**VIRTUAL
ALPHA**

6 Networking Avanti

Avanti supports virtual versions of the DE435 and DE500 Network Interface Cards. Two versions of the DE500 utilizing the 21140 and 21143 chip sets are supported. The DE435 is the default NIC selected by the Configuration Utility when creating a new configuration.

The following table outlines recommended NIC usage based on the operating system being run by the virtual Alpha.

NIC	Recommended Usage
DE435	- OpenVMS version 6.1-1H1 and higher - Digital UNIX version 3.2C and later
DE500 (21140)	- OpenVMS version 7.2 and higher - Digital UNIX/Tru64 UNIX version 4.0 through 4.0E
DE500 (21143)	- OpenVMS version 7.2 and higher - Digital UNIX/Tru64 UNIX version 4.0F and later

The DE435 is technically a 10Mb device, while the DE500 is capable of 100Mb. However, as virtual devices, all NIC variants offer the same level of performance. Actual virtual Alpha NIC performance is closely tied to the capabilities of the host NIC with which it is associated and to the software applications that use the NIC. An I/O or CPU bound application will be unable to take full advantage of a fast NIC.

6.1 PCAP Drivers

Npcap is the preferred network backend and is used by default when a compatible installation is available. Follow [6.11.1 Npcap Installation](#)^[84], then select the physical Ethernet adapter directly on the emulated NIC. Avanti falls back to its bundled Migration Specialties MsiPcap driver when supported Npcap cannot be loaded. Npcap is not supplied or licensed by Migration Specialties; review its license for the intended use. If an installed Npcap copy is not licensed for Avanti use, add `use_npcap_driver = false` to the top-level control component with a text editor before first opening the file in the Configuration Utility or emulator. For a configuration already opened under Npcap, set the same property in [4.1.8.1 VLC \[+\]](#)^[50], save, close the Configuration Utility, and reopen it before further use. This prevents subsequent Npcap loading and refreshes the Interface lists for MsiPcap. Npcap normally supports host-to-guest and same-host guest-to-guest traffic without a TAP adapter or Windows Network Bridge.

Avanti also supplies its own legacy NDIS5 backend, MsiPcap. MsiPcap remains available as a supported fallback and is installed by default, but it suppresses locally transmitted packet reflection. A guest can therefore communicate with systems beyond the Windows host while communication with that host or another Avanti instance on the same host is unavailable. This does not indicate failure of the external network path.

First try MsiPcap with the selected physical adapter directly. If host-to-guest or same-host guest-to-guest communication is required and does not work, use the [6.1.1 MsiPcap TAP Bridging](#)^[79] procedure. One local emulator needs one TAP adapter.

Multiple local emulators need one separate TAP adapter per emulator, with all of those TAP adapters placed in the same Windows Network Bridge; do not attach every emulator to one shared TAP adapter. Add one physical adapter to that bridge only when the bridged guests also need the external network.

A wired Ethernet adapter is strongly preferred. Wireless adapters and virtual switches can impose additional MAC-address or promiscuous-mode restrictions; see [6.7 Networking with Wireless Ethernet](#)^[81] and [6.8.1.1 Promiscuous Mode](#)^[82].

6.1.1 MsiPcap TAP Bridging

Use this procedure only when an emulator uses MsiPcap and must communicate with its Windows host or another Avanti instance on that host, but direct attachment to the physical adapter does not carry that traffic. MsiPcap can still carry external traffic when this host-local limitation is present. Npcap is preferred for new configurations and does not ordinarily require this workaround.

1. Install one OpenVPN TAP-Windows6 9.24.7 adapter for each local Avanti instance that needs the workaround. Obtain the signed installer from OpenVPN's official release server: use the [cross-signed package](#) on Windows 8/8.1 and Windows Server 2012/2012 R2, or the [attestation-signed package](#) on newer supported Windows releases. Run the installer with administrator rights and include its TAP Utilities. For each additional device, run the resulting *TAP-Windows / Utilities / Add a new TAP virtual ethernet adapter* Start-menu shortcut as administrator. Do not configure multiple emulators to use the same TAP adapter.
2. For one emulator that needs only host-to-guest traffic, do not create a Windows Network Bridge. Configure the host side of its single TAP adapter with an address on an isolated subnet, and configure the guest on the same subnet.
3. For traffic between two or more local emulators, select their separate TAP adapters in Windows Network Connections and create one Windows Network Bridge. Configure any host-side address on the resulting Network Bridge rather than on an individual TAP member.
4. If bridged emulators also need access beyond the Windows host, add at most one physical network adapter to that bridge. A bridge containing only two or more TAP adapters is sufficient for traffic among the host and local emulators.
5. In each Avanti configuration, attach the emulated NIC to its own TAP adapter and retain MsiPcap as the selected backend.
6. Test host-to-guest, guest-to-guest, and external traffic separately. A successful external test does not prove that host-local forwarding works.

Creating or changing a Windows Network Bridge requires administrator rights and can temporarily interrupt host connectivity. Wireless adapters and hypervisor virtual switches may reject bridged or additional-MAC traffic. Treat bridging through either as a compatibility experiment, not a guaranteed solution; wired Ethernet is preferred. A TAP bridge also does not bypass promiscuous-mode or MAC-spoofing restrictions imposed by an upstream virtual switch.

6.2 Adding a Host NIC

If a host NIC is added while Avanti or the Configuration Utility is running, close both programs and reopen the Configuration Utility to rescan the available adapters. If the adapter is still absent and MsiPcap is in use, open an elevated command window and run "net stop msipcap" followed by "net start msipcap", then reopen the Configuration Utility. After installing or updating Npcap, or when a newly installed adapter remains

absent, reboot Windows before starting Avanti. Reinstalling Avanti is not normally required.

6.3 Dedicating a NIC

On dual NIC systems (this includes systems with a hardware NIC and a wireless NIC), it is best to disable TCP/IP services on the NIC assigned to Avanti. Prior to launching Avanti, open the Properties box of the NIC assigned to Avanti and uncheck all items assigned to the NIC. This will prevent Windows from trying to share the NIC with Avanti. For users running Avanti on a system equipped with both a wired and wireless NIC, assigning Avanti the wired NIC will provide more stable network performance.

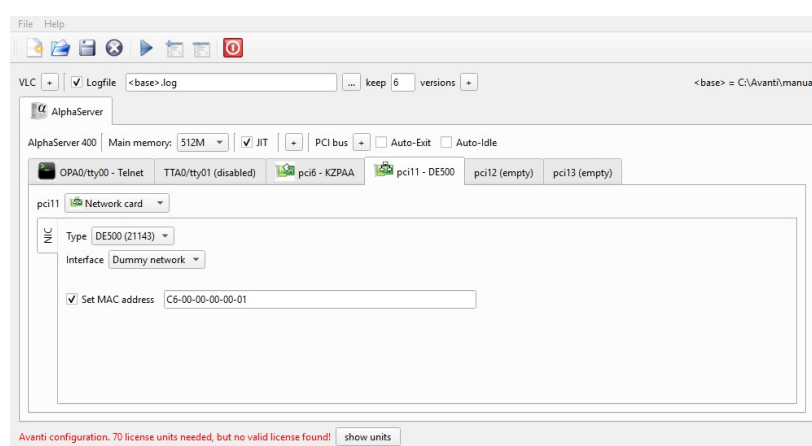
6.4 NICs and Multiple Instances of Avanti

Npcap is preferred when multiple Avanti instances share one host. Normally attach each emulated NIC directly to the same physical adapter. Each emulated NIC still requires a unique MAC address, as described in [4.1.7.6.2 NIC](#)^[46] and [4.1.7.6.2.3 Multiple Avanti Instances and MAC Addressing](#)^[48]. To avoid clashes with other networking equipment or automatically generated virtual NIC MAC addresses, it is recommended that manually assigned addresses start with C6-00-00.

With MsiPcap, direct attachment to one physical adapter can carry traffic beyond the Windows host while traffic between the local emulators remains unavailable. If same-host guest-to-guest communication is required, follow [6.1.1 MsiPcap TAP Bridging](#)^[79]; create a separate TAP adapter for each emulator and place those TAP adapters in one Windows Network Bridge. Do not attach multiple emulators to one shared TAP adapter.

Note: The MAC address field will not accept an invalid MAC address. Trying to type or cut and paste an invalid MAC address will result in nothing being entered in the MAC address box.

6.5 Manually Modifying the Avanti MAC Address



Avanti automatically assigns a unique MAC address to each virtual Alpha NIC. The assigned MAC address is calculated based off the MAC of the associated host NIC. In cases where a specific MAC address is desired, or when the generated MAC address causes a network conflict, a MAC address can be manually assigned via the Configuration Utility. Select the desired NIC definition in the Configuration Utility; check the Set MAC address box; and enter a valid, unique MAC address.

Warning: Do not set the LSB (multicast bit) of the first octet. Doing so makes the first number odd (ex. "09-00-2b-aa-bb-cc"), which violates the Ethernet MAC standard and will interfere with NIC functionality.

Note: The MAC address field will not accept an invalid MAC address. Trying to type or cut and paste an invalid MAC address will result in nothing being entered in the MAC address box.

6.6 DE435 for Older Guest Releases

For an older guest release that does not recognize a configured DE500, the DE435 is the conservative first alternative. Historical guidance used the DE435 for OpenVMS releases before V7.2 and Digital UNIX releases before V4.0, but those exact cutoffs were not revalidated across every kit for Avanti 5.1.0. Treat them as troubleshooting history rather than a complete compatibility boundary.

Consult the network-driver documentation for the installed guest release, verify which adapter the guest actually enumerates, and validate bidirectional traffic before retiring the previous configuration. See [8 OpenVMS Specific Notes](#)^[100] or [9 Tru64 UNIX Specific Notes](#)^[112] for the supported guest-family boundaries.

6.7 Networking with Wireless Ethernet

A wireless adapter and access point do not necessarily forward frames whose source or destination MAC address differs from the Windows host's wireless address. Results therefore depend on the adapter, its driver, and the access point. Wired Ethernet is strongly recommended for DECnet, LAT, clustering, or multiple Avanti instances on one host.

For Npcap, first select the wireless adapter directly and test all required protocols. Avanti uses Ethernet-format packets; do not enable Npcap's raw 802.11 or monitor mode. Direct Npcap attachment does not guarantee that the wireless infrastructure will forward the emulated MAC address or non-IP protocols.

For MsiPcap, first try the wireless adapter directly. If host-to-guest or same-host guest-to-guest traffic is required and does not work, the [6.1.1 MsiPcap TAP Bridging](#)^[79] procedure is a possible workaround. A Windows Network Bridge that includes a wireless uplink is not supported by every wireless adapter or access point and is not a guarantee of external connectivity.

As another limited workaround, the virtual Alpha NIC can use the wireless adapter's MAC address. Do not assign the same TCP/IP address to Windows and the virtual Alpha. This approach is incompatible with DECnet Phase IV and DECnet Phase V compatibility mode because those protocols change the virtual Alpha NIC to a DECnet-encoded AA-00-04-xx-xx-xx address. Even without DECnet compatibility mode, MAC matching succeeds only when the wireless combination forwards the required protocols.

To diagnose a wireless path, capture traffic on the Windows host and on a wired system elsewhere on the network, then compare which frames reach each side. Verify every protocol the guest requires; successful TCP/IP traffic does not prove that DECnet, LAT, or clustering traffic is forwarded.

6.8 VMware NICs

When Avanti runs in a VMware ESXi virtual machine, create a separate port group for its virtual NIC. On the Security settings tab for this port group, set the following options to Accept:

- Promiscuous mode
- MAC address changes
- Forged transmits

6.8.1 VMware Network Troubleshooting

This section lists potential VMware network problems and solutions.

6.8.1.1 Promiscuous Mode

Older versions of VMware ESXi and VMware Server may require that the virtual NICs be manually set to promiscuous mode. Depending on the VMware product, accomplishing this may require adding an entry to a VMware configuration file or finding the right configuration option in the configuration menus.

If the VMware NIC cannot accept traffic for the emulated MAC address, treat it like a wireless NIC. Npcap should still be tried first with direct attachment. For MsiPcap, [6.1.1 MsiPcap TAP Bridging](#)^[79] can solve host-local forwarding, but a TAP adapter does not bypass filtering imposed by the upstream hypervisor virtual switch. Enable the hypervisor's applicable promiscuous-mode, forged-transmit, or MAC-spoofing settings as well. All the caveats in [6.7 Networking with Wireless Ethernet](#)^[81] apply.

6.8.1.2 Disappearing NIC

VMware has a bad habit of disabling a NIC if it does not appear to be in use at the Windows level. The symptoms are the NIC is still visible to the host system and to Avanti, but no longer communicates on the network. If this problem is encountered, enabling some Windows protocols on the NIC should fix it. First try enabling the following protocols:

- QoS Packet Scheduler
- Link-Layer Topology Discovery Mapper I/O Driver
- Link-Layer Topology Discovery Responder

If that does not correct the problem, enable Internet Protocol Version 4 (TCP/IPv4) on the NIC and allow it to be assigned an IP on the Windows side.

6.9 Hyper-V Virtual NICs

If DECnet Phase IV support is required under Hyper-V, MAC address spoofing must be enable. However, Microsoft Hyper-V versions prior to Windows Server 2008 R2 Hyper-V and Hyper-V Server 2008 R2 do not support MAC address spoofing. This prevents the MAC address change inherent in a DECnet Phase IV installation. DECnet Phase IV support under Hyper-V requires a Hyper-V release that supports MAC address spoofing.

6.10 Network Issues

6.10.1 Diagnosing Possible Host Offload Problems

Historical field reports associated some host-adapter offload settings with DECnet, TCP/IP, or System Communications Services (SCS) problems. A physical Intel I226-V/Npcap test reproduced Avanti's host-originated IPv4, TCP, and UDP checksum-repair counts with the corresponding transmit offloads enabled; disabling each transmit setting alone removed its matching count. The tested TCP and UDP file transfers completed with matching hashes in every state. This does not establish that an offload setting caused the historical communications symptoms, and results may differ by adapter and driver.

If one of the following symptoms is repeatable, record the Windows adapter and driver, packet backend, traffic direction, protocol, guest NIC, and current offload settings before changing anything:

- Unable to establish communications to the Avanti NIC.
- Communications with Avanti are unstable (time outs, packet loss)
- Cluster communications are unstable (SCS cluster time outs, packet loss)

As a controlled diagnostic, disable one applicable transmit checksum-offload setting at a time in the Windows adapter's Advanced properties and repeat the same workload. Do not infer a cause from disabling several features together, and do not attribute Large Send Offload or receive-only features to checksum repair without separate evidence. Restore every former value after the test unless the isolated change reproducibly corrects the recorded case.

6.10.2 Diagnosing DECnet and SCS Packet Loss Through a Switch

Historical field reports associated some switch configurations, including older Cisco Catalyst 4000 equipment, with DECnet or System Communications Services (SCS) packet loss under load. Avanti 5.1.0 qualification did not reproduce the issue or qualify switch families, brands, speed classes, or prioritization behavior.

If packet loss is repeatable, preserve the failing topology and inspect switch counters, VLAN membership, filtering, loop protection, quality-of-service policy, and port negotiation before attributing it to unrecognized protocols. Then try one controlled diagnostic at a time:

- Temporarily select a mutually supported fixed speed on the affected port and adapter, then repeat the same traffic test.
- Repeat the test through a known-good alternate switch or direct isolated path.
- Compare counters and packet traces from the failing and control paths.

Keep a changed speed or switch only when the controlled comparison corrects the recorded symptom. Restore temporary settings otherwise. Past success or failure with a brand or speed is not a current compatibility guarantee.

6.11 Packet Capture Drivers: MsiPcap and Npcap

Avanti supports two packet capture backends: the bundled MsiPcap driver and the third-party Npcap driver. Npcap is preferred and is used by default when a compatible installation is available; otherwise Avanti falls back to MsiPcap.

See [6.11.1 Npcap Installation](#) to obtain and install Npcap. Npcap is not supplied or licensed by Migration Specialties, so review its license for the intended use. Set `use_npcap_driver = false` under [4.1.8.1 VLC](#) to prevent Avanti and its Configuration Utility from using an installed Npcap copy that is not licensed for Avanti use.

NDIS Driver	Characteristics
Npcap	Supported NDIS6 driver and Avanti's preferred backend. Follow 6.11.1 Npcap Installation and reboot Windows. If a compatible installation is available and <code>use_npcap_driver</code> remains true, Avanti uses it instead of MsiPcap. Avanti normally uses a physical adapter directly with Npcap; no TAP adapter or Windows Network Bridge is ordinarily required. Installation does not by itself establish that the Npcap license permits use by Avanti.
MsiPcap	Bundled Avanti driver installed with the product and used automatically when Npcap is unavailable or <code>use_npcap_driver</code> is false. Depending on the host network path, communication between Avanti and its own Windows host or another emulator on that host can require a TAP adapter and Windows Network Bridge.

Note: After installing or updating Npcap, reboot before starting Avanti.

6.11.1 Npcap Installation

Npcap is the preferred network backend for new Avanti configurations. On Windows 8/8.1 and Windows Server 2012/2012 R2, install the standalone [Npcap 1.79 package](#). Do not use the Npcap 1.89 installer's bundled 1.79-driver option on these legacy hosts: that installation path can fail while creating the Npcap service (error 0x800F0203). Run the standalone Npcap 1.79 installer instead. On Windows 10/11 and Windows Server 2016/2019/2022/2025, use [Npcap 1.89](#). The official [Npcap download page](#) lists currently available releases. Review the current Npcap license before installing it; Migration Specialties does not redistribute Npcap with Avanti, and the free edition permits only the uses described on that page.

During Npcap installation, check:

- Install Npcap in WinPcap API-compatible Mode

The Npcap option for raw 802.11 traffic and monitor mode is not required by Avanti. Avanti uses Ethernet-format packets. Do not place an adapter in monitor mode for Avanti; monitor mode can disconnect it from its wireless network.

After installing or updating Npcap, reboot Windows before starting Avanti. [use_npcap_driver in VLC](#) defaults to true, so every NIC in the process uses a compatible Npcap installation when it is available and otherwise falls back to MsiPcap. Set `use_npcap_driver` to false when Npcap is installed for another application but is not licensed for Avanti use, or when MsiPcap is required for a specific compatibility test. To prevent the Configuration Utility from loading Npcap while it first reads an older file

that omits this now-default-true setting, add `use_npcap_driver=false` to the top-level control component with a text editor before opening the file. Changing the setting in VLC [+] refreshes every NIC Interface list for the selected backend; save, close, and reopen the Configuration Utility before further use when licensing requires that Npcap remain unloaded. The former per-NIC driver property is ignored and removed when the Configuration Utility saves an older file.

Normally select the physical Ethernet adapter directly. Npcap does not ordinarily require a TAP adapter or Windows Network Bridge. See [6.1 PCAP Drivers](#)^[78] for the separate MsiPcap bridging guidance and wireless limitations.

Avanti Device Notes

VIRTUAL
ALPHA

7 Avanti Device Notes

7.1 Default Serial Ports

Avanti supports two default serial ports. Both onboard COM1 and COM2 UARTs are present to the Alpha firmware even when a port has no host-side connection in the configuration file; an unconnected port remains idle and does not open a Telnet listener or host COM port. The two virtual serial ports are included in a zero-unit configuration; assigning physical host COM ports requires license units. Virtual serial ports can be accessed using the supplied PuTTY terminal emulator or a commercial terminal emulator such as KEA or Reflection.

Tip: Migration Specialties recommends enabling both virtual serial ports when building, modifying, or troubleshooting an Avanti configuration. Having two serial access points to a virtual Alpha system is useful in case one session locks up or network problems block telnet access.

7.1.1 Serial Port Telnet Port Numbers

When using Avanti virtual serial ports, the Avanti configuration utility default port number assignments are OPA0/tty00 = 9000 and TTA0/tty01 = 9001. If multiple Avanti instances are to be run on a single host, then unique port number assignments need to be made for each virtual serial port.

Example:

Avanti Instance	OPA0/tty00	TTA0/tty01
Alpha01	9000	9001
Alpha02	9002	9003
Alpha03	9004	9005

7.1.2 Serial Port Logging

To record output from a serial port, check Log file in that port's configuration tab. The utility suggests a name based on the configuration <base> value and serial-port number. Verify that the selected path is unique across all ports, serial cards and emulator instances; change it where necessary.

This records output sent by the emulated serial port, together with the log header. Input typed into a terminal appears only if the guest echoes it back as output; this is not a separate capture of every keystroke. Logging remains available independently of whether a Telnet client is connected. It is separate from logging performed by PuTTY or another terminal program.

Each serial logfile uses the same filename, versions, timestamp and wmi settings as the main log. See [11.1.1 Avanti Log File](#) for retention and [4.1.8.2 Logfile](#) for header and timestamp controls. Output is not size-limited; allow sufficient disk space and protect logs containing sensitive guest data.

7.1.3 Console Port

The default console port on an OpenVMS system is OPA0 and tty00 on a Tru64 system. The console port is always enabled by default on new configurations.

7.1.4 Physical Serial Devices

Avanti can map a Windows COM device to a virtual serial port. The mapping path and settings are source-backed, but the current compatibility evidence did not exercise arbitrary physical adapters or attached devices. Confirm that the COM device exists, is not in use by another process, and works with its Windows driver before assigning it. See [4.1.7.5 Serial Ports: OPA0/tty00 – TTA0/tty01](#) for the mapping procedure.

Note: Match baud rate, data bits, parity, stop bits, and flow control at both ends. Historical reports associated mismatched settings with an apparently hung port, but that exact failure signature was not reproduced in the 5.1.0 validation.

7.2 5-Port Serial Card Support (OpenVMS)

For OpenVMS, in addition to the console ports OPA0 and TTA0, Avanti can configure up to 25 additional serial ports through five virtual 5-port serial cards. The configuration and resource limits are source-checked. Current runtime qualification covers the retained-firmware OpenVMS cases recorded in the compatibility audit, including bidirectional pending-read exchanges on all five ports of a configured card; it does not establish sustained or concurrent traffic on every card.

Note: The modified Digiboard interface is not a supported Digital UNIX or Tru64 UNIX device. Historical investigation found no established guest-driver mapping for its six I/O windows and shared interrupt. Do not add it to a UNIX configuration; the former statement that it causes unpredictable behavior was not independently reproduced.

The serial cards are not supported by the Avanti configuration utility. Generate and save the rest of the configuration there, make a backup, close the utility, and then add the card manually. The following sample demonstrates the card block. The full-file example later in this chapter is a historical syntax illustration, not a current ready-to-run configuration.

```
isa0 = digiboard
{
  serial0 = i16550
  {
    tn = telnet
    {
      port = 9010;
      action = ""C:\Program Files\Common Files\MigrationSpecialties
Shared\putty.exe"" telnet://127.0.0.1:9010";
    }
  }
  serial1 = i16550
  {
    phys = ext_serial
    {
      device = "\\.\COM1";
    }
  }
  serial2 = i16550
  {
    phys = ext_serial
    {
      device = "\\.\COM2";
    }
  }
  serial3 = i16550
  {
    phys = ext_serial
    {
      device = "\\.\COM30";
    }
  }
}
```

```

    }
    serial4 = i16550
    { phys = ext_serial
      { device = "\\.\COM31";
      }
    }
  }
}

```

This example defines an emulated Digiboard card containing five serial ports, TXA0 through TXA4. TXA0 is a telnet port. TXA1 through TXA4 illustrate physical COM-port mappings; those particular host devices were not part of the current runtime qualification and must exist on the target Windows host.

Up to five serial ports can be defined on each card, running from serial0 thru serial4. Up to five Digiboard cards can be defined, running from isa0 thru isa4, for a total of 25 additional serial ports. However, isa2, isa3, and isa4 conflict with pci13, pci12, and pci11 respectively. That means that isa2 can only be used if pci13 is not used, etc. This limits the number of Digiboard cards to four for most systems (where one disk controller and one NIC are required).

The sections within "serial = i16550 { ... }" follow the same configuration rules as the regular serial ports, so they can be telnet server ports or mappings to host COM devices. Physical-device operation depends on the Windows driver, hardware, and matching serial settings and has not been qualified for arbitrary COM devices.

OpenVMS uses SYS\$YSDRIVER for the emulated card, but the card is not discovered without the release-appropriate firmware and guest setup described in the following topics.

Each card requires 10 license units, including its five ports whether they use virtual or physical connections. Card identifiers must be complete unsigned decimal names isa0 through isa4, with no duplicate numeric position; each card similarly permits at most one serial0 through serial4. Leading zeroes identify the same position, not an additional device. Missing numbers, signs, trailing text, overflow and positions outside these limits are rejected.

Normally omit `iobase` and `irq`. The address is determined by the ISA card number, not declaration order: isa0 uses I/O base 256 (hexadecimal 100) and IRQ 15; isa1 uses 512 (200) and IRQ 14; isa2 uses 768 (300) and IRQ 10; isa3 uses 1024 (400) and IRQ 9; isa4 uses 1280 (500) and IRQ 5. Each card occupies 48 contiguous I/O bytes. These defaults do not overlap one another or the two base UARTs. The configuration utility omits an explicit `iobase=0` when saving; it does not provide a card editor or [+] dialog.

For compatibility with an existing guest setup, an explicit `iobase` override is retained. Use a decimal multiple of 8 from 8 through 65488, with all 48 bytes free; zero means automatic assignment. An explicit `irq` must be 1 through 15, except reserved cascade IRQ 2; `irq=0` means automatic assignment, never IRQ 0. Cards cannot share an IRQ or overlapping I/O bytes with another card or either onboard base UART, even when that UART has no configured host connection. Base serial0 occupies hexadecimal 3F8 through 3FF on IRQ 4, and serial1 occupies 2F8 through 2FF on IRQ 3. Invalid settings prevent startup. Other guest hardware reservations must also be respected when choosing overrides.

Migration: back up an older hand-edited configuration before correcting rejected names or resources. Keep each port's telnet or physical-device settings with its intended card and port. Prefer removing conflicting overrides to use automatic allocation; otherwise choose distinct free ranges and IRQs. If card numbers, addresses or interrupts change, update the firmware ISACFG entries and OpenVMS startup commands using the new emulator log, and verify the resulting guest device names before resuming use. The

five-card maximum still requires pci11, pci12 and pci13 to be unused; for example, isa0 through isa3 can coexist with a NIC in pci6 and a SCSI controller in pci11. This remains an OpenVMS-only feature.

7.2.1 Defining the Serial Card to the Firmware

With the retained AlphaServer 400 firmware used by Avanti 5.1.0, each card must be made known to OpenVMS through the firmware ISACFG utility. After defining the serial cards and ports in the configuration file, start the emulator, type EXIT at the >>> prompt, and inspect the resulting emulator log. The log prints the ISACFG invocations for that configuration together with the OpenVMS V7.1-and-higher guest commands. Use the current log rather than deriving addresses from the historical example below. Native-firmware setup is separate future work.

```
00011.78: Digiboard multi-serial card configured.
00011.78: Firmware configuration commands:
00011.78: >>> isacfg -mk -slot 1 -dev 0 -etyp 1 -enadev 1 -
handle DIGI
00011.78: >>> isacfg -mod -slot 1 -dev 0 -iobase0 100 -iobase1
108 -iobase2 110 -iobase3 118 -iobase4 120 -iobase5 128 -irq0 15
00011.78: Add these lines to SYS$SYSTEM:SYS$USER_CONFIG.DAT:
00011.78:     device           = "Digiboard Serial Port"
00011.78:     name               = TX
00011.78:     driver              = SYS$YSDDRIVER
00011.78:     adapter             = ISA
00011.78:     id                  = DIGI
00011.78:     end_device
00011.78: Add these lines to your startup procedure:
00011.78:     $ mcr sysman io
connect /vector=60 /driver=sys$ysddriver txa1:
00011.78:     $ mcr sysman io
connect /vector=60 /driver=sys$ysddriver txa2:
00011.78:     $ mcr sysman io
connect /vector=60 /driver=sys$ysddriver txa3:
00011.78:     $ mcr sysman io
connect /vector=60 /driver=sys$ysddriver txa4:
```

This retained sample shows the **firmware** and **OpenVMS** sections for one card. Slot, address, interrupt, and device-letter values can differ; only the commands emitted by the current run describe the current configuration.

For retained firmware, enter the generated console commands for the card. The settings are retained in the Avanti configuration's .nvr file after a controlled console EXIT.

```
>>> isacfg -mk -slot 1 -dev 0 -etyp 1 -enadev 1 -handle DIGI
>>>init
>>> isacfg -mod -slot 1 -dev 0 -iobase0 100 -iobase1 108 -iobase2
110 -iobase3 118 -iobase4 120 -iobase5 128 -irq0 15
>>>init
```

Enter the ISACFG commands from the current Avanti log at the console and verify their resource values before applying them.

A "sh config" or "isacfg -all" command can be used to confirm the presence of the ISA card definition in the firmware.

```

>>>sh config

Firmware
SRM Console:      V7.0-9
show_arc: Can't find Flash Rom containing ARC console.
PALcode:         VMS PALcode V5.56-2, OSF PALcode X1.46-2
Serial Rom:      V4.6
Diag Rom:        V1.7

Processor
DECchip (tm) 21064-3      166Mhz 512KB Cache

MEMORY
  512 Meg of System Memory
  Bank 0 = 256 Mbytes(128 MB Per Simm) Starting at 0x0
  Bank 1 = 256 Mbytes(128 MB Per Simm) Starting at 0x10000000
  Bank 2 = No Memory Detected

PCI Bus
  Bus 00 Slot 06: NCR      810A Scsi Controller
                                pka0.7.0.6.0      SCSI Bus
ID 7
                                dka200.2.0.6.0      RZ28
                                dka300.3.0.6.0      COMPAQ
BA03611C9B
                                dka600.6.0.6.0      RRD42

  Bus 00 Slot 07: Intel SIO 82378

  Bus 00 Slot 11: DECchip 21040 Network Controller
                                ewa0.0.0.11.0      02-13-46-
6A-94-24

ISA
Slot  Device  Name          Type          Enabled  BaseAddr  IRQ
DMA
0
  0      MOUSE      Embedded      Yes        60        12
  1      KBD        Embedded      Yes        60         1
  2      COM1       Embedded      Yes       3f8         4
  3      COM2       Embedded      Yes       2f8         3
  4      LPT1       Embedded      Yes       3bc         7
  5      FLOPPY     Embedded      Yes       3f0         6
  2
1
  0      DIGI       Singleport    Yes       100        15
                                108
                                110
                                118
                                120
                                128

>>>

```

This is historical SHOW CONFIG output after one card was defined; the serial-card results are highlighted in blue. Verify the actual card, six address windows, and interrupt in the running console rather than expecting the complete transcript to match.

7.2.2 Defining the Serial Card to OpenVMS

Once the firmware changes have been completed, boot VMS and apply the VMS configuration updates to enable the card and serial ports. Versions of OpenVMS prior to V7.1 use different configuration options from VMS 7.1 and higher.

7.2.2.1 Serial Card Configuration Prior to OpenVMS 7.1

Version of VMS prior to V7.1 use the SYS\$SPECIFIC:[SYSMGR]ISA_CONFIG.DAT to define ISA devices. If the file does not already exist, it can be created from the SYS\$COMMON:[SYSMGR]ISA_CONFIG.TEMPLATE.

1. The commands written to the Avanti log file are for VMS 7.1 and higher. However, the information provided in these commands can be used to configure earlier versions of VMS. Using the data written to the Avanti log file, adding the following lines to SYS\$SPECIFIC:[SYSMGR]ISA_CONFIG.DAT will enable serial card recognition by OpenVMS 6.2.

```
[TXA0]
NAME=TX
DRIVER=SYS$YSDDRIVER
IRQ=F                                ← irq0
NODE=1                              ← slot
PORT=(100:8,108:8,110:8,118:8,120:8,128:8) ← iobase0..iobase5
```

All numeric fields in ISA_CONFIG.DAT are hexadecimal. The example therefore uses IRQ=F for IRQ 15. Convert the decimal irq0 value printed in the emulator log before entering it here; the printed I/O base addresses are already hexadecimal.

2. If more than one Digiboard is defined, the historical procedure uses similar sections for [TXB0], [TXC0], [TXD0] and [TXE0]. Current runtime qualification covers one configured card, not this repetition across all five; add and validate cards one at a time using the data for each card from the Avanti log.
3. Once ISA_CONFIG.DAT has been updated, reboot VMS.
4. After the reboot is complete, a TXA0 device will be present that corresponds to serial0 on the Digiboard card. If additional cards are defined, the first port on each of these will be present as well (TXB0, TXC0, TXD0, TXE0). TXu1 thru TXu4 can be added using the SYSMAN IO CONNECT command. For example, placing the following commands into a VMS startup file such as SYS\$MANAGER:SYSTARTUP_VMS.COM will enable devices TXA1 – TXA4.

```
$! Define additional serial ports.
$!
$ MCR SYSMAN
IO CONNECT/NOADAP/DRIVER=SYS$YSDDRIVER TXA1:
IO CONNECT/NOADAP/DRIVER=SYS$YSDDRIVER TXA2:
IO CONNECT/NOADAP/DRIVER=SYS$YSDDRIVER TXA3:
IO CONNECT/NOADAP/DRIVER=SYS$YSDDRIVER TXA4:
EXIT
$!
```

With the firmware and VMS configuration changes completed, the additional serial ports are available for use.

Note: Errors in ISA_CONFIG.DAT or in the SYSMAN commands can prevent normal OpenVMS startup. Keep a verified backup and console access before editing. The exact recovery was not executed in the 5.1.0 validation: if startup fails immediately after this change, preserve the console signature and use the installed OpenVMS release's documented conversational-boot procedure to set STARTUP_P1 to "MIN", then back up and revert the offending ISA_CONFIG.DAT change. Do not apply this recovery to an unrelated boot failure.

7.2.2.2 OpenVMS 7.1 and Higher Serial Card Configuration

The Avanti log writes the retained-firmware and OpenVMS commands used by the validated V7.1-and-higher serial-card path. OpenVMS V7.1 and higher uses SYS\$SYSTEM:SYS\$USER_CONFIG.DAT to define ISA devices. Use the current log and validate the resulting devices; the evidence does not qualify every later OpenVMS release or native firmware.

1. Per the commands provided, add the following lines to SYS\$SYSTEM:SYS\$USER_CONFIG.DAT to enable serial card recognition by VMS. If the SYS\$SYSTEM:SYS\$USER_CONFIG.DAT does not exist, create it.

```
device = "Digiboard Serial Port"
  name = TX
  driver = SYS$YSDRIVER
  adapter = ISA
  id = DIGI
end_device
```

2. Reboot VMS.
3. After the reboot is complete, a TXA0 device will be present, which corresponds to serial0 on the Digiboard card. TXA1 thru TXA4 can be added using the SYSMAN IO CONNECT command. Place the following commands into a VMS startup file such as SYS\$MANAGER:SYSTARTUP_VMS.COM:

```
$! Set up system serial ports.
$!
$ MCR SYSMAN
IO CONNECT /VECTOR=60 /DRIVER=SYS$YSDRIVER TXA1:
IO CONNECT /VECTOR=60 /DRIVER=SYS$YSDRIVER TXA2:
IO CONNECT /VECTOR=60 /DRIVER=SYS$YSDRIVER TXA3:
IO CONNECT /VECTOR=60 /DRIVER=SYS$YSDRIVER TXA4:
EXIT
$!
```

The historical multi-card procedure repeats the commands for TXB0 through TXE4. Current runtime qualification covers one configured card, not every additional-card combination. Add and validate cards one at a time using the commands written to the current emulator log.

With the firmware and VMS configuration changes completed, the additional serial ports are available for use.

Note:Errors in SYS\$USER_CONFIG.DAT or in the SYSMAN commands can prevent normal OpenVMS startup. Keep a verified backup and console access before editing. The exact recovery was not executed in the 5.1.0 validation: if startup fails immediately after this change, preserve the console signature and use the installed OpenVMS release's documented conversational-boot procedure to set STARTUP_P1 to "MIN", then back up and revert the offending SYS\$USER_CONFIG.DAT change. Do not apply this recovery to an unrelated boot failure.

7.2.3 Sample Configuration File With Serial Card

The following historical full-file example illustrates where one serial-card block was placed. It was not executed as a complete Avanti 5.1.0 configuration: its paths, ports, host devices, controller layout, and other settings are site-specific and may be stale. Create and save the supported parts of a new configuration with the current Configuration Utility, close it, back up the file, and add only the required serial-card block from the preceding topic. Validate the configuration and one port before adding more mappings.

```
cp = control
{
  cp_log = logfile
  {
    filename = "D:\Avanti\Alpha07.1-2.log";
  }
  alpha = alpha
  {
    image = "D:\Avanti\Alpha07.1-2.nvr";
    memory = 512M;
    jit_level = 1;
    pciBus = dc21071da
    {
      data = "D:\Avanti\Alpha07.1-2.toy";
      serial0 = i16550
      {
        s0_tn = telnet
        {
          port = 9000;
          action = ""C:\Program Files\Common
Files\MigrationSpecialties
Shared\putty.exe"" telnet://127.0.0.1:9000";
        }
      }
      serial1 = i16550
      {
        tn = telnet
        {
          port = 9001;
          action = ""C:\Program Files\Common
Files\MigrationSpecialties
Shared\putty.exe"" telnet://127.0.0.1:9001";
        }
      }
      pci6 = symbios
      {
        disk0.2 = file
        {
          vendor = "DEC";
          model_num = "RZ28";
          rev_num = "D41C";
          image = "D:\Avanti\Alpha\SystemV71-2.vdisk";
        }
        disk0.3 = file
        {
          vendor = "COMPAQ";
          model_num = "BA03611C9B";
          rev_num = "3B07";
          image = "D:\Avanti\Alpha\Data.vdisk";
        }
        disk0.6 = device
        {
          device = "\\.\CdRom0";
          cdrom = true;
          read_only = true;
        }
      }
    }
  }
}
```

```

    }
}
pci7 = i82378
{
}
pci11 = de435
{
    adapter = "Emulator1";
}
isa0 = digiboard
{
    serial0 = i16550
    {
        tn = telnet
        {
            port = 9010;
            action = ""C:\Program Files\Common
Files\MigrationSpecialties Shared\putty.exe""
telnet://127.0.0.1:9010";
        }
    }
    serial1 = i16550
    {
        phys = ext_serial
        {
            device = "\\.\COM1";
        }
    }
    serial2 = i16550
    {
        phys = ext_serial
        {
            device = "\\.\COM2";
        }
    }
    serial3 = i16550
    {
        phys = ext_serial
        {
            device = "\\.\COM30";
        }
    }
    serial4 = i16550
    {
        phys = ext_serial
        {
            device = "\\.\COM31";
        }
    }
}
}
}
}

```

7.3 Virtual Tapes

Like virtual disks, virtual tape devices appear as files to the host system. By default, Avanti assigns the extension .vtape to a virtual tape file. The vtape format utilized by Avanti is fully compatible with the vtape format used in SimH. Avanti virtual tape devices default to a DEC DLT2000 device type.

Each SCSI tape READ or WRITE command may transfer at most 16 MiB. A larger request returns a SCSI error without allocating or transferring the requested data. This per-command limit does not limit the total size of a virtual tape file.

A single WRITE FILEMARKS command may write at most 1,024 marks. Issue additional commands for a larger sequence; the total number of marks on a virtual tape is not limited by this per-command bound.

SPACE to end-of-data is not supported and returns a SCSI check condition rather than repositioning the tape. A failure to finalize a tape image during UNLOAD also returns a check condition; do not replace the host file until Avanti has released it successfully.

Note: Avanti puts no limit on the size of a vtape file. Continuously appending to a tape will eventually fill the host system disk.

Avanti treats virtual tape files as follows:

- If a virtual tape file does not exist when Avanti opens the device, it is created.
- After the guest unloads the tape and the host file is renamed, Avanti creates a new tape file the next time the associated tape device is accessed. See [7.3.1 Changing Tapes](#) for the safe procedure.
- If a virtual tape file exists on Avanti startup, it is used.
- Avanti holds the tape file open with host read sharing only after the following operations. Windows processes may read or copy the file, but cannot write, rename, or delete it until the guest unloads the tape:
 - Tru64: Tape read/write operations commence.
 - VMS: Historical OpenVMS field guidance states that tape activity begins when INITIALIZE or MOUNT is executed and that an INITIALIZE'd backing file remains locked until a later MOUNT/DISMOUNT sequence or guest shutdown. This guest-command lifecycle has not been revalidated for Avanti 5.1.0.
- Avanti releases a tape file when an UNLOAD command is sent to the virtual tape drive. The following operations issue an UNLOAD command:
 - Tru64: The `mt unload` and `mt offline` forms are retained historical command examples and have not been revalidated across the supported Tru64 releases. Verify the command accepted by the installed release.
 - VMS: Historical OpenVMS field guidance states that DISMOUNT issues the UNLOAD command. This guest-to-SCSI behavior has not been revalidated for Avanti 5.1.0; confirm that Avanti has released the backing file before replacing or renaming it.
- Historical OpenVMS field reports state that INITIALIZE reduced the underlying tape file to a few kilobytes. This guest-specific result has not been revalidated for Avanti 5.1.0; the production implementation guarantees only that, after the current session records a write, closing or unloading truncates the backing file to the logical content length recorded during that session.

7.3.1 Changing Tapes

A virtual tape can be changed while Avanti is running after the guest has unloaded it. The unload closes Avanti's handle to the backing file. Renaming the file while it is still loaded is not a supported tape-change procedure. Avanti creates a new file at the configured path when the guest next accesses the device. To change the virtual tape Tape1.vtape, follow these steps:

- 1) Stop tape access.
 - a) Tru64 UNIX: The following are retained historical command examples that have not been revalidated across the supported Tru64 releases: issue `mt unload` or `mt offline` for the tape device. Verify the command accepted by the installed release before relying on this procedure.
 - b) VMS: Historical OpenVMS field guidance uses DISMOUNT for the tape device. This guest-to-SCSI unload behavior has not been revalidated for Avanti 5.1.0; confirm that Avanti has released the backing file before continuing.
- 2) From Windows, rename the file Tape1.vtape to a new name, such as AUG03_Backup.vtape.
- 3) The next time a tape operation takes place against the virtual tape device, the Tape1.vtape file will be recreated.

7.3.1.1 Virtual Tape File Space Allocation

Creating an unused virtual tape produces an empty backing file. On the first write, and whenever later writes exceed the current allocation, Avanti extends the host file to the next 100 MiB boundary. This reduces incremental file growth and fragmentation. After a session records a write, closing or unloading the tape truncates the physical file length to the logical content length recorded during that session. Merely reopening and closing an existing tape without writing does not reconstruct a logical end from earlier sessions.

7.3.1.2 Make Tape Utility

To facilitate converting real tapes to virtual tapes, Avanti includes the `mktape.exe` utility in the Avanti installation folder. Mktape requires a Windows system with a SCSI controller and compatible SCSI tape drive to read OpenVMS or Tru64 UNIX generated tapes. This physical-tape procedure is retained as historical service guidance and has not been revalidated for the 5.1.0 release. Run it from an elevated command prompt when access to the physical tape device requires administrator rights.

To create a tape image file from a real tape using `mktape`, open a command window and enter a command similar to the following:

```
"C:\Program Files\MSI Digital Emulator Collection\mktape.exe"  
\\.\tape0 "%USERPROFILE%\Documents\tape1.vtape"
```

This example uses the default installation folder and the current user's existing Documents directory. If Avanti was installed elsewhere, use the `mktape.exe` beside `dec.exe`. The first argument, `\\.\tape0`, is the Windows tape-device path. The second argument is the virtual-tape output file; its output directory must already exist. Mktape stages the copy in that directory and replaces an existing output file without prompting only after the tape copy completes successfully. Preserve an existing file first if you need to retain it.

OpenVMS Specific Notes



8 OpenVMS Specific Notes

Avanti supports OpenVMS Alpha V6.1-1H1 and later. This is the guest-family support boundary, not a claim that every installation kit, layered product, virtual-device combination, or field-test release has been qualified with every Avanti release.

An unqualified OpenVMS V6.1 installation kit can predate AlphaServer 400 support and is not interchangeable with V6.1-1H1. Verify the complete version and hardware-update level displayed by the installation kit rather than relying on an abbreviated media label.

Use the KZPAA narrow SCSI controller with OpenVMS releases before V7.1-2. The supported KZPCA wide-controller matrix starts at OpenVMS V7.1-2. Recorded runtime testing confirms that V7.1 rejects KZPCA while V7.1-2 boots and performs storage I/O with KZPCA.

A version beginning with E identifies a field-test kit. For example, E8.2 is not OpenVMS V8.2 and does not establish support for a final V8.2 release.

8.1 Porting an OpenVMS System

An OpenVMS migration can use normal OpenVMS backup and restore mechanisms, including a network transfer, but it is not a universal copy-and-boot operation. Before changing the source system, retain a verified backup and recovery path. Plan for the exact OpenVMS release, source storage and network drivers, Avanti disk and NIC configuration, licenses, boot variables, and application dependencies; validate the migrated system independently before cutover.

If you are not comfortable with OpenVMS, Migration Specialties offers turnkey OpenVMS porting services. Contact us for more information at sales@migrationspecialties.nl.

8.2 OpenVMS Auto Boot

At the SRM console prompt, configure an OpenVMS system disk for automatic boot as follows. Replace DKA0 with the actual system-disk device when necessary.

```
>>> SET AUTO_ACTION BOOT
>>> SET BOOT_OSFLAGS 0
>>> SET BOOTDEF_DEV DKA0
>>> EXIT
```

EXIT closes Avanti cleanly and writes the console variables to the configuration's NVRAM file. The next launch uses the saved device and flags and boots automatically. This sequence has been validated with the exact curated OpenVMS V7.0 KZPAA system; it is standard SRM configuration guidance rather than qualification of every OpenVMS release or system-disk layout.

8.3 Reconfiguring the Network

Avanti presents its first three network devices as EWA0, EWB0, and EWC0. A migrated OpenVMS system configured for different controllers may therefore need its DECnet and TCP/IP products reconfigured for EW devices.

The sequence below is retained historical service guidance for DECnet Phase IV and older UCX/TCP/IP Services installations. It has not been executed across the Avanti 5.1.0 guest matrix and is not a substitute for the configuration and startup instructions supplied with the exact OpenVMS, DECnet, and TCP/IP product versions. Back up SYSTARTUP_VMS.COM and the product configuration before changing them, and arrange a console recovery path.

- 1) Disable the DECnet (STARTNET.COM) and TCP/IP (UCX\$STARTUP.COM) startups in SYSTARTUP_VMS.COM. Comment out commands similar to these:

```
$ IF F$SEARCH("SYS$SYSTEM:NETACP.EXE") .NES. "" THEN  
  @SYS$MANAGER:STARTNET
```

```
$ @SYS$MANAGER:UCX$STARTUP.COM
```

```
$ @SYS$MANAGER:TCPIP$STARTUP.COM
```

- 2) Reboot VMS.
- 3) Run NETCONFIG.COM and reset the DECnet parameters.
- 4) Enable DECnet startup in SYSTARTUP_VMS.COM (STARTNET.COM).

Note: Historical service guidance ran DECnet before TCP/IP and invoked both startup procedures directly from SYSTARTUP_VMS.COM. That order and the blanket prohibition on batch submission have not been revalidated as universal requirements. Preserve the supported startup mechanism for the installed product versions unless their documentation or a reproduced migration problem requires explicit serialization.

- 5) Reboot, then verify the configured DECnet and LAT devices and inspect their startup messages before proceeding.
- 6) Run UCX\$CONFIG.COM or TCPIP\$CONFIG.COM and reset the TCP/IP configuration.
- 7) Enable TCP/IP in SYSTARTUP_VMS.COM (UCX\$STARTUP or TCPIP\$STARTUP).
- 8) Reboot, then verify the configured TCP/IP interface, address, route, and required services. If validation fails, preserve the console and startup output and restore the saved configuration before trying a different release-matched procedure.

8.4 Bypassing a NIC

If a guest configuration contains a NIC that should remain visible but must not pass traffic, assign that NIC to Dummy network. For example, if EWA and EWB are defined but only EWB is used, EWA can remain present as a disconnected emulated card while EWB is assigned to a host adapter. This can preserve guest adapter naming and order during migration, but it does not prove that the guest network configuration needs no changes; verify the guest interfaces and startup files.

Dummy network stores the reserved disconnected adapter value, creates no packet backend, and does not connect the NIC to the host, an external network, or another virtual NIC. Select a real host adapter when traffic is required.

8.5 Maximum Disk Size Under OpenVMS

OpenVMS V6.0 through V8.3 support a maximum disk size of 1TB. OpenVMS V8.4 introduced a maximum disk size of 2TB. These guest limits apply whether Avanti backs the emulated SCSI disk with an image file or a host physical disk. A host physical-disk path can impose additional limits. The note in Section 1.1 of VSI's [I/O User's Reference Manual](#) explains the V8.4 change to unsigned block numbers and counts, and the need for applications to handle volumes and files larger than 1TB correctly.

Caveats:

The following pre-V7.2 notes are retained as historical operating-system and hardware guidance. They were not boundary-tested by the Avanti 5.1.0 storage validation and are not separate limits imposed by Avanti. Confirm them in documentation for the exact OpenVMS release and storage hardware before planning a migration.

- Pre-V7.2 versions do not support a system disk larger than 32GB.
- Pre-V7.2 versions have a maximum of 1 million clusters, so for an n-GB drive the cluster size will be 2^n , which may get rather large.

8.6 OpenVMS Clustering

- Historical field reports describe OpenVMS clusters containing Avanti systems and physical VAX, Alpha, or Itanium systems. Those mixed-hardware configurations have not been reproduced across the Avanti 5.1.0 candidate matrix and are not a current stability qualification.
- Historical field reports also describe satellite booting into a cluster. This procedure has not been revalidated for Avanti 5.1.0; validate the exact OpenVMS release, network path, and cluster configuration before relying on it.

8.6.1 Quorum Disk and TCQ

Historical Avanti cluster configurations enabled Tagged Command Queuing (TCQ) on a quorum disk. Avanti's TCQ option advertises tagged-command support to the guest and also requires disconnect support, but the claim that every OpenVMS quorum disk requires this setting has not been revalidated for Avanti 5.1.0. Follow the documentation for the installed OpenVMS release and validate the exact cluster before relying on the historical setting. See [4.1.8.6 SCSI Disk](#) [\[+\]](#) [\[56\]](#) for the Avanti options.

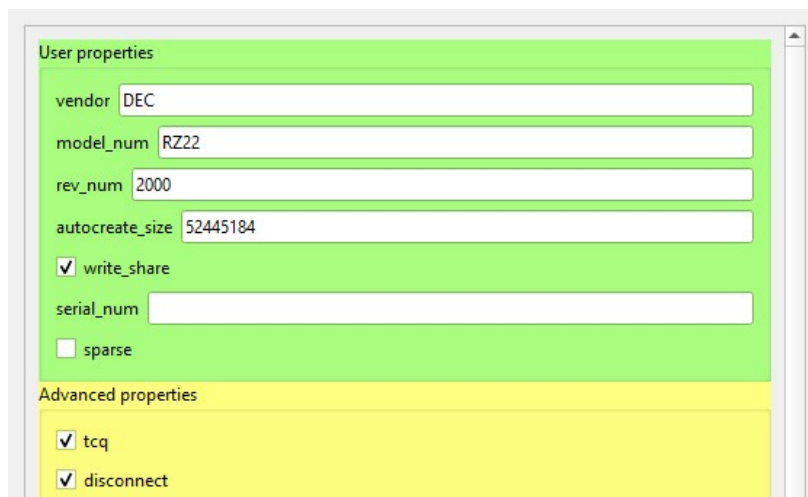
8.6.2 Clusters and Disk Sharing

The `write_share` option permits multiple Avanti processes on the same Windows host to open one image file for writing. It changes only the host file-sharing mode; it does not provide cluster coordination, locking, cache coherency, or protection against guest filesystem corruption. Use it only when the guest systems are correctly configured members of a cluster that supports concurrent access to that disk. See [4.1.8.6 SCSI Disk](#) [\[+\]](#) [\[56\]](#).

Warning: Using the `write_share` feature to share disks with non-clustered Avanti instances is not recommended. Doing so may result in disk corruption.

Historical field guidance used host-shared physical devices, such as SAN disks, when cluster members ran on separate hosts. No representative cross-host SAN configuration has been revalidated for Avanti 5.1.0. Validate device ownership, Windows access semantics, guest clustering, and failure recovery for the exact storage path.

For a same-host image-file experiment, point each participating Avanti configuration at the exact same image and enable `write_share` for that disk. This is not by itself a supported cluster design; first preserve a backup and validate the complete guest cluster and recovery procedure.



The screenshot shows a configuration window with two sections: 'User properties' (green background) and 'Advanced properties' (yellow background). In the 'User properties' section, the following fields are visible: 'vendor' with value 'DEC', 'model_num' with value 'RZ22', 'rev_num' with value '2000', 'autocreate_size' with value '52445184', a checked checkbox for 'write_share', an empty 'serial_num' field, and an unchecked checkbox for 'sparse'. In the 'Advanced properties' section, there are two checked checkboxes: 'tcq' and 'disconnect'.

Historical example: an OpenVMS 8.3 cluster shared a system disk and quorum disk stored in `VMS83_Clustering.img` and `V83_Quorum.img`. The image shows `write_share` and `TCQ` enabled on the quorum disk. This captured example has not been reproduced for Avanti 5.1.0 and does not establish that the same options are correct for every OpenVMS release or storage design.

8.7 VMS 6.n and Large Disk Support

Avanti 2.4 removed the emulator's former 8GB disk-size restriction for VMS 6.n guests. Current validation initialized, mounted, wrote, and read a 12GiB image-backed disk on OpenVMS V6.2 using a KZPAA controller.

Avanti presents image-backed and host physical disks to OpenVMS as SCSI block devices, so the applicable OpenVMS, file-system, device-driver, and application limits determine usable capacity. The 12GiB validation does not qualify every controller, patch level, file system, application, or capacity up to the architectural maximum.

8.8 VMS 6.2 Installation

Historical installation guidance lists an RZ56-sized 635 MB disk as the OpenVMS V6.2 minimum and recommends at least 1 GB. The current 5.1.0 evidence validates V6.2 storage at larger sizes but does not test the 635 MB boundary. Treat that value as a historical floor, verify the requirements of the exact installation kit and layered products, and allocate additional space for updates, paging, logs, and application data.

8.9 VMS 6.2 Image Backups

Historical OpenVMS V6.2 service guidance uses BACKUP/IMAGE/NOALIAS when creating a system-disk save set so that the VMS\$COMMON directory tree is copied rather than relying on the source alias. This exact alias case has not been revalidated for Avanti 5.1.0. Confirm the qualifiers in the BACKUP documentation for the installed release and test both the save and restore on a disposable target before relying on the result.

The following device names are examples only. Substitute the actual source, save-set, and disposable restore devices; review the effect of /IGNORE=INTERLOCK before using it on an active system.

Image Backup Command

```
$ BACKUP/IMAGE/NOALIAS/IGNORE=INTERLOCK DKA0:
MKA600:SYSTEM.BCK/SAVE
```

Image Restore Command

```
$BACKUP/IMAGE MKA600:SYSTEM.BCK/SAVE DKB0:
```

After the restore, verify the VMS\$COMMON alias and contents, boot the restored copy independently, and retain the original system disk until recovery has been demonstrated.

8.10 VMS 6.2 Network Support

Avanti provides DE435 and DE500 virtual NIC identities. Historical field guidance recommends DE435 for OpenVMS releases before V7.2 because some older configurations encountered DE500 startup problems. Current retained-firmware evidence verifies selected DE435 operation but does not establish V7.2 as a universal DE500 boundary or reproduce the workaround below. Prefer DE435 for an untested older guest unless release-matched OpenVMS documentation and a controlled test establish DE500 support.

If an older guest must use DE500 and DECnet or TCP/IP does not start, preserve the exact console output before testing the following historical sequence on a recoverable copy. The original error signature behind this field guidance was not retained, so treat the sequence as a diagnostic experiment for network-service startup failure, not as a known fix for an identifiable error. Do not apply it to unrelated network failures.

- Use the DE500 21143 NIC definition in the Avanti configuration file.
- Adapt the following sequence to the DECnet and TCP/IP products installed on that guest. Do not copy it unchanged into a production startup procedure.

```
$ @SYS$MANAGER:STARTNET.COM      !Start DECnet
$ MC NCP SET EXEC STAT OFF       !Shut down DECnet
$ WAIT 00:00:10                  !Pause 10 seconds*
$ @SYS$MANAGER:STARTNET.COM      !Restart DECnet
!
$ @SYS$STARTUP:UCX$STARTUP.COM    !Start TCP/IP services
```

The ten-second delay and reported NETNOSTATE bug check are historical observations, not qualified timing requirements. Validate DECnet and TCP/IP after a controlled reboot, and remove the sequence if it does not address the recorded failure.

8.11 OpenVMS V7.0 Login After Installation

With the exact curated OpenVMS V7.0 system tested on Avanti's AlphaServer 400 model, a normal OPA0 login is not presented immediately after installation. Historical service reports describe the same behavior on a physical AlphaServer 400, but the current 5.1.0 validation did not independently test physical hardware. The curated-system result does not qualify every OpenVMS V7.0 kit, patch level, or controller.

If the required OpenVMS licenses were registered during installation, the tested system permits a SYSTEM login through TTA0. The login banner should identify OpenVMS V7.0 and the expected node.

Otherwise, use [8.11.1 OpenVMS V7.0 Conversational Boot](#) to reach privileged DCL and install the licenses. Restore SYS\$SYSTEM:STARTUP.COM as the startup procedure before returning the system to normal use.

8.11.1 OpenVMS V7.0 Conversational Boot

Use the following procedure when the exact curated OpenVMS V7.0 system running on Avanti's AlphaServer 400 model does not present a normal OPA0 login after installation. The procedure has been exercised with a KZPAA system disk; it is not blanket qualification of every V7.0 kit, patch level, or controller.

```
>>> BOOT DKA0 -FLAGS 0,1
SYSBOOT> SET/START=OPA0:
SYSBOOT> CONTINUE
```

The system boots to a DCL prompt. Spawn a subprocess so that the console remains usable when the process that runs the startup procedure logs out, then run the system startup procedure.

```
$ SET NOON
$ SPAWN
%DCL-S-SPAWNED, process SYSTEM_1 spawned
%DCL-S-ATTACHED, terminal now attached to process SYSTEM_1
$ @SYS$SYSTEM:STARTUP
```

When the startup procedure returns control, spawn again to obtain a subprocess that remains available for recovery work such as installing licenses.

```
$ SET NOON
$ SPAWN
%DCL-S-SPAWNED, process SYSTEM_1 spawned
%DCL-S-ATTACHED, terminal now attached to process SYSTEM_1
$ SET DEF SYS$SYSTEM:
```

When recovery work is finished, shut the system down. Perform another conversational boot and restore the normal startup procedure before continuing normal use.

```
>>> BOOT DKA0 -FLAGS 0,1
SYSBOOT> SET/START=SYS$SYSTEM:STARTUP.COM
SYSBOOT> CONTINUE
```

8.12 VMS 7.1 Installation Halt

Historical field reports describe an occasional halt during the first OpenVMS V7.1 boot after an installation from image media. The current 5.1.0 compatibility evidence includes successful V7.1 installation and disk boot but did not reproduce this intermittent halt. If this exact first-boot symptom occurs, record the complete console output and try one ordinary boot again. Do not assume that another boot failure has the same cause or recovery.

8.13 VMS 7.3 Install from Virtual RRD42

Historical field reports describe an OpenVMS V7.3 installation from image media entering mount verification and not recovering when the emulated drive identifies as an RRD42. Current 5.1.0 evidence includes a successful V7.3 installation from image media, but it does not reproduce this failure or compare RRD42 and RRD40 identities. If this exact symptom occurs, first preserve the console output and configuration. As a compatibility workaround, try the following advanced properties:

- vendor: DEC
- model_num: RRD40

This identification change resolved the historical cases; it is not a general diagnosis of every mount-verification failure or a current guarantee that one retry will succeed. Restore the original identity if it does not address the recorded symptom.

8.14 OpenVMS 8.3

Historical Avanti guidance listed 64 MB as the minimum memory for OpenVMS V8.3. The current 5.1.0 compatibility evidence does not test that boundary, so 64 MB is not a newly qualified minimum. Configure memory according to the documentation and workload requirements for the exact OpenVMS kit, and use more than the historical minimum unless a controlled low-memory installation is specifically required.

8.15 VSI OpenVMS Rebranding Error

If a rebranding error is encountered while upgrading a non-VSI OpenVMS system disk to a VSI version of OpenVMS, stop the upgrade, preserve the complete error output, and make a verified backup before changing the disk. Follow the installation and upgrade manual for the exact target OpenVMS release. The following checks are historical service guidance, not a replacement for that release's procedure:

- Confirm the target release's file-system and hard-link prerequisites. Do not convert the system disk or enable features solely because an earlier Avanti topic recommended doing so.
- For V8.4-2L2, check the SYSCOMMON/VMS\$COMMON directory aliasing using Section 4.6.2, Checking the SYSCOMMON Directories, in the [VSI OpenVMS Alpha](#)

[Version 8.4-2L2 Installation and Upgrade Manual](#). If the directory file identifiers differ, do not attempt an ad hoc repair; obtain assistance from your OpenVMS support provider. Use the corresponding instructions for another target release.

Earlier field guidance also suggested using DFU from the OpenVMS Freeware media to analyze or repair the disk. That repair route has not been validated for Avanti 5.1.0 or against the current VSI upgrade procedure. Do not use it on the only copy of a system disk; obtain release-matched support before any repair.

8.16 OpenVMS SCSI Support Limitations

The supported KZPCA wide-controller matrix starts at OpenVMS V7.1-2. Use the KZPAA narrow controller with earlier releases; it exposes seven guest targets per controller.

8.17 Serial Devices

By default, Avanti presents two serial ports under OpenVMS, OPA0 and TTA0. Procedures that check for serial devices by scanning for a TX device will need to be updated to reflect the ports presented by Avanti.

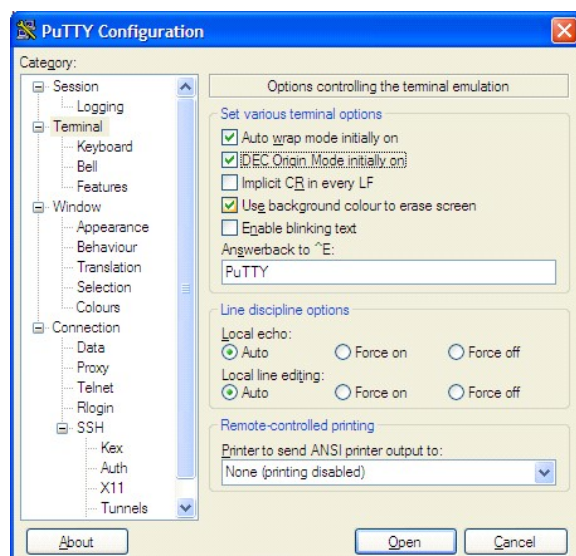
Example of obtaining the terminal device name:

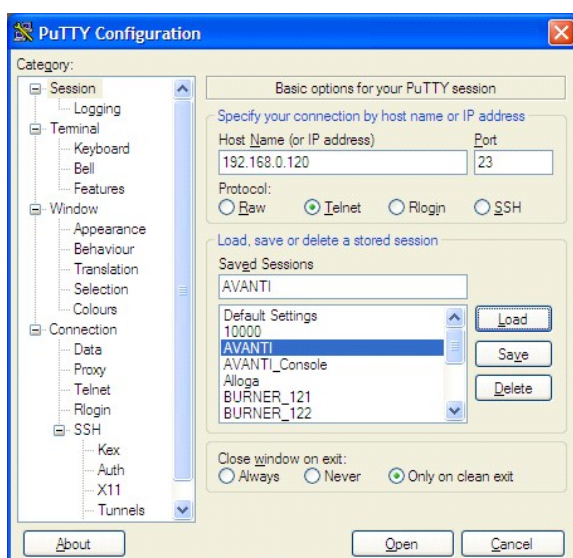
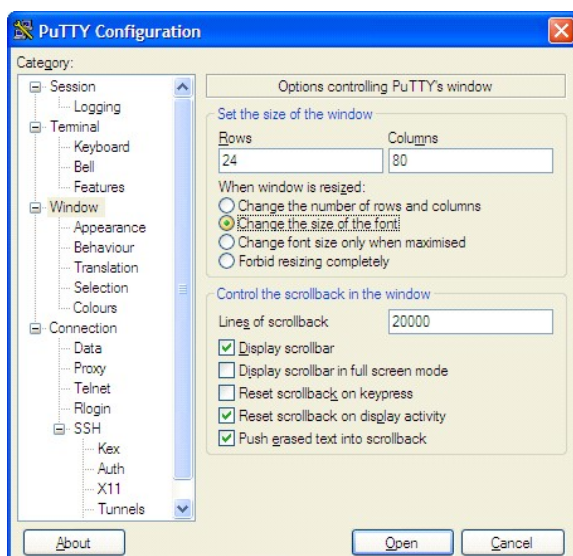
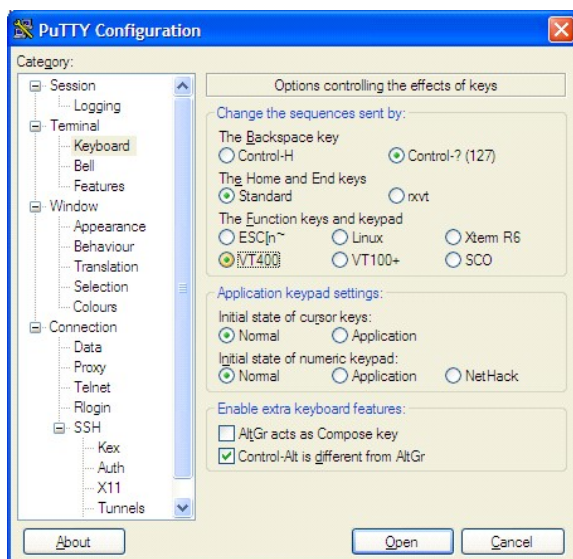
```
$ TERM = F$GETDVI("SYS$INPUT", "DEVNAM")
$ SH SYM TERM
T = "_TTA0:"
```

This DCL example is retained as historical operational guidance and was not independently executed during the 5.1.0 documentation review. Run it in the intended terminal session and verify the reported device name rather than assuming that every session returns TTA0.

Note: TX serial devices can be added using the Digiboard serial card. See [7.2 5-Port Serial Card Support \(OpenVMS\)](#).

8.18 OpenVMS PuTTY Settings





Starting with a default PuTTY configuration, the legacy settings shown above are an operational starting point for OpenVMS serial or Telnet sessions. They have not been revalidated as a complete profile for the current PuTTY release or every OpenVMS

application. Verify terminal type, keyboard, backspace, character-set, and line-discipline behavior with the exact guest and application; use VT400 keyboard mode only when the application requires it.

8.18.1 Transferring PuTTY Settings

PuTTY stores saved session settings under the current user's Windows registry profile. The following Regedit procedure is retained as historical migration guidance; it has not been executed across the complete supported Windows range for Avanti 5.1.0.

Close PuTTY, back up the destination user's existing PuTTY registry key, open Command Prompt (cmd.exe) as the source user, and run the following command there. The percent-delimited environment-variable syntax is for Command Prompt, not PowerShell:

```
regedit /e "%userprofile%\Desktop\putty-registry.reg"  
"HKEY_CURRENT_USER\Software\SimonTatham\PuTTY"
```

Confirm that putty-registry.reg was created on the source user's desktop and inspect it before transfer. Copy it to the destination system without treating it as trusted input merely because it has a .reg extension.

While signed in as the intended destination user, close PuTTY and use Regedit's Merge action on the reviewed file. Importing changes that user's registry and may overwrite saved sessions with matching names; it is not an additive-only operation. Start PuTTY and verify the imported sessions before deleting either registry backup.

8.19 UNXSIGNAL Bug Check

The following UNXSIGNAL bug check is a historical field observation from OpenVMS Alpha V6.2 when an application first allocated space on a newly mounted virtual disk. It has not been reproduced as part of Avanti 5.1.0 qualification and must not be read as applying to every OpenVMS release before V7.3.

```
**** OpenVMS (TM) Alpha Operating System V6.2      - BUGCHECK ****  
** Code=0000041C: UNXSIGNAL, Unexpected signal name in ACP  
** Crash CPU: 00      Primary CPU: 00      Active CPUs: 00000001  
** Current Process = BPCD_BG30  
** Image Name = BUILD$DKC0:[OPENV.NETBACKUP]BPCD_AXP.EXE;1
```

This crash is due to an old disk geometry problem. The problem causes an overflow in one of the following UCB fields:

UCB\$_SECTORS
UCB\$_TRACKS
UCB\$_CYLINDERS

This results in the VCB\$_BLOCKFACT field in the VCB being zero. The first space allocation on the volume generates a divide-by-zero error, which crashes the system with a UNXSIGNAL bugcheck.

Historical guidance identifies a MOUNTSHR.EXE correction in OpenVMS V7.3 and the patch kits listed below. These package names and their applicability have not been independently verified against a current vendor patch catalog; confirm the correct kit for the exact guest release before installation.

Historically referenced patch kits:

MOUNTSHR.EXE_V62R
VMOUNT.EXE_V62R
VMS73_F11X-V0200
VMS73_F11X-V0300

As a historical workaround, field guidance used changing the virtual-disk size; for example, an affected RZ25 configuration was changed to an RZ56. This workaround has not been reproduced for Avanti 5.1.0. Verify it against the exact guest release and preserve the original disk configuration before applying it.

Tru64 UNIX Specific Notes



9 Tru64 UNIX Specific Notes

Avanti supports Digital UNIX V3.2C and later, including the later releases named Tru64 UNIX. This is the guest-family support boundary, not a claim that every installation kit, hardware-update kit, virtual-device combination, or pre-release has been qualified with every Avanti release.

OSF/1 V1.2 and V1.3A predate the AlphaServer 400 and are outside the supported guest matrix. Some V3.2 hardware-update kits initially identify their V3.2C base system; record the installed version after applying the update rather than treating the kit filename as the running version.

Digital UNIX V4.0D and earlier do not support the KZPCA wide SCSI controller on the emulated AlphaServer 400. V4.0E has not been qualified for KZPCA and is not part of the current KZPCA support claim. Use KZPAA for those releases. The supported KZPCA matrix starts at V4.0F, for which runtime testing covers boot and storage I/O.

9.1 Porting a Tru64 System

Avanti presents guest hardware modeled on an AlphaServer 400, but migrating a DIGITAL UNIX or Tru64 UNIX installation is not guaranteed to be equivalent to moving between physical systems. The required storage, network, kernel, boot, and application changes depend on the exact guest release and source platform. Work from a verified copy of the source disks, preserve a recovery path, and validate the migrated system before cutover. If you are not comfortable with Tru64 UNIX, Migration Specialties offers turnkey porting services. Contact us for more information at camiel@migrationspecialties.nl.

There are two choices when moving from one Alpha type to another:

- 1) Boot from the O/S CD, build a new system disk, and restore/merge the files from your original system or disks.
- 2) Boot from the old system disk using the Generic kernel, genvmunix, and build a new kernel that supports the new Alpha's architecture (i.e. the platform type).

Historical service guidance uses a command of this form to boot the generic kernel:

```
>>> boot dkaXXX -flags 1 -file /genvmunix
```

The current 5.1.0 evidence includes systems that use generic and custom kernels, but it does not validate this exact migration command for every supported release. Confirm the device name and boot flags in the documentation for the installed release. If the generic kernel reaches single-user mode with the root file system read-only, use it as a recovery and kernel-rebuild path; do not treat genvmunix as the normal long-term production kernel.

Consult the System Administration manual supplied with your installed DIGITAL UNIX or Tru64 UNIX release, particularly its kernel-configuration procedures, and the corresponding command reference pages. Use your release's documentation media or retained documentation set; the former ENEA web mirror is no longer available at the address previously listed here. Section numbering and procedures differ between releases.

Historical migration procedures use bcheckrc, sizer -n, edits to the generated configuration file, and doconfig to build a new 'vmunix'. Command options and generated files vary by release. Follow the complete procedure for the installed guest rather than copying this sequence in isolation or using instructions for a different

release. Retain the working kernel and do not delete or overwrite genvmunix until the replacement kernel has booted successfully and the recovery path has been tested.

9.2 Tru64 Auto Boot

At the SRM console prompt, configure a Tru64 UNIX system disk for automatic boot as follows. Replace DKA0 with the actual system-disk device when necessary.

```
>>> SET AUTO_ACTION BOOT
>>> SET BOOT_OSFLAGS A
>>> SET BOOTDEF_DEV DKA0
>>> EXIT
```

EXIT closes Avanti cleanly and writes the console variables to the configuration's NVRAM file. The next launch uses the saved device and the A boot flag and boots automatically.

9.3 Tru64 Version Support

Avanti supports Digital UNIX V3.2C and later, including the later releases named Tru64 UNIX. External Field Test (EFT), field-test, and other pre-release versions are not part of the supported matrix unless explicitly identified.

The KZPCA support matrix starts at V4.0F. V4.0D and earlier do not support that controller on the emulated AlphaServer 400, and V4.0E has not been qualified for KZPCA. Use KZPAA with those releases.

9.4 Network Notes

The topics in this section combine current Avanti configuration behavior with historical network troubleshooting. Start with [6.1 PCAP Drivers](#) and the supported guest guidance, and verify the selected host adapter, packet backend, emulated NIC type, and guest interface before applying a workaround.

Historical switch, offload, LAT, adapter-mode, and dedicated-NIC suggestions are diagnostic experiments rather than blanket 5.1.0 requirements. Record the failing case, change one setting at a time, validate traffic in both directions, and restore the previous setting when the change does not correct the symptom.

9.4.1 NIC Support in Digital UNIX V3.2x Releases

Historical field guidance treats Digital UNIX releases in the V3.2x family as predating DE500 support and therefore uses the DE435 as the conservative adapter choice. The Avanti 5.1.0 evidence does not qualify every V3.2x kit or establish that every such kit rejects a DE500, so do not treat this as a newly tested release-by-release boundary.

Use the DE435 unless the installed release's own driver documentation and a disposable traffic test establish another supported configuration. Verify that the expected `tu` interface is present and that traffic works in both directions before relying on the configuration.

9.4.2 NIC Console Variables

The retained firmware exposes a mode variable for each emulated NIC. Historical troubleshooting used an explicit `Fast` mode for a DE500 and `Twisted Pair` for a DE435 when a guest failed to recognize a card, performed poorly, or passed traffic in only one direction. Avanti 5.1.0 validation did not establish a universal prohibition on `Auto`; leave a working configuration unchanged.

The following is an example for a DE500 at EWA and a DE435 at EWB. Inspect the actual console variables and card order before changing them; do not copy the device letters blindly.

```
>>> set ewa0_mode Fast
>>> set ewb0_mode Twisted Pair
>>> exit
```

Use the `exit` command and confirm that Avanti closes normally so the console parameters are saved in the configured `.nvr` file. Restart Avanti and test recognition plus bidirectional traffic. Record the former value and restore it if the change does not correct the observed symptom.

The symptoms above are retained as historical troubleshooting reports; they were not reproduced as universal Tru64 Tulip-driver behavior in the 5.1.0 qualification work.

9.4.3 Sharing NICs with Windows

Npcap is the preferred Avanti network backend and normally permits the Windows host and an emulated NIC to use the same physical adapter. See [6.1 PCAP Drivers](#)⁷⁸ for the current backend guidance.

Historical field reports associated some Windows adapter and driver combinations with poor throughput, retransmission, packet loss, and a Tru64 UNIX 0x670 machine check while the host and guest shared an adapter. Those reports were not reproduced across the supported Windows range and do not establish that sharing is generally unsafe.

If the exact symptom is repeatable, first record the Windows adapter, driver, packet backend, guest NIC, and traffic direction. Then test a dedicated wired adapter as a diagnostic isolation step. Retain the dedicated layout only when it corrects the recorded case; it is not a general Avanti requirement.

9.4.4 LAT and Dual NICs

Historical field guidance associated dual guest NICs on the same network segment with duplicate or ghost LAT services or nodes. That topology and every LAT implementation were not revalidated for Avanti 5.1.0.

If the symptom is present, consult the LAT documentation for the installed guest release and exclude one verified interface as a diagnostic. The following Digital UNIX example excludes `tul`; the command and interface name may differ on another release or configuration.

```
# latcp -E tul
```

Confirm that the duplicate service disappears and that the intended LAT and non-LAT traffic still works. Restore the former setting if it does not correct the recorded symptom.

9.4.5 Switching NICs

If the DIGITAL UNIX or Tru64 UNIX system being migrated does not already include the driver used by the configured Avanti DE435 or DE500, prepare and test a release-matched kernel before cutover. Historical systems commonly require 'tu' support, but the driver name, supported adapter, and kernel procedure must be confirmed for the exact guest release. Keep a generic or previously working kernel bootable until the replacement has been verified.

- Tru64 UNIX V5.1B System Administration guide AA-RH9FE-TE, using its release-specific kernel-building procedures.

Or

- Tru64 UNIX V4.0F System Administration guide AA-PS2RF-TE, using its release-specific kernel-building procedures.

These retained document identifiers are historical references, not proof that one set of steps applies to another DIGITAL UNIX or Tru64 UNIX release. Use the documentation supplied with the installed guest and verify both network operation and a fallback boot before retiring the previous kernel.

9.5 SCSI Support Limitations

Digital UNIX V3.2C through V4.0D do not support the KZPCA wide SCSI controller on the emulated AlphaServer 400 and are limited to the KZPAA controller's seven guest targets. V4.0E has not been qualified for KZPCA. The supported KZPCA matrix starts at V4.0F.

Runtime testing establishes KZPCA boot and storage I/O at Digital UNIX V4.0F.

9.6 V5 Disk Considerations

The Tru64 UNIX array-query behavior and recommendations below are retained as historical field guidance. They have not been independently revalidated for Avanti 5.1.0.

All V5 releases of Tru64 UNIX attempt to interrogate HP/Compaq storage arrays to acquire essential capability information. Consequently, whenever an HSG, HSZ, EVA or XP disk unit is detected, V5 will request the appropriate array specific code pages containing the unit information. However, when Avanti is using disk volume files there is no array information to be discovered. Therefore, when using Tru64 V5 on Avanti, labeling disk volume files as array volumes is not recommended. Instead, for disks above 18GB, use the default RZ58 catch-all type. For all other volumes, use one of the supplied disk types.

Warning: Labeling a volume as an HSZ, HSG, etc. unit will often cause Tru64 UNIX V5 to mis-identify or reject the volume because the additional array information does not exist.

9.6.1 V5 Disk Serial Number Issue

Tru64 UNIX versions prior to V5 do not utilise disk serial numbers or WWIDs, whereas V5's support for multi-pathing requires unique disk serial number or WWIDs to correctly identify each discrete storage element.

Avanti provides for this in one of two ways:

1. By default, if the serial number field is blank, Avanti derives a serial number from the disk's configured controller bus and target. For example, disk0.0 produces SRL0000 and disk0.1 produces SRL0101. If that default is already in use in the same emulator process, Avanti uses a fallback that also includes the parent controller's PCI device number.
2. The user can enter a unique serial number in the serial number field of a disk's advanced properties using the Configuration Utility. The disk serial number can be any unique value. The special default for HSZ22 disks is described below.

Generated serial numbers are not written into the configuration file. They can therefore change if a disk moves to another bus, target, or controller. For a stable identity across configuration changes or migrations, set an explicit unique serial number before the guest begins using the disk.

Warning: Once a Tru64 UNIX configuration is built, do not modify the disk serial numbers. Doing so may cause Tru64 UNIX to think a disk has been changed out and invalidate the configuration.

The exception to the normal positional default is the HSZ disk type. When creating a custom disk size using the Avanti Configuration Utility, the disk type is assigned as HSZ22. An HSZ22 disk with a blank serial number receives the fixed value 00000002198505070c012c21bba00300 when that value is not already in use. A later blank disk that collides with a generated default receives the PCI-device fallback described above.

The following Tru64 UNIX array-query, WWID, migration, and patch-kit behavior is retained as historical field guidance. It has not been independently revalidated for Avanti 5.1.0. The structure of the special HSZ serial number was important to a small number of pre-V5 releases with certain patchkits when handling HSZ disks; for them at least one valid HSZ serial number/WWID had to be present for those releases to recognize the HSZ type. If the HSZ type is not needed, use one of the other types.

When using disk serial numbers or WWIDs with V5 releases, care must be taken when migrating an existing installation to ensure the donor's disk serial numbers are carried forward to the migrated installation. Under V5, the WWIDs can be viewed via:

```
# hwmgr -show scsi -full
...
      SCSI                DEVICE    DEVICE  DRIVER NUM  DEVICE
FIRST
HWID:  DEVICEID HOSTNAME  TYPE      SUBTYPE OWNER  PATH  FILE
VALID PATH
-----
-----
    34:  2            mareth    disk     none     0       1    dsk1
[0/1/0]

      WWID:04100038:"DEC      HSZ22
00000002198505070c012c21bba00300"
...
      SCSI                DEVICE    DEVICE  DRIVER NUM  DEVICE
FIRST
HWID:  DEVICEID HOSTNAME  TYPE      SUBTYPE OWNER  PATH  FILE
VALID PATH
-----
-----
    43:  9            mareth    disk     none     0       1    dsk8
[1/2/0]

      WWID:0410001f:"DEC      HSZ22                SRL0d02"
```

9.7 Maximum Physical Volume Size Under Tru64 UNIX

The version of Tru64 UNIX and the selected file system determine the supported physical-volume size. The table below is a historical summary of limits stated in the listed Tru64 UNIX Software Product Descriptions; Avanti 5.1.0 has not independently exercised every limit. Check the authoritative SPD and patch documentation for the exact guest release and file system before selecting a production volume size.

Tru64 Version	Maximum Volume Size	Details
V3	128GB	V3.2C & V3.2G both state 128GB for AdvFs and UFS
V4	512GB	V4.0A states 512GB for AdvFs and UFS
V5	1TB	V5.0A, V5.1, V5.1B-6 state 1TB for AdvFs and UFS and add a total domain size of 16TB for AdvFs, that is 16 x 1TB volumes

9.8 TRU64 Unix Virtual Tape Support

Avanti virtual tape support for Tru64 UNIX is limited in scope. The guest-version and command restrictions below are retained historical field guidance; they have not been independently revalidated across the stated releases for 5.1.0. Validate the intended backup and restore procedure before relying on it for production media.

- Tru64 UNIX V3.X - No support
- Tru64 UNIX V4.X - Limited support
- Tru64 UNIX V5.X - Limited support

Avanti does not implement or support tapes in their fullest form under Tru64 UNIX.

Read/write operations can be made to a virtual tape file via the `/dev/*mt*` or `/dev/tape/*` device special files. The resultant file cannot be detached from Avanti, nor can a new file be attached 'on the fly'. However, the tape file can be copied from the Windows side.

Tru64's `mt unload` or `mt offline` both serve to close the tape drive's file. They do not detach the tape file. Once closed, the file can be copied via Windows processes.

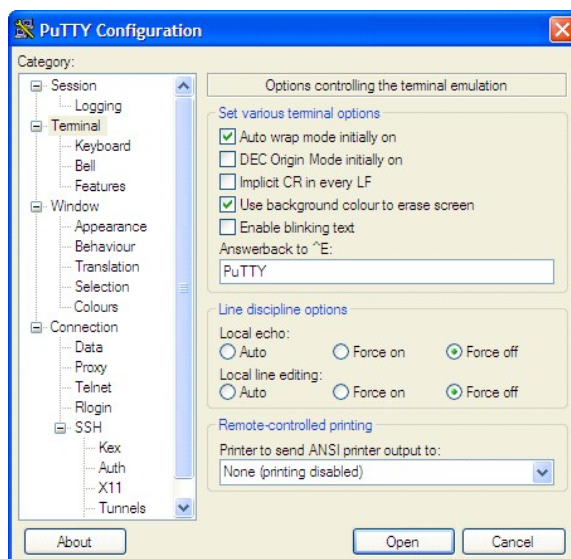
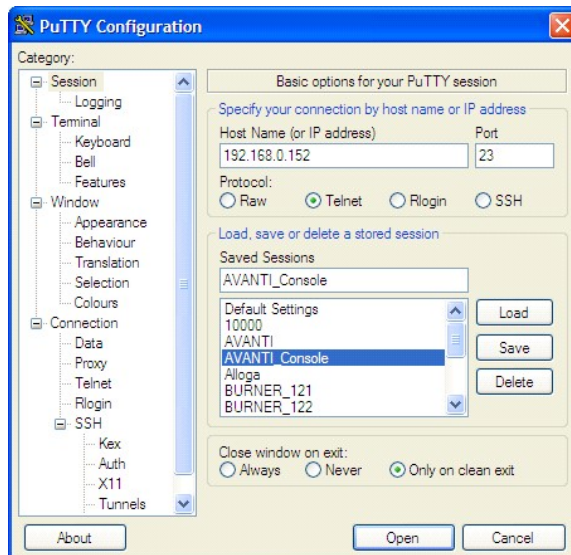
Limited Support

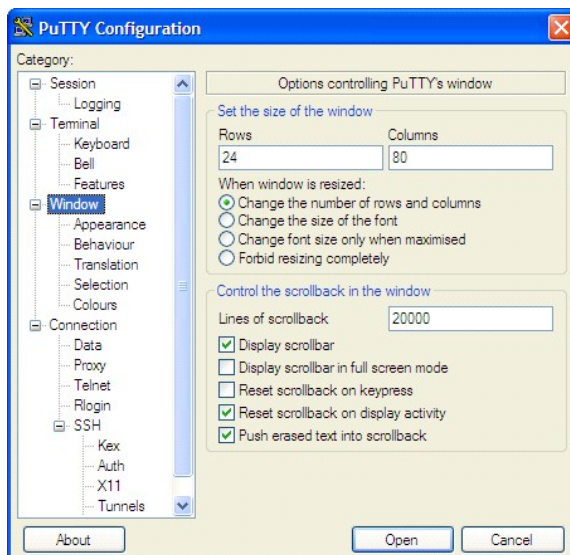
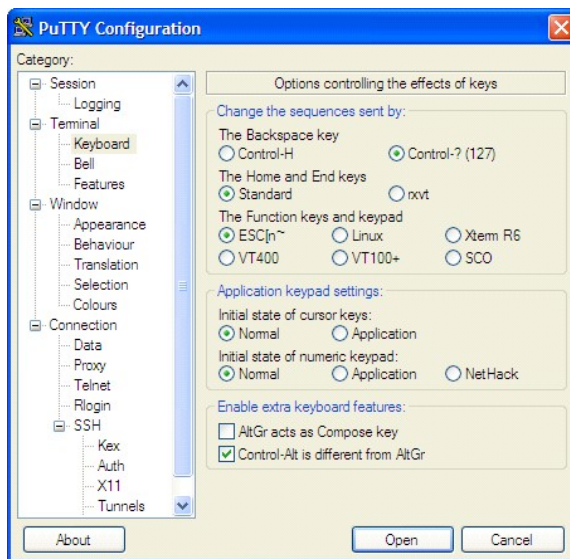
- Tape operations are only supported with explicitly set block sizes. I.e. Explicit I/O sizes MUST be specified on write operations (`tar`, `cpio`, `vdump`), and read operations MUST use `dd` with an explicit read size (eg. `bs=50k`) with a pipe to `tar`, `cpio`, `vrestore`, etc.
- The virtual tape does not differentiate between high and low densities.
- The virtual tape does not support compression.

Select KZPAA or KZPCA according to the guest-version boundary and required target count; no current KZPAA-versus-KZPCA tape benchmark establishes a general performance recommendation for 5.1.0. Avanti's supported KZPCA matrix starts at

Digital UNIX/Tru64 UNIX V4.0F, V4.0E has not been qualified for KZPCA; use KZPAA with earlier or unqualified guest releases.

9.9 Tru64 UNIX PuTTY Settings





Starting with a default PuTTY configuration, the legacy settings shown above are an operational starting point for Tru64 UNIX serial or Telnet sessions. They have not been revalidated as a complete profile for the current PuTTY release or every Tru64 UNIX application. Verify terminal type, keyboard, backspace, character-set, and line-discipline behavior with the exact guest and application.

9.9.1 Transferring PuTTY Settings

PuTTY stores saved session settings under the current user's Windows registry profile. The following Regedit procedure is retained as historical migration guidance; it has not been executed across the complete supported Windows range for Avanti 5.1.0.

Close PuTTY, back up the destination user's existing PuTTY registry key, open Command Prompt (cmd.exe) as the source user, and run the following command there. The percent-delimited environment-variable syntax is for Command Prompt, not PowerShell:

```
regedit /e "%userprofile%\Desktop\putty-registry.reg"
"HKEY_CURRENT_USER\Software\SimonTatham\PuTTY"
```

Confirm that putty-registry.reg was created on the source user's desktop and inspect it before transfer. Copy it to the destination system without treating it as trusted input merely because it has a .reg extension.

While signed in as the intended destination user, close PuTTY and use Regedit's Merge action on the reviewed file. Importing changes that user's registry and may overwrite saved sessions with matching names; it is not an additive-only operation. Start PuTTY and verify the imported sessions before deleting either registry backup.

Miscellaneous Notes

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10 Miscellaneous Notes

10.1 Boot Console Variables

Avanti emulates the AlphaServer 400/166 SRM console variables. To preserve changes for the next launch, leave the emulator through the SRM EXIT command so it writes the current values to the configured NVRAM file.

```
>>> set bootdef_dev DKA0
>>> set boot_osflags 0
>>> exit
```

Do not rely on an abrupt process termination to preserve recently changed console variables. A controlled EXIT has been validated by setting these values, launching Avanti again with the same NVRAM file, and observing the saved device and flags during automatic OpenVMS boot.

10.2 Floating Point Values

Extensive tests have been run against the VAX and IEEE floating point instructions. There are two minor deviations under Avanti from the behavior of real AlphaServer 400 hardware.

1. With IEEE floating point instructions, the least significant bit of the fraction may differ between Avanti and a real AlphaServer 400. This is due to a rounding difference. There should be very few applications where this difference is significant.
2. After an overflow occurs in a multiplication or division instruction, the result (which is always invalid) differs between Avanti and a real AlphaServer 400. The overflow condition is properly signaled, so this should not be a problem for a well-behaved application.

10.3 Graphics Support

X-windows graphics is supported using X-windows clients that run on PCs such as ReflectionX, eXceed, Excursion, and Xming. They provide the same functionality as an X-windows terminal.

10.4 Shared CD-ROMs

Separate Avanti processes can be configured to reference the same host optical drive, and Avanti treats a configured CD-ROM as read-only. Avanti does not coordinate media state or concurrent access between those processes, and this arrangement has not been qualified for 5.1.0. Prefer a separate image path or copy for each emulator when concurrent access matters. If one host drive is shared, keep the media fixed, expect guest operations to interfere with one another, and stop the affected emulators before changing or ejecting it.

10.5 SCSI Controller Enumeration

Historical retained-firmware guidance says that the old bus-probe algorithm enumerates KZPAA controllers before KZPCA controllers regardless of PCI position. In a two-controller example, that assigns PKA to KZPAA and PKB to KZPCA. The complete old/new comparison below was not independently executed during the 5.1.0 documentation review; confirm the actual names with SHOW DEVICE before changing any boot definition or guest configuration.

In a more elaborate example with three SCSI controllers, the maximum supported by Avanti:

```
Sl Ca Device Name
ot rd
```

```
pciKZ PKB
6 PC
A
```

```
pciKZ PKA
11 PA
A
```

```
pciKZ PKC
12 PC
A
```

The retained firmware provides the following historical sequence to request PCI bus order:

```
>>> set bus_probe_algorithm new
>>> init
```

After the initialization, verify the resulting controller and disk names at the console. Changing enumeration can change boot-device paths; make the change only with console access, a recorded copy of the previous settings, and a tested recovery path.

```
Sl Ca Device Name
ot rd
```

```
pciKZ PKA
6 PC
A
```

```
pciKZ PKB
11 PA
A
```

```
pciKZ PKC
12 PC
A
```

The historical restoration sequence is:

```
>>> set bus_probe_algorithm old
>>> init
```

Verify that the expected names return after restoration.

Troubleshooting

**VIRTUAL
ALPHA**

11 Troubleshooting

This chapter outlines troubleshooting tools and known problems.

11.1 Log Files

If a problem with Avanti is encountered, log files are the first thing the Migration Specialties support team will request. Avanti offers the following logging options.

11.1.1 Avanti Log File

The Avanti log file is enabled by default. This file logs the emulator startup, shutdown, runtime, and error messages. 6 log files are retained by default. A version number appended to each log file name denotes past log files. A fresh log file is created each time the emulator is launched.

```
Current Log:          .log
Previous Log:        .log;-1
...
Oldest Retained Log: .log;-5
```

filename

Each logfile component requires a file name. The configuration utility initially uses <base>.log for the main emulator log, where <base> represents the configuration file name without its extension when saved. Select a writable file location using the Log file controls; the emulator must have permission to create the file and rotate its predecessors. A file-open failure prevents that logfile component from starting.

versions (default: 6; range: 1 through 500)

The count includes the current file. With 6, normal startup rotation keeps the current file plus up to five predecessors, ;-1 through ;-5. With 1, the previous current file is replaced without retaining it. Rotation takes place when the logfile component is created, not at a size limit or daily interval. Reducing the count does not automatically purge every older suffix left by a previously larger count.

Use a distinct file name for each main or serial-port logger and each running emulator. Logging components do not coordinate rotation of a shared file. The count is not a backup guarantee: preserve needed logs separately, and check file-system permissions or file locks if rotation fails. A long-running session can produce a large file even with a small versions count.

Line timestamps and optional host-header information are described under [4.1.8.2 Logfile](#) ^[51]. Review logs before sharing them: headers include licensing information and may include host details; serial output can contain guest data.

11.1.2 Terminal Log Files

The OPA0/tty00 and TTA0/tty01 ports each provide an Avanti serial-output logging option, disabled by default in a new configuration. Enable Log file on the port's configuration tab and choose its own file name. A fresh current log is created when the emulator starts, with predecessor retention controlled by versions. These files can grow large during a long run.

Avanti records serial output, not a separate copy of all terminal input; typed text appears when the guest echoes it. See [7.1.2 Serial Port Logging](#) ^[88] for details. Client-side capture is a separate facility described under [11.1.3 PuTTY Log Files](#) ^[127].

11.1.3 PuTTY Log Files

PuTTY sessions can be configured to log activity, as can most other terminal emulators. Such logs can be used in conjunction with the Avanti logs for problem diagnosis.

Tip: Capturing History

Two changes to the PuTTY configuration are useful when capturing information. Similar changes are recommended if using other terminal emulators.

- 1) Under Change Settings> Window modify "Lines of scrollbar" to 2000. PuTTY then retains 2000 lines of history in the scroll back buffer.
- 2) Under Change Settings> Sessions select "Never" for "Close window on exit". This preserves the PuTTY window if the virtual Alpha crashes.
- 3) Once these changes have been made, highlight "Default Settings" under the Saved Sessions box and click the [Save] button. PuTTY will then retain the setting for future console sessions.

11.2 Avanti Crash Dump File

Avanti diagnostic reports use the filename pattern

`<base>_YYYYMMDD_HHMMSSmmm_<reason>.cra`, where `<base>` is the configuration filename without its final extension. For example, a report produced by the Halt command at 14:30:12.347 on September 6, 2026 for Alpha01.cfg is named `Alpha01_20260906_143012347_halt.cra`. The timestamp is the host's local time, including milliseconds. The final short reason identifies the internal condition that requested the report.

The report is written in the same folder as the configuration file. Its contents are gzip-compressed even though the file retains the Avanti-specific .cra extension. Each timestamped report is a separate file; creating a later report does not normally replace an earlier one.

Avanti may create a report after a fatal emulator failure, a related OpenVMS failure, or another internal diagnostic condition. Using **Halt** on the Avanti Control Icon always creates a report whose reason is `halt`; that file records the requested diagnostic state and does not by itself mean that Avanti crashed.

A report includes the failure description, exact Avanti build, host operating-system and processor details, the complete configuration text, exception information, and detailed emulator and device state. Licensed builds can also include the license serial, generation, customer, and license comments. Configuration values and diagnostic state can expose customer names, host paths, network or device details, and other operational information.

Treat .cra files as confidential diagnostic data. Keep the original file unchanged, review its handling under your organization's security policy, and provide it only through the support channel agreed with Migration Specialties. Do not post a crash report to a public forum. Unless support asks otherwise, send the original compressed .cra file together with the configuration and log files described under Problem Submission; you do not need to rename or decompress it.

11.3 Halting a Hung System

Using the Halt option on the Avanti Control Icon in the Windows Notification Area forces output to the Avanti log file and generates an Avanti crash dump file.

11.4 Halt on Guest O/S Boot

Historical field reports describe occasional halts while older guest operating-system releases are booting. These reports have not been reproduced across the 5.1.0 candidate guest matrix, and a captured halt is not by itself evidence that the same event occurs on physical Alpha hardware. Record the complete console signature before recovery and use the following topics only when their displayed message matches.

11.4.1 XDELTA not loaded

Historical OpenVMS and Tru64 UNIX field reports include boot halts that end at the console with an XDELTA not loaded message. In the captured OpenVMS example below, issuing INIT at the console reset the guest and allowed another boot attempt. That observation has not been reproduced across the 5.1.0 candidate guest matrix, so INIT is not a universal remedy for every boot halt. Record the halt code and program counter first; if the same halt recurs, investigate the guest and boot configuration rather than repeatedly resetting it.

```
>>>b
(boot dka0.0.0.6.0 -flags 0)
block 0 of dka0.0.0.6.0 is a valid boot block
reading 904 blocks from dka0.0.0.6.0
bootstrap code read in
base = 1f2000, image_start = 0, image_bytes = 71000
initializing HWRPB at 2000
initializing page table at 1e4000
initializing machine state
setting affinity to the primary CPU
jumping to bootstrap code

      OpenVMS (TM) Alpha Operating System, Version V7.1

ff.halt code = 5
HALT instruction executed
PC = 110678
fe.fd.fc.fb.fa.f9.f8.breakpoint at PC 1108e0 desired, XDELTA not
loaded
f7.f6.f5.
ef.df.ee.ed.ec.f4.eb.ea.e9.e8.e7.e6.....e5.
V7.0-9, built on Mar 18 1999 at 13:25:37
>>>
```

11.4.2 Unexpected exception/interrupt through vector 420

The historical transcript below records one unexpected exception/interrupt through vector 420 during an OpenVMS boot. In that observation the firmware rebooted the guest automatically and the later boot reached OpenVMS V8.3. The event has not been reproduced across the 5.1.0 candidate guest matrix, is not evidence of universal physical-hardware parity, and does not guarantee an automatic reboot after every vector 420 exception. If the firmware does not restart, preserve the console diagnostics and use the normal console recovery procedure for the installed guest.

```
ff.fe.fd.fc.fb.fa.f9.f8.f7.f6.f5.
ef.df.ee.ed.ec.f4.eb.ea.e9.e8.e7.e6.....e5.
V7.0-9, built on Mar 18 1999 at 13:25:37

CPU 0 booting

(boot dka200.2.0.6.0 -flags 0)
block 0 of dka200.2.0.6.0 is a valid boot block
reading 1226 blocks from dka200.2.0.6.0
bootstrap code read in
base = 1f2000, image_start = 0, image_bytes = 99400
initializing HWRPB at 2000
initializing page table at 1e4000
initializing machine state
setting affinity to the primary CPU
jumping to bootstrap code
unexpected exception/interrupt through vector 420
process idle, pcb = 001159D0

pc: 00000000 00116A24  ps: 00000000 00001F04
r2: 00000000 001112A0  r5: 00000000 00001F04
r3: 00000000 00022650  r6: 00000000 00001259
r4: 00000000 000EE658  r7: 00000000 0000000A

exception context saved starting at 00116900

GPRs:
 0: 00000000 00000000 16: 00000000 00116A08
 1: 00000000 000001F4 17: 00000000 00006000
 2: 00000000 000ED330 18: 00000000 000384C0
 3: 00000000 00076CC0 19: 00000000 0012DD10
 4: 00000000 000EE658 20: 00000000 0012DD10
 5: 00000000 00038B88 21: 00000000 00000000
 6: 00000000 00001259 22: 00000000 00116A08
 7: 00000000 0000000A 23: 00000000 00000001
 8: 00000000 00110670 24: 00657174 00000000
 9: 00000000 00110678 25: 00000000 00000001
10: 00000000 000D0DE8 26: 00000000 00116A20
11: 00000000 00000001 27: 00000000 00111940
12: 00000000 001159D0 28: 00000000 00038BD8
13: 00000000 00000010 29: 00000000 00000000
14: 00000000 00000011 30: 00000000 00116A40
15: 00000000 00000000

dump of active call frames:

breakpoint at PC 1108e0 desired, XDELTA not loaded
ff.fe.fd.fc.fb.fa.f9.f8.f7.f6.f5.
ef.df.ee.ed.ec.f4.eb.ea.e9.e8.e7.e6.....e5.
V7.0-9, built on Mar 18 1999 at 13:25:37

CPU 0 booting

(boot dka200.2.0.6.0 -flags 0)
block 0 of dka200.2.0.6.0 is a valid boot block
reading 1226 blocks from dka200.2.0.6.0
bootstrap code read in
base = 1f2000, image_start = 0, image_bytes = 99400
initializing HWRPB at 2000
initializing page table at 1e4000
initializing machine state
setting affinity to the primary CPU
jumping to bootstrap code
```

OpenVMS (TM) Alpha Operating System, Version V8.3
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11.5 Problem Submission

Avanti users with current support contracts can contact Migration Specialties directly for support. For community assistance, visit VSI's [Hardware Emulators forum](#).

When posting a problem report, please provide the following information:

- 1) Avanti configuration file (.cfg)
- 2) Avanti log file (.log)
- 3) The original Avanti crash dump file (.cra), if produced. Do not rename or decompress it. Treat all submitted files as confidential, use only the agreed support channel, and never post them publicly.
- 4) Host System Information
 - a) Windows O/S
 - b) Hardware information:
 - i) CPU Type
 - ii) Number of CPU's
 - iii) Memory Installed

Glossary

VIRTUAL
ALPHA

12 Glossary

Avanti	AlphaServer 400 emulator; configurations requiring zero license units need no key
GUI	Graphical User Interface
JIT	Just-In-Time compilation
NIC	Network Interface Card
NVRAM	Non-Volatile RAM
Shadow Code	Avanti pre-processes Alpha instructions, optimizing them to achieve better performance upon execution. These optimized instructions are referred to as shadow code. Shadow code is retained in memory until it is executed.
Shadow Memory	Holds shadow code.
SPD	Software Product Description: A document providing detailed product specifications.
TOY	Time-Of-Year

Avanti Emulator Files



13 Avanti Emulator Files

Each Avanti emulator configuration has a set of files associated with it. By default, the files are stored in the same folder as the configuration file and use its base name. Timestamped crash reports add the time and an internal reason to that base name. If the emulator configuration is moved, its associated files should be moved with it.

File Extension	Example	Function	Created by...
.cfg	Alpha01.cfg	Configuration file. Defines the emulator's virtual hardware.	User
.log	Alpha01.log	Avanti log file. Records launch and runtime information during an emulator session.	Avanti at configuration launch. The file is replaced each time the configuration is launched. By default, logging is enabled and 6 versions of the log file are retained.
.cra	Alpha01_20260906_143012347_halt.cra	Gzip-compressed diagnostic report. Treat this file as confidential.	Avanti on Halt, after a fatal emulator failure, or on another internal diagnostic trigger. Timestamped reports are retained separately.
.nvr	Alpha01.nvr	NVRAM information storage. This file takes the place of non-volatile RAM. It stores boot configuration parameters.	Avanti at normal exit.
.toy	Alpha01.toy	Time-Of-Year information storage. The toy file stores the date and time offset for the virtual Alpha system	Avanti at normal exit.

Disk and CD-ROM image files are also a user-defined part of an Avanti configuration. If these files are moved, the associated Avanti configuration file must be updated.

Avanti Command Line Options



14 Avanti Command Line Options

Avanti supports the following command line options. Options can be shortened to the least number of unique characters. I.e. /C = /CONFIGURATION_FILE

Command Line Option	Description
/CONFIGURATION_FILE="filename"	5.6 Launching Avanti Manually  65
/INSTALL	5.13 Installing Avanti as a Service  70
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