

VSI OpenVMS x86-64 V9.2 Installation Guide

Operating System and Version: VSI OpenVMS x86-64 Version 9.2

Installation Guide



VMS Software

Copyright © 2026 VMS Software, Inc. (VSI), Boston, Massachusetts, USA

Legal Notice

Confidential computer software. Valid license from VSI required for possession, use or copying. Consistent with FAR 12.211 and 12.212, Commercial Computer Software, Computer Software Documentation, and Technical Data for Commercial Items are licensed to the U.S. Government under vendor's standard commercial license.

The information contained herein is subject to change without notice. The only warranties for VSI products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. VSI shall not be liable for technical or editorial errors or omissions contained herein.

HPE, HPE Integrity, HPE Alpha, and HPE Proliant are trademarks or registered trademarks of Hewlett Packard Enterprise.

Table of Contents

Preface	v
1. Introducing OpenVMS x86-64 V9.2	v
2. Intended Audience	v
3. Using the VSI Customer Portal	v
4. Other Related Documentation	v
5. Licensing	vi
5.1. Using VMware vSphere Hypervisor Licenses	vi
Chapter 1. Preparing to Install V9.2	1
1.1. Tested Platforms	1
1.2. Platforms Documentation	1
1.2.1. Recommended Settings for Virtual Machines	2
Chapter 2. Booting and Installing on a Virtual Machine	3
2.1. Booting the Virtual Machine	3
2.2. Installing OpenVMS x86-64 V9.2	5
2.3. Post-Installation Steps for OpenSSH	14
Chapter 3. Networking on V9.2	17
3.1. Setting Up DECnet Phase IV	17
3.2. Configuring TCP/IP Services V6.0	17
Appendix A. Setting up a VMS Cluster	25
A.1. Initial Preparation	26
A.2. Creating the First Virtual Machine	27
A.3. Starting the Virtual Machine	28
A.4. Adding a Node Using a Copy of an Existing System Disk	29
A.5. Creating the Second Virtual Machine	30
A.6. Finalizing Cluster Setup	30
A.7. Saving Your Cluster Setup	33

Preface

VMS Software, Inc. (VSI) is an independent software company licensed by Hewlett Packard Enterprise to develop and support the OpenVMS operating system.

1. Introducing OpenVMS x86-64 V9.2

This manual provides instructions for booting and installing VSI OpenVMS Version 9.2 for x86-64 (hereafter referred to as OpenVMS x86-64 V9.2) using an ISO file on guest virtual machines.

Note

You cannot upgrade from previous versions of OpenVMS x86-64. You must perform a fresh install of OpenVMS x86-64 V9.2.

2. Intended Audience

Users of this manual are expected to obtain and reference any additional documentation specific to their hardware and environment. Users are expected to know how to identify the various devices involved in their installation and be familiar with the console commands that are available on their system and virtual machines.

Users should be experienced with the different virtual machine platforms where they plan to run OpenVMS x86-64 V9.2 as a guest virtual machine.

Make sure you read the Release Notes, Installation Guide, and Boot Manager Guide prior to installing OpenVMS x86-64 V9.2.

3. Using the VSI Customer Portal

See the VSI OpenVMS x86-64 V9.2 announcement email for information about how to log issues against the VSI OpenVMS x86-64 V9.2 release and for using the VSI Services Portal at <https://sp.vmssoftware.com>.

4. Other Related Documentation

- *VSI OpenVMS x86-64 V9.2 Release Notes*
- *VSI x86-64 Cross-tools Kit Installation and Startup Guide*
- *VSI OpenVMS Linker Manual*
- *VSI Calling Standard Manual*
- *VSI OpenVMS x86-64 Boot Manager User Guide*
- VSI OpenVMS TCP/IP Services V5.7 documentation at [Documentation — VMS Software, Inc.](https://docs.vmssoftware.com/) [<https://docs.vmssoftware.com/>]
- Third party documentation as cited throughout this document

5. Licensing

During the installation, you will be prompted to enter Product Authorization Keys for the base operating environment and any layered products that are not already included in the base OS.

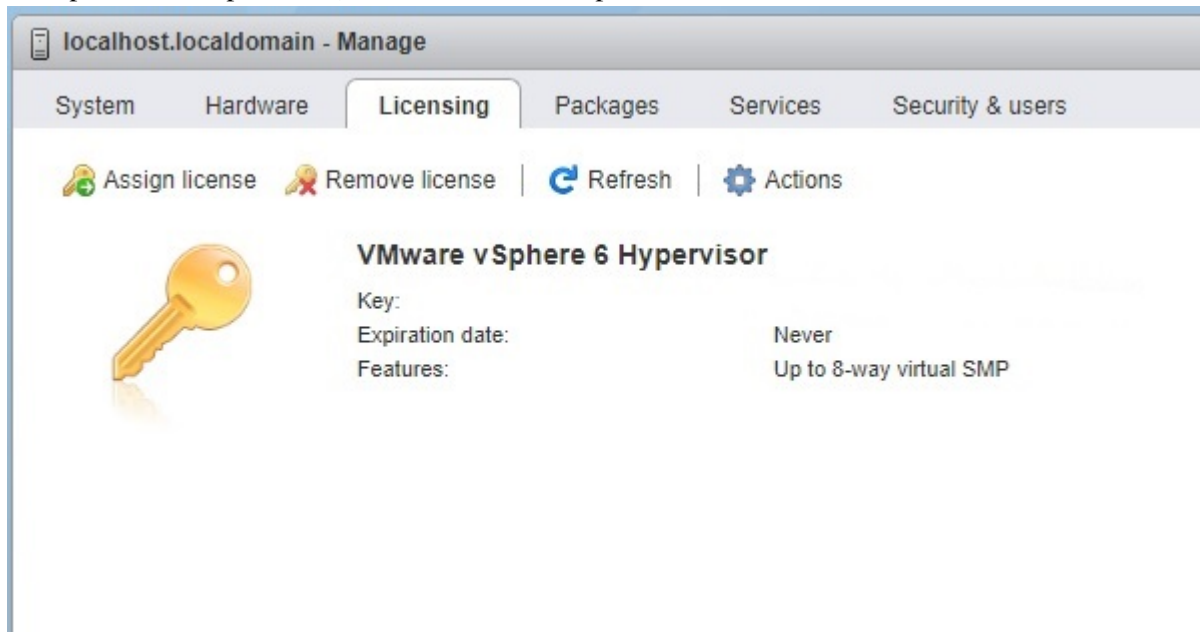
A PAK is represented as a text structured file containing a series of named fields and unique values that were generated by VSI. You have the option of deferring PAK entry until after the installation and entering them using the OpenVMS LICENSE utility. If you choose to enter your PAKs during the installation, you can either type the values of each requested field, or copy-and-paste the values into the console (assuming your console connection supports this action, such as using a terminal emulator).

Below is an example of a typical PAK:

```
$ LICENSE REGISTER OPENVMS-X86-BOE -
/ISSUER=VSI -
/AUTHORIZATION=1-VSI-SAMPLAUTH-0001 -
/PRODUCER=VSI -
/UNITS=32 -
/TERMINATION_DATE=31-OCT-2022
/OPTIONS=(PCL,X86_64) -
/CHECKSUM=X-XXXX-XXXX-XXXX-XXXX
```

5.1. Using VMware vSphere Hypervisor Licenses

Use this procedure to run VMware vSphere Hypervisor on an ESXi server with a basic license (not Enterprise or Enterprise Plus). You must use serial ports within the same ESXi server.



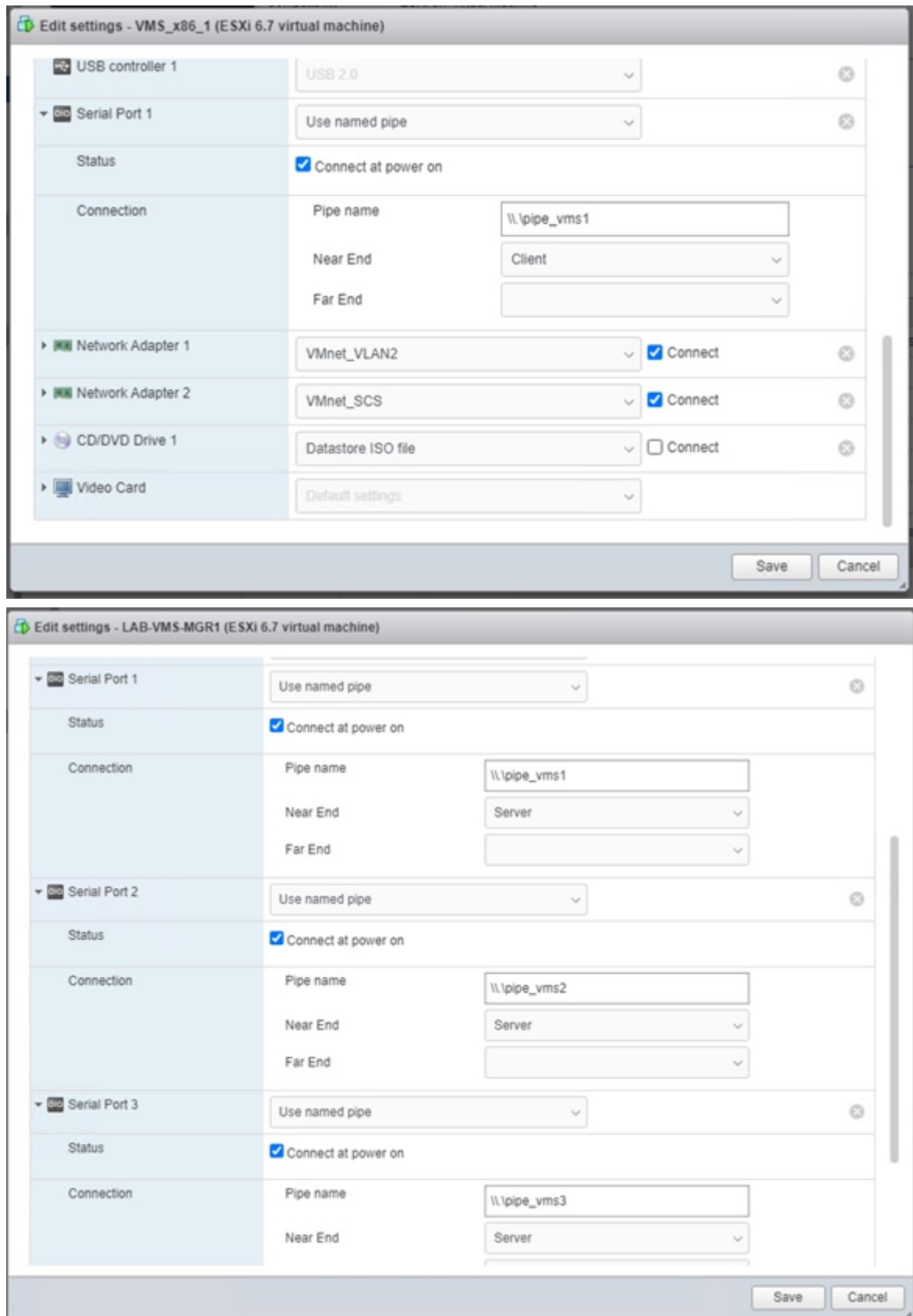
Use the named pipe functionality to map COM1/OPA0: on the VMS virtual machine to a pipe on a management server on which a terminal emulator is installed.

With the VM system in client mode, use the following syntax: `\\.\pipe_xxx`

With the management system in server mode, use the following syntax: `\\.\pipe_xxx`, where `xxx` is a unique string for each VM.

The terminal emulator should be set for serial connection at 115200 baud.

The following two figures show how to set up pipes for a local terminal emulator-based console.



The following two figures show how to set up pipes between two local virtual machines where one plays the role of VMS console. This could be a virtual machine guest running any OS that supports a terminal emulator.

Edit Settings

open4

×

Virtual Hardware

VM Options

ADD NEW DEVICE

> USB controller	USB 2.0	
> Video card	Auto-detect settings	▼
VMCI device	Device on the virtual machine PCI bus that provides support for the virtual machine communication interface	
SATA controller 0	AHCI	
▼ Serial port 1	Use named pipe	ⓧ
Status	☒ Connect At Power On	
Pipe name	\\.\pipe\com_1	
Near End	Server ▼	
Far End	A virtual machine ▼	
I/O Mode	☒ Yield CPU on poll	
> Other	Additional Hardware	

CANCEL

OK

Edit Settings

Windows-Openvms

Virtual Hardware

VM Options

ADD NEW DEVICE

> Network adapter 1	VM Network	☒ Connected
> CD/DVD drive 1	Host Device	☐ Connected
> Video card	Specify custom settings	
VMCI device Device on the virtual machine PCI bus that provides support for the virtual machine communication interface		
> Serial port 1	Use named pipe	☒ Connected
Status	☒ Connect At Power On	
Pipe name	\\pipe\com_1	
Near End	Client	
Far End	A virtual machine	
I/O Mode	☒ Yield CPU on poll	
> Other	Additional Hardware	

CANCEL

OK

Chapter 1. Preparing to Install V9.2

1.1. Tested Platforms

VSI has tested VSI OpenVMS x86-64 V9.2 with the following VMware products:

VMware Product	Minimum Versions Tested by VSI
Workstation Pro	V15.5.7
Workstation Player	V16.1.0
Fusion Pro	V11.5.7
Fusion Player	V12.1.0
ESXi	V6.7.0, V7.0.2

Important

Note that not all VMware license types are currently supported for running OpenVMS x86-64 V9.2.

VSI has tested VSI OpenVMS x86-64 V9.2 with the following Kernel-based Virtual Machine (KVM) products. The following table includes the Linux version and QEMU version:

Linux Distribution	QEMU Version (Package Information)
<i>CentOS Linux release 7.9.2009 (Core)</i>	2.12.0 (qemu-kvm-ev-2.12.0-44.1.el7_8.1)
<i>Linux Mint 20.2</i>	4.2.1 (Debian 1:4.2-3ubuntu6.21)
<i>OpenSUSE Leap 15.3</i>	5.2.0 (qemu-5.2.0-150300.112.4.src)
<i>Rocky Linux 8.5</i>	4.2.0 (qemu-kvm-4.2.0-59.module+el8.5.0+726+ce09ee88.1)
<i>Ubuntu 18.04 LTS</i>	2.11.1 (Debian 1:2.11+dfsg-1ubuntu7.39)
<i>Ubuntu 20.04.4 LTS</i>	4.2.1 (Debian 1:4.2-3ubuntu6.23)

VSI has tested OpenVMS x86-64 V9.2 with Oracle VirtualBox 6.1.34 and regularly installs updates when they are available.

See the *VSI OpenVMS x86-64 V9.2 Release Notes* for more information about supported virtual environments.

1.2. Platforms Documentation

Due to the many third-party platform products that you can use with OpenVMS x86-64 V9.2, VSI cannot provide the complete documentation for these products. The following table lists each product and a URL to its documentation web site:

Oracle VirtualBox	https://www.virtualbox.org/wiki/End-user_documentation
-------------------	---

Redhat Enterprise Linux	https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/9
VMware ESXi Enterprise	https://docs.vmware.com/en/VMware-vSphere/index.html
VMware Fusion	https://docs.vmware.com/en/VMware-Fusion/index.html
VMware Workstation Pro	https://docs.vmware.com/en/VMware-Workstation-Pro/index.html
VMware Workstation Player	https://docs.vmware.com/en/VMware-Workstation-Player/index.html

1.2.1. Recommended Settings for Virtual Machines

VSI recommends that your OpenVMS virtual machine be configured with:

- Memory Minimum of 6 GB
- Minimum Number of CPUs: 2
- Operating system: Other or 64-bit
- At least two 8 GB SATA/AHCI disks
- Boot Option: If present, disable Secure Boot, and select/enable UEFI or EFI (BIOS is not supported)
- Console Communication
- Serial line for non-console login
- Network: Adapter Type or Device Model of e1000 (ESXi or KVM); 82540EM (VirtualBox)
- CD/DVD (physical or virtual) device with the OpenVMS installation kit (the .ISO file) assigned to it
- Chipset, where offered: ICHP (VirtualBox); Q35 (KVM)

Chapter 2. Booting and Installing on a Virtual Machine

This chapter provides instructions to boot and install V9.2 on a guest VM. As a prerequisite, you should use your host system's Platform Firmware Boot Manager (typically blue setup screens and menus) to set your host system up to boot to the UEFI Shell. See the *OpenVMS x86-64 Boot Manager User Guide* for more information.

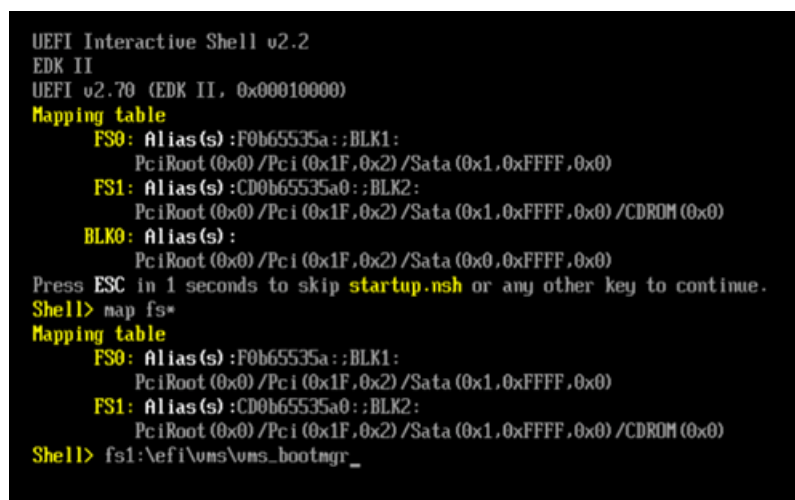
Important

Examples shown in this section use VMware ESXi. Although some small differences in terminal behavior, console appearance, and log output exist with other VM environments, these examples should still be applicable regardless of your environment. In some environments, reboots of your VM automatically brings up the OpenVMS Boot Manager prompt instead of the UEFI Shell prompt. To avoid the possibility of odd character output and/or to ensure an accurate list of bootable devices for the OpenVMS Boot Manager, type the EXIT command at the BOOTMGR> prompt, and immediately press the ESC key repeatedly until your system's Platform Firmware Boot Manager screen is displayed. Then simply hit the RETURN key and the BootMgr> prompt will be displayed again.

2.1. Booting the Virtual Machine

Follow the steps in this section to boot your virtual machine.

1. The following figure shows the graphics console that comes up when the VM is started. At the Shell> prompt, enter the command map fs* to display the file systems available on your system.



```
UEFI Interactive Shell v2.2
EDK II
UEFI v2.70 (EDK II, 0x00010000)
Mapping table
FS0: Alias(s):F0b65535a::BLK1:
    PciRoot(0x0)/Pci(0x1F,0x2)/Sata(0x1,0xFFFF,0x0)
FS1: Alias(s):CD0b65535a0::BLK2:
    PciRoot(0x0)/Pci(0x1F,0x2)/Sata(0x1,0xFFFF,0x0)/CDROM(0x0)
BLK0: Alias(s):
    PciRoot(0x0)/Pci(0x1F,0x2)/Sata(0x0,0xFFFF,0x0)
Press ESC in 1 seconds to skip startup.nsh or any other key to continue.
Shell> map fs*
Mapping table
FS0: Alias(s):F0b65535a::BLK1:
    PciRoot(0x0)/Pci(0x1F,0x2)/Sata(0x1,0xFFFF,0x0)
FS1: Alias(s):CD0b65535a0::BLK2:
    PciRoot(0x0)/Pci(0x1F,0x2)/Sata(0x1,0xFFFF,0x0)/CDROM(0x0)
Shell> fs1:\efi\ums\ums_bootmgr_
```

2. Choose the file system that maps to the .ISO file that you have downloaded and set up as a CDROM/ DVD. The shell sees the .ISO file as a CDROM, so you need to choose an FS n that is labeled CDROM. In the above example, we know that fs1 is the .ISO that we want to boot.
3. Knowing that fs1 is associated with the CDROM that is the .ISO, enter the following command to run the Boot Manager:

```
fs1:\efi\ums\ums_bootmgr.efi
```

4. The OpenVMS Boot Manager is displayed in the graphics console as shown in the following figure.

Note

The graphics console may display somewhat differently when your hypervisor is running on a Windows or on a Linux system. In the figure, the OpenVMS Boot Manager is running in an ESXi client VM on an ESXi 7.0 server.

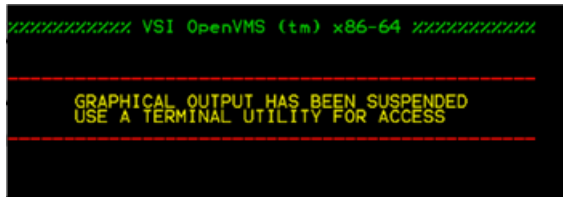


5. VSI recommends at this time to connect to the remote terminal/emulator of your choice using the VM host's IP address and the port you set up for your VM. Below is the log of a terminal connection using bash and telnet. Note the two telnet commands that are needed, and that a prompt is not yet visible:

```
Bash-3.2$ telnet 10.0.1.10 2023
Trying 10.0.1.10. . .
Connected to myserver.mycompany.com.
Escape character is '^]'.
^]
telnet> unset crlf
Will send carriage returns as telnet <CR><NUL>.
^]
telnet> mode char
```

6. At the BOOTMGR> prompt on the graphics console, enter the DEVICES command to show the devices that have bootable VMS file systems on them. You must boot from the one labeled as the DVD, which should be the only device listed if this is your first OpenVMS installation.

7. At the BOOTMGR> prompt on the graphics console, type BOOTMGR> BOOT DKA0, where DKA0 represents the DVD device.
8. When the DVD device is booted (that is, the OpenVMS installation kit is booted), the output on the graphics console display is suppressed. The graphics console displays the following message.



9. You must now use the terminal/emulator screen to continue with the installation. The OpenVMS Installation Menu should be displayed.

2.2. Installing OpenVMS x86-64 V9.2

This section provides a log of an OpenVMS x86-64 V9.2 boot and installation with subsequent reboots to complete the installation while using a remote terminal from a macOS. The user connected via telnet when the graphics console was at the initial BOOTMGR> prompt. The log below is an example of an installation as seen after the initial boot command has been given. This log can be used as a guide to installations where mostly default prompts are selected; exceptions to default selections are noted. The standard time zone prompts and other messages have been removed to improve readability.

```
BOOTMGR> BOOT DKA100
Booting...
%VMS_BOOTMGR-I-INSTALL, Booting an OpenVMS Installation Kit...
100%
%%%%%%%%% VSI OpenVMS (tm) x86-64 %%%%%%%%%%

GRAPHICAL OUTPUT HAS BEEN SUSPENDED
USE A TERMINAL UTILITY FOR ACCESS

VSI Primary Kernel SYSBOOT Jun 2 2022 11:43:57
%SYSBOOT-I-VMTYPE, Booting as a VMware (tm) Guest
VMS Software, Inc. OpenVMS (TM) x86_64 Operating System, V9.2
Copyright 2022 VMS Software, Inc.
MDS Mitigation active, variant verw (MD_CLEAR)
```

CPU messages have been removed from this portion of the log.

```
Installing required known files...
Configuring devices...
%EIA0, Link up: 1000 mbit, fdx, flow control (rcv only), 08-00-27-C5-F8-A1
```

The installation procedure begins.

```
*****
You can install or upgrade the OpenVMS X86-64 operating system
or you can install or upgrade layered products that are included
on the OpenVMS X86-64 distribution media.
```

```
You can also execute DCL commands and procedures to perform
"standalone" tasks, such as backing up the system disk.
```

Please choose one of the following:

- 1) Upgrade, install or reconfigure OpenVMS X86-64 Version V9.2
- 2) Display layered products that this procedure can install
- 3) Install or upgrade layered products
- 4) Show installed products
- 5) Reconfigure installed products
- 6) Remove installed products
- 7) Find, Install or Undo patches; Show or Delete Recovery Data

- 8) Execute DCL commands and procedures
- 9) Shut down this system

Enter CHOICE or ? for help: (1/2/3/4/5/6/7/8/9/?) 1

Important

Throughout the procedure the OpenVMS installation menu is displayed. Please note that OpenVMS x86-64 V9.2 does not support menu items # 3, 5, 6, and 7.

This procedure will ask a series of questions.

- () - encloses acceptable answers
- [] - encloses default answers

Type your response and press the <Return> key. Type:

- ? - to repeat an explanation
- ^ - to change prior input (not always possible)
- Ctrl/Y - to exit the installation procedure

This procedure installs the OpenVMS X86-64 operating system.

All software and data files that were previously on the target disk will be removed.

You must enter the device name for the target disk on which OpenVMS X86-64 will be installed.

Enter device name for target disk: (? for choices) ?

Device Name	Device Type Name	Volume Label	Size (blocks/xB)
-----	-----	-----	-----
DKA100:	ATA VMware Virtual S		
DKA200:	ATA VMware Virtual S		

For volume label and device size enter ??

Enter device name for target disk: (? for choices) dka100:

Enter volume label for target system disk: [X86SYS] madrexsys

OpenVMS V9.0 and later requires that the target system disk be initialized with On-Disk Structure Level 5 (ODS-5).

Hard links can be enabled on ODS-5 disks. WBEM Services for OpenVMS does not require hard links. (? for more information)

Do you want to enable hard links? (Yes/No/?) y

You have chosen to install OpenVMS X86-64 on a new disk.

The target system disk, DKA100:, will be initialized with structure level 5 (ODS-5).
Hard links WILL be enabled.
The disk will be labeled MADREXSYS.
Any data currently on the target system disk will be lost.

Is this OK? (Yes/No) Yes

Initializing and mounting target....

Creating page file....

You must enter a password for the SYSTEM account.

The password must be a minimum of 8 characters in length, and may not exceed 31 characters. It will be checked and verified.
The system will not accept passwords that can be guessed easily.

The password will not be displayed as you enter it.

Password for SYSTEM account:

Re-enter SYSTEM password for verification:

For your system to operate properly, you must set two parameters:
SCSNODE and SCSSYSTEMID.

SCSNODE can be from 1 to 6 letters or numbers. It must contain at least one letter.

If you plan to use DECnet, SCSNODE must be the DECnet Phase IV node name, or the DECnet-Plus (Phase V) node synonym.

If you have multiple OpenVMS systems, the SCSNODE on each system must be unique.

Enter SCSNODE: madrex

If you plan to use DECnet, SCSSYSTEMID must be set based on the DECnet Phase IV address.

Do you plan to use DECnet? (Yes/No) [Yes]

DECnet Phase IV addresses are in the format

DECnet_area_number.DECnet_node_number

DECnet_area_number is a number between 1 and 63.

DECnet_node_number is a number between 1 and 1023.

If you plan to use DECnet WITHOUT Phase IV compatible addresses,
enter 0.0.

Enter DECnet (Phase IV) Address: [1.1] 1.177

SCSSYSTEMID will be set to 1201.

This was calculated as follows:
 $(\text{DECnet_area_number} * 1024) + \text{DECnet_node_number}$

Configuring the Local Time Zone

You need to configure your local time zone. Please follow the prompts, which have been removed from this log for brevity, to select your time zone.

If you have Product Authorization Keys (PAKs) to register,
you can register them now.

Do you want to register any Product Authorization Keys? (Yes/No) [Yes] No

Note

You can register the PAKs now by responding YES to the prompt, or later by responding NO. You register licenses later by using the SYSS\$UPDATE:VMSLICENSE.COM procedure or the LICENSE REGISTER command.

The following products are part of the OpenVMS installation;
they will be installed along with the OpenVMS operating system:

- o Availability Manager (base) for OpenVMS X86-64
- o TCP/IP Services for OpenVMS X86-64
- o KERBEROS for OpenVMS X86-64
- o SSL111 V1.1-1N for OpenVMS X86-64 (based on OpenSSL V1.1.1n)
- o OpenSSH for OpenVMS X86-64
- o 64-bit PERL for OpenVMS X86-64

You can also install the following optional products along with the OpenVMS operating system:

- o DECwindows Motif for OpenVMS X86-64
- o DECnet-Plus for OpenVMS X86-64
- o DECnet Phase IV for OpenVMS X86-64

If you want to change your selections, you can do so later in the installation by answering "NO" to the following question:

"Do you want the defaults for all options?"

Do you want to install DECwindows Motif for OpenVMS X86-64 V1.8? (Yes/No) [Yes]

The DECnet-Plus kit is provided with the OpenVMS operating system kit.
DECnet Phase IV applications are supported by DECnet-Plus.

DECnet Phase IV is also provided as an option.

If you install DECnet-Plus and TCP/IP you can run DECnet applications over a TCP/IP network. Please refer to the VSI DECnet-Plus for OpenVMS Planning Guide for information on running DECnet over TCP/IP.

Do you want to install DECnet-Plus for OpenVMS X86-64 V9.2-B?
(Yes/No) [Yes] no

Do you want to install DECnet Phase IV for OpenVMS X86-64 V9.2? (Yes/No) [Yes]

The installation operation can provide brief or detailed descriptions. In either case, you can request the detailed descriptions by typing ?.

Do you always want detailed descriptions? (Yes/No) [No]

The kit validation information has been removed from this log for brevity.

The following product has been selected:

VSI X86VMS OPENVMS V9.2 Platform (product suite)

Configuration phase starting ...

You will be asked to choose options, if any, for each selected product and for any products that may be installed to satisfy software dependency requirements.

Configuring VSI X86VMS OPENVMS V9.2: OPENVMS and related products Platform

Copyright 2015-2022 VMS Software, Inc.

VMS Software, Inc.

Do you want the defaults for all options? [YES]

Availability Manager (base) for OpenVMS X86-64

TCP/IP Services for OpenVMS X86-64

* Product VSI X86VMS TCP/IP X6.0-16 requires a system reboot.
Can the system be REBOOTED after the installation completes? [YES]

Important

VSI recommends to accept the default for the reboot. Responding with No will abort the installation.

KERBEROS for OpenVMS X86-64
SSL111 V1.1-1N for OpenVMS X86-64 (based on OpenSSL V1.1.1n)
OpenSSH for OpenVMS X86-64
64-bit PERL for OpenVMS X86-64

```
Do you want to review the options? [NO]
Execution phase starting ...
```

At this point, the installation procedure begins the execution phase and provides a list of products that will be installed and other informational messages. This information has been removed from this log for brevity.

```
Portion done: 0%...10%...20%...30%...40%...50%...60%...70%...80%...90%
```

```
%PCSI-I-PRCOUTPUT, output from subprocess follows ...
% - Execute SYS$MANAGER:TCPIP$CONFIG.COM to proceed with configuration of
%   VSI TCP/IP Services for OpenVMS.
%
Portion done: 100%
```

```
% - Execute SYS$MANAGER:TCPIP$CONFIG.COM to proceed with configuration of
%   VSI TCP/IP Services for OpenVMS.
%
```

```
Portion done: 100%
```

The following products have been installed:

VMSPORTS X86VMS PERL534 T5.34-0	Layered Product
VSI X86VMS AVAIL_MAN_BASE V9.2	Layered Product
VSI X86VMS DECNET_PHASE_IV V9.2	Layered Product
VSI X86VMS DWMOTIF V1.8	Layered Product
VSI X86VMS DWMOTIF_SUPPORT V9.2	Layered Product
VSI X86VMS KERBEROS V3.3-2	Layered Product
VSI X86VMS OPENSSE V8.9-1B	Layered Product
VSI X86VMS OPENVMS V9.2	Platform (product suite)
VSI X86VMS SSL111 V1.1-1N	Layered Product
VSI X86VMS TCPIP X6.0-16	Layered Product
VSI X86VMS VMS V9.2	Operating System

VSI X86VMS OPENVMS V9.2: OPENVMS and related products Platform

VSI X86VMS OPENVMS V9.2: OPENVMS and related products Platform

VSI X86VMS TCPIP X6.0-16: VSI TCP/IP Services for OpenVMS.

VSI X86VMS SSL111 V1.1-1N: SSL111 for OpenVMS X86-64 V1.1-1N (Based on OpenSSL 1.1.1n)

Review the Installation Guide and Release Notes for post install directions.

Review the Installation Guide and Release Notes for post upgrade verification suggestions.

Refer to SYS\$HELP:SSL111-N-X86.RELEASE_NOTES for more information.

Check the release notes for current status of the product.

VSI X86VMS KERBEROS V3.3-2

Configure and set up Kerberos

If Kerberos will be run on this system, but has not been used previously, you need to perform the following steps.

- o Run the Kerberos configuration procedure:

```
@SYS$STARTUP:KRB$CONFIGURE.COM
```

- o Add the following line to SYS\$MANAGER:SYSTARTUP_VMS.COM:

```
$ @SYS$STARTUP:KRB$STARTUP
```

- o Add the following line to SYS\$MANAGER:SYLOGIN.COM:

```
$ @SYS$MANAGER:KRB$SYMBOLS
```

Press RETURN to continue:

VSI X86VMS SSL111 V1.1-1N: SSL111 for OpenVMS X86-64 V1.1-1N (Based on OpenSSL 1.1.1n)

Review the Installation Guide and Release Notes for post install directions.

Review the Installation Guide and Release Notes for post upgrade verification suggestions.

Refer to SYS\$HELP:SSL111-N-X86.RELEASE_NOTES for more information.

VMSPORTS X86VMS PERL534 T5.34-0

Post-installation tasks are required for Perl for OpenVMS.

To use the Perl provided with this kit, run the following set-up command procedure, assuming you installed in SYS\$COMMON.

```
$ @sys$common:[perl-5_34]perl_setup.com
```

You may wish to put that command in SYS\$MANAGER:SYLOGIN.COM to make Perl available to all users on the system.

Perl includes its own help system called perldoc. Type

```
$ perldoc perldoc
```

for the documentation to perldoc itself. Type

```
$ perldoc perldelta
```

for the changes that are new in version T5.34-0 of Perl.

There are many Perl-related resources on the web; point your browser at:

```
http://www.perl.org
```

to get started, and thank you for using Perl for OpenVMS.

%PCSI-I-SYSTEM_REBOOT, executing reboot procedure ...

Shutdown/reboot deferred when this product is installed as part of the O/S installation/upgrade

%PCSI-I-SYSTEM_REBOOT, executing reboot procedure ...

Running SYS\$UPDATE:SYS\$MD.COM to update the memory disk...

DKA0:[VMS\$COMMON.SYS\$LDR]SYS\$MD.DSK;1 created (177712 blocks in 1 extent), mounted on LDM7113: (volume label MD22159DF16A) with 1018 free blocks, containing OpenVMS V9.2.

%LD-I-UNIT, Allocated device is LDM7114:

The installation is now complete.

When the newly installed system is first booted, a special startup procedure will be run. This procedure will:

- o Configure the system for standalone or OpenVMS Cluster operation.
- o Run AUTOGEN to set system parameters.
- o Reboot the system with the newly set parameters.

You may shut down now or continue with other operations.

```
Process X86VMS_INSTALL logged out at 8-JUN-2022 15:52:14.84

Press Return to continue...
*****
You can install or upgrade the OpenVMS X86-64 operating system or you can install or
upgrade layered products that are included on the OpenVMS X86-64 distribution media.

You can also execute DCL commands and procedures to perform "standalone" tasks, such as
backing up the system disk.

Please choose one of the following:

1) Upgrade, install or reconfigure OpenVMS X86-64 Version V9.2
2) Display layered products that this procedure can install
3) Install or upgrade layered products
4) Show installed products
5) Reconfigure installed products
6) Remove installed products
7) Find, Install or Undo patches; Show or Delete Recovery Data
8) Execute DCL commands and procedures
9) Shut down this system

Enter CHOICE or ? for help: (1/2/3/4/5/6/7/8/9/?) 9
```

Important

Throughout the procedure the OpenVMS installation menu is displayed. Please note that OpenVMS x86-64 V9.2 does not support menu items # 3, 5, 6, and 7.

```
Shutting down the system

VSI Dump Kernel SYSBOOT Jun 2 2022 11:43:57

%ENTROPY, Entropy collection disabled for dump.

** Dumping error logs to the system disk (MADREX$DKA100:)
** Error logs dumped to MADREX$DKA100:[SYS0.SYSEXE]SYS$ERRLOG.DMP
** (used 36 out of 48 available blocks)

Restarting the system...
```

You must return back to the graphics console screen, and at the Shell> prompt, type the following to bring up the VMS Boot Manager:

```
vms_bootmgr.efi
```

Note

You will observe that whatever is typed in the graphics console screen is echoed on your terminal/emulator screen.

```
vms_bootmgr.efi

VSI OpenVMS Boot Manager: V9.2, Build 113 (Mar 28 2022)

ENABLED: Symmetric Multi-Processing
ENABLED: Crash Dump Processing
ENABLED: Console output to Legacy COM 1 Port

Checking Required Processor Features:
PASSED

BOOT MANAGER DEVICE:  DKA100
DEFAULT BOOT COMMAND: BOOT DKA0 0 00000000
```

VIRTUAL MACHINE GUEST: VMware (TM) No Mouse support; Use Commands or Arrow Keys
CONNECT A REMOTE TERMINAL SESSION NOW.

Still on the graphics console screen, enter the **DEVICES** command to see the list of bootable devices and ensure the HD/SATA Disk with the OpenVMS label you used during your installation is listed.

Type the **BOOT** command using the **DKxn** device with the correct label:

```
BOOTMGR>DEVICES
BOOTABLE DEVICES (System Disks, Installation Kits, other):

DKA0      (DVD) = FS1      UEFI: V9_2      OpenVMS: None      1338 MB  SATA DVD
DKA100    (HD) = FS0      UEFI: V9_2      OpenVMS: MADREXSYS 12288 MB  SATA Disk

BOOTMGR> BOOT DKA100
```

Return to your terminal screen when you see the message that the graphical output has been suspended.

```
Booting...
%VMS_BOOTMGR-I-INSTALL, Booting an OpenVMS Installation Kit...

%%%%%%%%%% VSI OpenVMS (tm) x86-64 %%%%%%%%%%
```

```
GRAPHICAL OUTPUT HAS BEEN SUSPENDED
USE A TERMINAL UTILITY FOR ACCESS
```

```
VSI Primary Kernel SYSBOOT Jun 2 2022 11:43:57

%SYSBOOT-I-VMTYPE, Booting as a VMware (tm) Guest

VMS Software, Inc. OpenVMS (TM) x86_64 Operating System, V9.2

Copyright 2022 VMS Software, Inc.

MDS Mitigation active, variant verw(MD_CLEAR)
```

CPU messages have been removed from this portion of the log.

```
Installing required known files...

Configuring devices...
```

Informational system messages have been removed from this portion of the log.

```
AUTOGEN will now be run to compute the new system parameters. The system will then shut
down and reboot, and the installation or upgrade will be complete.

After rebooting you can continue with such system management tasks as:

Configuring networking software (TCP/IP Services, DECnet, other)
Using SYS$MANAGER:CLUSTER_CONFIG.COM to create an OpenVMS Cluster
Creating FIELD, SYSTEST and SYSTEST_CLIG accounts if needed

%AUTOGEN-I-BEGIN, GETDATA phase is beginning.
```

AUTOGEN informational messages have been removed from this portion of the log.

```
%AUTOGEN-I-SYSGEN, parameters modified
%AUTOGEN-I-END, SETPARAMS phase has successfully completed.
%AUTOGEN-I-BEGIN, REBOOT phase is beginning.

The system is shutting down to allow the system to boot with the generated site-specific
parameters and installed images.
```

The system will automatically reboot after the shutdown and the upgrade will be complete.

```
SHUTDOWN -- Perform an Orderly System Shutdown on node MADREX
```

System informational messages have been removed from this portion of the log.

```
VSI Dump Kernel SYSBOOT Jun 2 2022 11:43:57
```

```
** Dumping error logs to the system disk (MADREX$DKA100:)  
** Error logs dumped to MADREX$DKA100:[SYS0.SYSEXE]SYS$ERRLOG.DMP  
** (used 36 out of 160 available blocks)
```

```
Restarting the system...
```

Once again you must return to the graphics console to boot your device. At the Shell> prompt, type VMS_BOOTMGR.EFI then at the BOOTMGR> prompt, enter the DEVICES command to see the list of bootable devices and ensure the HD/SATA Disk with the OpenVMS label you used during your installation is listed.

Type the BOOT command using the DKxn device with the correct label:

```
BOOTMGR>BOOT DKA100
```

Return to your terminal screen when you see the message that the graphical output has been suspended.

```
VSI OpenVMS Boot Manager: V9.2, Build 113 (Mar 28 2022)
```

```
ENABLED: Symmetric Multi-Processing  
ENABLED: Crash Dump Processing  
ENABLED: Console output to Legacy COM 1 Port
```

```
Checking Required Processor Features:  
PASSED
```

```
BOOT MANAGER DEVICE: DKA0  
DEFAULT BOOT COMMAND: BOOT DKA100 0 00000000
```

```
VIRTUAL MACHINE GUEST: VMware (TM) No Mouse support; Use Commands or Arrow Keys
```

```
CONNECT A REMOTE TERMINAL SESSION NOW.
```

```
BOOTMGR> DEVICES  
BOOTABLE DEVICES (System Disks, Installation Kits, other):
```

DKA100	(HD) = FS0	UEFI: V9_2	OpenVMS: MADREXSYS	12288 MB	SATA Disk
DKA0	(DVD) = FS1	UEFI: V9_2	OpenVMS: None	1338 MB	SATA DVD

```
BOOTMGR>BOOT DKA100
```

```
Booting...
```

```
%%%%%%%%%% VSI OpenVMS (tm) x86-64 %%%%%%%%%%
```

```
GRAPHICAL OUTPUT HAS BEEN SUSPENDED  
USE A TERMINAL UTILITY FOR ACCESS
```

```
VSI Primary Kernel SYSBOOT Jun 2 2022 11:43:57
```

```
%SYSBOOT-I-VMTYPE, Booting as a VMware (tm) Guest
```

```
VMS Software, Inc. OpenVMS (TM) x86_64 Operating System, V9.2
```

```
Copyright 2022 VMS Software, Inc.  
MDS Mitigation active, variant verw(MD_CLEAR)
```

CPU messages have been removed from this portion of the log.

```
%EIA0, Link up: 1000 mbit, fdx, flow control (rcv only), 08-00-27-C5-F8-A1
%RUN-S-PROC_ID, identification of created process is 00000404
%RUN-S-PROC_ID, identification of created process is 00000405
```

OPCOM messages have been removed from this portion of the log.

```
The OpenVMS system is now executing the site-specific startup commands.
```

OPCOM messages have been removed from this portion of the log.

```
Accounting information:
Buffered I/O count:          2864      Peak working set size:      13968
Direct I/O count:           1444      Peak virtual size:        274624
Page faults:                3612      Mounted volumes:          0
Charged CPU time:           0 00:00:02.16  Elapsed time:           0 00:00:07.22
```

The installation is complete. The Welcome to OpenVMS banner and the Username: prompt is displayed after pressing the Return/Enter key.

```
<enter>
Welcome to OpenVMS (TM) x86_64 Operating System, Version V9.2

Username: SYSTEM

Password:

VMS Software, Inc. OpenVMS (TM) x86_64 Operating System, V9.2
$
```

2.3. Post-Installation Steps for OpenSSH

OpenSSH has been integrated into the OpenVMS x86-64 V9.2 installation as a required layered product and installed unconditionally. However, before OpenSSH can be used, several manual steps are needed after installation:

1. Boot the target disk of the OpenVMS x86-64 V9.2 installation.
2. Log into the system with the SYSTEM account.
3. Configure and start up TCP/IP.
4. Execute the following OpenSSH command procedures in the exact order listed:
 - a. `$ @sys$common:[openssh.bin]ssh$create_account.com`
 - b. `$ @sys$common:[openssh.bin]ssh$create_startup_file.com`
 - c. `$ @sys$common:[openssh.bin]ssh$generate_keys.com`
 - d. `$ @sys$common:[openssh.bin]ssh$install_info.com`
5. To begin using OpenSSH, it must also be started, which can be done by updating the system files as described by `SSH$INSTALL_INFO.COM` and rebooting or by executing the following startup procedure explicitly:

```
$ @SYS$STARTUP:SSH$STARTUP.COM
```

6. Also, you can define logical names for the SSH commands using:

```
$ @SSH$ROOT:[BIN]SSH$DEFINE_COMMANDS.COM
```

OpenSSH is now ready for use.

Note

The SSH\$INSTALL_INFO.COM procedure, above, describes post-installation steps, first an update if the system is part of a cluster, and then updates to apply to the system startup and shutdown command files for any system, as follows:

1. In a cluster, on all the nodes that are going to use the same common ssh\$root installation directory as the current node, copy the following files to the SYS\$STARTUP directory of each node:

```
SYS$STARTUP:SSH$STARTUP.COM
SYS$STARTUP:SSH$SHUTDOWN.COM
SYS$STARTUP:SSH$DEFINE_ROOT.COM
```

2. To automatically start OpenVMS OpenSSH during system startup, add the following line to the file SYS\$MANAGER:SYSTARTUP_VMS.COM after the TCPIP startup command procedure:

```
$ @SYS$STARTUP:SSH$STARTUP.COM
```

3. To shut down OpenVMS OpenSSH during system shutdown, add the following line to the file SYS\$MANAGER:SYSHUTDWN.COM:

```
$ @SYS$STARTUP:SSH$SHUTDOWN.COM
```

Running the command procedure SSH\$DEFINE_COMMANDS.COM creates logical names for the OpenSSH utility commands, as listed below. Individual users may add this command procedure to their LOGIN.COM file, or it can be added to SYLOGIN.COM to define these logical names for all users.

- SCP
- SFTP
- SSH_ADD
- SSH_AGENT
- SSH_KEYGEN
- SSH_KEYSCAN
- SSH

The command procedure SYS\$COMMON:[OPENS\$SSH.BIN]SSH\$DEASSIGN_COMMANDS.COM can be used to deassign these commands.

Note

If SSH\$DEFINE_COMMANDS.COM is run with the parameter "ALL", the following additional commands will be defined. These commands are intended primarily for administrative purposes and generally are not used by other users.

- **SSHSTART**

Starts and creates (if necessary) OpenSSH services. Before running this command, check the file `SSH$ROOT:[ETC]SSHD_CONFIG` to ensure that SSH server configuration details are correct. You may also need to modify the client configuration file `SSH$ROOT:[ETC]SSH_CONFIG` before starting the services.

- **SSHSTOP**

Stops OpenSSH services. If the parameter "ALL" is specified with this command, the service definitions will be removed from the TCP/IP configuration.

- **SSHSHOW**

Shows details of running OpenSSH processes including SSH connections, number of connected clients, and so on. Note that each client connection consists of two processes, namely a process with a name of the form `SSHD_BGxxxxx` (where `xxxxx` is the number of the associated BG device), and a user process with a name of the form `FTAxixx_USERNAME` for the `USERNAME` in question. The name of the user process can be changed by the user.

- **SSHVERSION**

Displays information about the various OpenSSH programs, including version details and related data.

Chapter 3. Networking on V9.2

This chapter provides information about networking options and instructions for DECnet Phase IV and for VSI TCP/IP Services on OpenVMS x86-64 V9.2.

3.1. Setting Up DECnet Phase IV

During the installation, if you chose to install DECnet Phase IV, you need to configure this software using the NETCONFIG command procedure. See the *DECnet for OpenVMS Guide to Networking* manual for more information.

Once you have configured DECnet Phase IV, edit `SYS$COMMON:[SYSMGR]SYSTARTUP_VMS.COM` so that the software starts when the system reboots. You can have the software start interactively or in batch mode by making one of the following changes:

- Locate and uncomment the line:

```
$!$ START/NETWORK DECNET
```

So it now appears as:

```
$ START/NETWORK DECNET
```

- To start the network in a batch job (speeds up startup) locate and uncomment the line:

```
$!$ SUBMIT SYS$MANAGER:STARTNET.COM
```

So it now appears as:

```
$ SUBMIT SYS$MANAGER:STARTNET.COM
```

For more DECnet Phase IV documentation, visit [Documentation — VMS Software, Inc. \[https://docs.vmssoftware.com\]](https://docs.vmssoftware.com)

3.2. Configuring TCP/IP Services V6.0

This section provides information about configuring VSI TCP/IP Services for OpenVMS V6.0. The following is an example, and you should apply settings that are appropriate for your environment.

Log in to your SYSTEM account and enter:

```
$ @tcpip$config
```

```
VSI TCP/IP Services for OpenVMS Configuration Menu
```

```
Configuration options:
```

```
1 - Core environment
2 - Client components
3 - Server components
4 - Optional components
```

```
5 - Shutdown VSI TCP/IP Services for OpenVMS
6 - Startup VSI TCP/IP Services for OpenVMS
7 - Run tests
```

```
A - Configure options 1 - 4
[E] - Exit configuration procedure
```

Enter configuration option: a

VSI TCP/IP Services for OpenVMS Core Environment Configuration Menu

Configuration options:

- 1 - Domain
- 2 - Interfaces
- 3 - Routing
- 4 - BIND Resolver
- 5 - Time Zone

A - Configure options 1 - 5
[E] - Exit menu

Enter configuration option: 1

DOMAIN Configuration

Enter Internet domain: node1.example.com

VSI TCP/IP Services for OpenVMS Core Environment Configuration Menu

Configuration options:

- 1 - Domain
- 2 - Interfaces
- 3 - Routing
- 4 - BIND Resolver
- 5 - Time Zone

A - Configure options 1 - 5
[E] - Exit menu

Enter configuration option: 2

VSI TCP/IP Services for OpenVMS Interface & Address Configuration Menu

Hostname Details: Configured=Not Configured, Active=Not Configured

Configuration options:

- 0 - Set The Target Node (Current Node: <your_node>)
 - 1 - IE0 Menu (EIA0: TwistedPair 1000mbps)
- [E] - Exit menu

Enter configuration option: 1

VSI TCP/IP Services for OpenVMS Interface IE0 Configuration Menu (
Node: <your_node>)

Configuration options:

- 1 - Add a primary address on IE0
- 2 - Add an alias address on IE0
- 3 - Enable DHCP client to manage address on IE0

[E] - Exit menu

Enter configuration option: 1

* Is this address used by Clusters over IP (IPCI) [NO]:

IPv4 Address may be entered with CIDR bits suffix.
E.g. For a 16-bit netmask enter 192.0.2.1/16

Enter IPv4 Address []: 192.0.2.15

Default netmask calculated from class of IP address: 255.0.0.0

IPv4 Netmask may be entered in dotted decimal notation,
(e.g. 255.255.0.0), or as number of CIDR bits (e.g. 16)

```
Node      : <your_node>
Interface: IE0
IPCI      : No
Address   : 192.0.2.15/8
Netmask   : 255.0.0.0 (CIDR bits: 8)
Hostname  : <your_node>
```

Added hostname <your_node> (192.0.2.15) to host database

Updated system hostname in configuration database

```
Added Address IE0: 192.0.2.15 to configuration database
```

VSI TCP/IP Services for OpenVMS Interface & Address Configuration Menu

```
Hostname Details: Configured=<your_node>, Active=Not Configured
```

Configuration options:

```

0 - Set The Target Node (Current Node: <your_node>)
1 - IE0 Menu (EIA0: TwistedPair 1000mbps)
2 - 192.0.2.15/8          <your_node>          Configured
[E] - Exit menu

```

```
Enter configuration option: e
```

VSI TCP/IP Services for OpenVMS Core Environment Configuration Menu

Configuration options:

- 1 - Domain
- 2 - Interfaces
- 3 - Routing
- 4 - BIND Resolver
- 5 - Time Zone

```

A - Configure options 1 - 5
[E] - Exit menu

```

Enter configuration option: 3

DYNAMIC ROUTING Configuration

Dynamic routing has not been configured.

You may configure dynamic ROUTED or GATED routing. You cannot enable both at the same time. If you want to change from one to the other, you must disable the current routing first, then enable the desired routing.

19

routing requests made from remote hosts.

If you enable dynamic GATED routing, you will be able to configure this host to use any combination of the following routing protocols to exchange dynamic routing information with other hosts on the network:

- Routing Information Protocol (RIP) - Version 1 & 2
- Router Discovery Protocol (RDISC)
- Open Shortest Path First (OSPF)
- Exterior Gateway Protocol (EGP)
- Border Gateway Protocol (BGP-4)
- Static routes

* Do you want to configure dynamic ROUTED or GATED routing [NO]:

A default route has not been configured.

* Do you want to configure a default route [YES]:

Enter your Default Gateway host name or address: 192.0.2.2

192.0.2.2 is not in the local host database.

If you want to enter the default gateway in the local host database, enter its host name. Otherwise, enter <CR>.

Enter the Default Gateway host name []:

VSI TCP/IP Services for OpenVMS Core Environment Configuration Menu

Configuration options:

- 1 - Domain
- 2 - Interfaces
- 3 - Routing
- 4 - BIND Resolver
- 5 - Time Zone

A - Configure options 1 - 5

[E] - Exit menu

Enter configuration option: e

VSI TCP/IP Services for OpenVMS Configuration Menu

Configuration options:

- 1 - Core environment
- 2 - Client components
- 3 - Server components
- 4 - Optional components
- 5 - Shutdown VSI TCP/IP Services for OpenVMS
- 6 - Startup VSI TCP/IP Services for OpenVMS
- 7 - Run tests

A - Configure options 1 - 4

[E] - Exit configuration procedure

Enter configuration option: 2

VSI TCP/IP Services for OpenVMS Client Components Configuration Menu

Configuration options:

1 - DHCP Client	Disabled Stopped
2 - FTP Client	Disabled Stopped
3 - NFS Client	Disabled Stopped
4 - REXEC and RSH	Disabled Stopped
5 - RLOGIN	Disabled Stopped
6 - SMTP	Disabled Stopped
7 - TELNET	Disabled Stopped
8 - TELNETSYM	Disabled Stopped

A - Configure options 1 - 8

[E] - Exit menu

Enter configuration option: 2

FTP CLIENT Configuration

Service is not enabled.

Service is stopped.

FTP CLIENT configuration options:

1 - Enable service on this node

[E] - Exit FTP_CLIENT configuration

Enter configuration option: 1

The FTP SERVER is not enabled.

* Do you want to configure FTP SERVER [NO]: Y

FTP Configuration

Service is not defined in the SYSUAF.

Service is not defined in the TCPIP\$SERVICE database.

Service is not enabled.

Service is stopped.

FTP configuration options:

1 - Enable service on this node

[E] - Exit FTP configuration

Enter configuration option: 1

%TCPIP-I-INFO, creating TCPIP\$AUX identifier (uic=[3655,*])

Creating FTP Service Entry

VSI TCP/IP Services for OpenVMS Client Components Configuration Menu

Configuration options:

1 - DHCP Client Disabled Stopped

2 - FTP Client Enabled Stopped

3 - NFS Client Disabled Stopped

4 - REXEC and RSH Disabled Stopped

5 - RLOGIN Disabled Stopped

6 - SMTP Disabled Stopped

7 - TELNET Disabled Stopped

8 - TELNETSYM Disabled Stopped

A - Configure options 1 - 8

[E] - Exit menu

Enter configuration option: 7

TELNET Configuration

Service is not defined in the SYSUAF.

Service is not defined in the TCPIP\$SERVICE database.

Service is not enabled.

Service is stopped.

TELNET configuration options:

1 - Enable service on this node

[E] - Exit TELNET configuration

Enter configuration option: 1

Creating TELNET Service Entry

VSI TCP/IP Services for OpenVMS Client Components Configuration Menu

Configuration options:

1 - DHCP Client	Disabled Stopped
2 - FTP Client	Enabled Stopped
3 - NFS Client	Disabled Stopped
4 - REXEC and RSH	Disabled Stopped
5 - RLOGIN	Disabled Stopped
6 - SMTP	Disabled Stopped
7 - TELNET	Enabled Stopped
8 - TELNETSYM	Disabled Stopped

A - Configure options 1 - 8

[E] - Exit menu

Enter configuration option: e

VSI TCP/IP Services for OpenVMS Configuration Menu

Configuration options:

1 - Core environment
2 - Client components
3 - Server components
4 - Optional components
5 - Shutdown VSI TCP/IP Services for OpenVMS
6 - Startup VSI TCP/IP Services for OpenVMS
7 - Run tests

A - Configure options 1 - 4

[E] - Exit configuration procedure

Enter configuration option: 3

VSI TCP/IP Services for OpenVMS Server Components Configuration Menu

Configuration options:

1 - BIND	Disabled Stopped	12 - NTP	Disabled Stopped
2 - BOOTP	Disabled Stopped	13 - PC-NFS	Disabled Stopped
3 - DHCP	Disabled Stopped	14 - POP	Disabled Stopped
4 - FINGER	Disabled Stopped	15 - PORTMAPPER	Disabled Stopped
5 - FTP	Enabled Stopped	16 - RLOGIN	Disabled Stopped
6 - IMAP	Disabled Stopped	17 - RMT	Disabled Stopped
7 - LBROKER	Disabled Stopped	18 - SNMP	Disabled Stopped
8 - LPR/LPD	Disabled Stopped	29 - TELNET	Enabled Stopped
9 - METRIC	Disabled Stopped	20 - TFTP	Disabled Stopped
10- NFS	Disabled Stopped	21 - XDM	Disabled Stopped
11- LOCKD/STATD	Disabled Stopped		

A - Configure options 1 - 21

[E] - Exit menu

Enter configuration option: e

VSI TCP/IP Services for OpenVMS Configuration Menu

Configuration options:

1 - Core environment
2 - Client components
3 - Server components
4 - Optional components
5 - Shutdown VSI TCP/IP Services for OpenVMS

```
6 - Startup VSI TCP/IP Services for OpenVMS
7 - Run tests

A - Configure options 1 - 4
[E] - Exit configuration procedure
Enter configuration option: 4

VSI TCP/IP Services for OpenVMS Optional Components Configuration Menu

Configuration options:

1 - Configure PWIP Driver (for DECnet-Plus and PATHWORKS)
2 - Configure SRI QIO Interface (INET Driver)
3 - Set up Anonymous FTP Account and Directories
4 - Configure Kerberos Applications
5 - Configure failSAFE IP
6 - Configure IPsec (not present)

A - Configure options 1 - 6
[E] - Exit menu

Enter configuration option: e

VSI TCP/IP Services for OpenVMS Configuration Menu

Configuration options:

1 - Core environment
2 - Client components
3 - Server components
4 - Optional components

5 - Shutdown VSI TCP/IP Services for OpenVMS
6 - Startup VSI TCP/IP Services for OpenVMS
7 - Run tests

A - Configure options 1 - 4
[E] - Exit configuration procedure

Enter configuration option: 6

Begin Startup...

%TCPIP-I-INFO, TCP/IP Services startup beginning at 08-Mar-2022 20:50:11.20
%TCPIP-I-INFO, creating UCX compatibility file SYS$COMMON:[SYSEXEC]UCX$SERVICE.DAT
%TCPIP-I-NORMAL, timezone information verified

%RUN-S-PROC_ID, identification of created process is 0000045C
%TCPIP-I-SETLOCAL, setting domain and/or local host
%TCPIP-I-STARTCOMM, starting communication
%TCPIP-I-SETPROTP, setting protocol parameters
%TCPIP-I-DEFINTE, defining interfaces
%TCPIP-I-STARTNAME, starting name service
%TCPIP-S-STARTDONE, TCP/IP Kernel startup completed
%TCPIP-I-PROXYLOADED, loaded 0 NFS proxy records
%TCPIP-I-LOADSERV, loading TCPIP server proxy information
%TCPIP-I-SERVLOADED, auxiliary server loaded with 0 proxy records
-TCPPIP-I-SERVSKIP, skipped 0 communication proxy records
-TCPPIP-I-SERVTOTAL, total of 0 proxy records read
%TCPIP-S-STARTDONE, TCPIP$PROXY startup completed
%TCPIP-S-STARTDONE, TCPIP$FTP startup completed
%TCPIP-S-STARTDONE, TCPIP$FTP_CLIENT startup completed
%TCPIP-S-STARTDONE, TCPIP$TELNET startup completed
%TCPIP-S-STARTDONE, TCP/IP Services startup completed at 08-Mar-2022 20:50:14.94

Startup request completed.
Press <ENTER> key to continue ...
VSI TCP/IP Services for OpenVMS Configuration Menu
```

Configuration options:

- 1 - Core environment
- 2 - Client components
- 3 - Server components
- 4 - Optional components

- 5 - Shutdown VSI TCP/IP Services for OpenVMS
- 6 - Startup VSI TCP/IP Services for OpenVMS
- 7 - Run tests

- A - Configure options 1 - 4
- [E] - Exit configuration procedure

Enter configuration option: e

Confirm that your TCP/IP network has started and is configured. Enter:

\$ show network

The system displays network information similar to the following:

Product: TCP/IP Node: node1.example.com Address(es): 192.0.2.15
\$

Appendix A. Setting up a VMS Cluster

This appendix provides instructions to create a VMS cluster with two Oracle VirtualBox VMs both running on a Windows 10 system host with each using its own system disk.

Note

VSI development is providing the information in this appendix as one example of how to set up a cluster on a virtual machine. There may be other or better ways to do this. VSI encourages our customers to find other methods and to share them with us.

Use the following worksheet to list the names and addresses for your specific cluster environment. Variables in monospace font are used throughout the instructions.

Item	Your specific environment name
Location of the V9.2 ISO file (X86092OE)	_____
Your node names	
<VM1_nodename>	_____
<VM2_nodename>	_____
Names for your virtual machines	
<VM1_name>	_____
<VM2_name>	_____
Names for your system and paging disks	
<VM1_sysdisk_name>	_____
<VM1_paging_disk_name>	_____
<VM2_sysdisk_name>	_____
<VM2_paging_disk_name>	_____
DECnet addresses of your virtual machines	
<VM1_DECnet_address>	_____
<VM2_DECnet_address>	_____
SCSSYSTEMID	
<VM1_SCSSYSTEMID>	_____
<VM2_SCSSYSTEMID>	_____
MAC addresses ¹	
<VM1_DECnet_mac_address>	_____
<VM2_DECnet_mac_address>	_____
TCP/IP addresses for your virtual machines	

Item	Your specific environment name
<your_domain_name>	_____
<VM1_TCPIP_address_1>	_____
<VM1_TCPIP_address_2>	_____
<VM2_TCPIP_address_1>	_____
<VM2_TCPIP_address_2>	_____
Port numbers ²	
<VM1_port_number_1>	_____
<VM1_port_number_2>	_____
<VM2_port_number_1>	_____
<VM2_port_number_2>	_____
Number and password for the cluster	
<cluster_number>	_____
<cluster_password>	_____

¹The pseudo-MAC address used by DECnet comprises the fixed hex digits AA-00-04-00 followed by nn-nn that is the DECnet address in big-endian format. For example, 01-28 -> 0x2801 -> 10241 (also SCSSYSTEMID) -> (1024 * 10) + 1 -> DECnet address 10.1.

²In this article, we are using PuTTY as terminal emulator and have ports <VM1_name> COM1, <VM1_name> COM2, <VM2_name> COM1, <VM2_name> COM2, all using Host name 127.0.0.1, Connection Type: Raw, and ports <VM1_port_number_1>, <VM1_port_number_2>, <VM2_port_number_1>, and <VM2_port_number_2> respectively.

A.1. Initial Preparation

Follow these steps:

1. Locate the V9.2 ISO file. You may have a zipped copy, which you should unzip.
2. On an existing OpenVMS system, enter these commands to create a 2GB disk file that can be replicated as needed for each of the disks required:

```
$ LD CREATE EMPTY2GBDISK.DSK/SIZE=4194304/ERASE
$ LD CONNECT EMPTY2GBDISK.DSK LDA EMPTY$
$ INITIALIZE EMPTY$ EMPTY2GBDISK
$ LD DISCONNECT EMPTY$
$ ZIP EMPTY2GBDISK EMPTY2GBDISK.DSK
```

3. Copy the resulting EMPTY2GBDISK.ZIP file to your host system.
4. Unzip this archive four times to a folder where VirtualBox can access the DSK files. After each Unzip, rename the resulting EMPTY2GBDISK.DSK to:
 - <VM1_sysdisk_name>.DSK
 - <VM1_paging_disk_name>.DSK
 - <VM2_sysdisk_name>.DSK
 - <VM2_paging_disk_name>.DSK
5. Make a VMDK file for each one using the following command:

```
vboxmanage internalcommands createrawvmdk --filename <x>.vmdk --rawdisk <x>.dsk
```

A.2. Creating the First Virtual Machine

Follow these steps:

1. In the Oracle VM VirtualBox Manager window, click Machine, then New.
 2. In the Name field, enter <VM1_name>. Accept the default for the Machine Folder field, set Type to Other, and Version to Other/Unknown (64-bit).
 3. Click Next. VSI recommends that you set the memory size to 6144MB, then click Next again.
 4. Select “Do not add a virtual hard disk”, then click Create and Continue from the warning.
 5. Select Settings for the new VM and click System.
 6. In the Motherboard tab, uncheck Floppy and Optical, choose Chipset ICH9, and check Enable EFI.
 7. In the Processor tab, VSI recommends that you set the CPU count to at least 2.
 8. Select Storage from the settings menu.
 9. Click Add controller, select the AHCI (SATA) type controller. Add four disks to this controller in the following order:
 - <VM1_sysdisk_name>.VMDK (as a hard disk)
 - <VM1_paging_disk_name>.VMDK (as a hard disk)
 - X86092OE.ISO (as an optical drive)
 - <VM2_sysdisk_name>.VMDK (as a hard disk)
- You must add each disk to the available drives first, and then select it for the VM.
10. From the Settings menu, select Network.
 11. Enable the first three adapters. The first adapter is used to connect to your extended network using TCP/IP, and might include a VPN. The second adapter is used to connect to your local network (which may be entirely within your host system) using TCP/IP. The third adapter is used to connect your virtual machines using DECnet IV. All three adapters are used for cluster communication.
 12. For Adapter 1, select the NAT adapter type (default value).

Note

This setting is determined by how your computer accesses the rest of your network from the VM. In the example described here, the target machines are connected via VPN, which requires the NAT adapter type. If you are using a local network, change the adapter type to Bridged.

Under Advanced, make sure Adapter Type is set to Intel PRO/1000 MT Desktop (82540EM), use default MAC address, and make sure Cable Connected is checked.

13. Adapter 2 is a Bridged Adapter; accept the default name.

Under Advanced, specify the same settings as Adapter 1 with the default MAC address, but make sure Promiscuous is set to Deny.

14. Set up Adapter 3 the same way as Adapter 2 but override the MAC address with `<VM1_DECnet_mac_address>`. This MAC address matches the DECnet address `<VM1_DECnet_address>`.
15. From the Settings menu, select Ports. With our method, two ports with distinct port numbers are used on each system. Ports 1 and 2 are COM1 and COM2 respectively. The Port Mode is TCP. “Connect to existing pipe/socket” option should be unchecked, and Path/Address are set to `<VM1_port_number_1>` and `<VM1_port_number_2>`.

A.3. Starting the Virtual Machine

Follow these steps:

1. Start the VM that you have just set up.
2. In the Virtual Machine console window that is created, the VM boot process should stop at the `Shell>` prompt. If it does not, press ESC.
3. Click View, then click Scaled Mode. Close the Virtual Machine window.
4. In the Close Virtual Machine pop-up window, select Power Off the machine, and then click OK. This sets “Power off” as the default action on close.
5. Restart the VM.
6. Connect your COM1 port.
7. To find the CD-ROM and invoke the Boot Manager from it, enter the `map -r` command at the `Shell>` prompt. Because the only bootable disk is the ISO kit file, just `VMS_BOOTMGR` should be sufficient.

Enable auto-boot and set Flags to 800 before entering the `BOOT DKA200` command to begin the installation. You should install to the DKA0: disk with the following settings:

1. Set the volume label to `<VM1_nodename>_V92`
2. Enable hard links if you need them
3. Set `SCSNODE` to `<VM1_nodename>`
4. Set `SCSSYSTEMID` to `<VM1_SCSSYSTEMID>`
8. **Important:** When the system reboots to perform AUTOGEN, abort AUTO BOOT and manually boot the new system disk with the command `BOOT DKA0`. Once the AUTOGEN step is done and the system boots, log in and invoke `CLUSTER_CONFIG_LAN.COM`, option 1.
9. Answer Yes to the SCSI bus prompt and enter `<cluster_number>` and `<cluster_password>` when requested.
10. Answer Yes to the disk server prompt.

11. Answer No to the quorum disk prompt. Skip the port allocation class and set EXPECTED_VOTES to 1. You can safely ignore the warnings.
12. Run AUTOGEN again and let the system reboot as a single-node cluster.
13. At this point, you should modify several of the SYSGEN parameters. Refer to the *VSI OpenVMS System Management Utilities Reference Manual* for the description of MODPARAMS.DAT and update its contents and the CURRENT parameter settings. The values used should be from the following list:

```
WINDOW_SYSTEM=1
DISK_QUORUM=""
NISCS_LOAD_PEA0=1
VAXCLUSTER=2
EXPECTED_VOTES=1
MSCP_LOAD=1
MSCP_SERVE_ALL=5
INTERCONNECT="NI"
BOOTNODE="NO"
TTY_TYPAHDSZ=512
TTY_BUF=132
SCSNODE="<VM1_nodename>"
SCSSYSTEMID=<VM1_SCSSYSTEMID>
VOTES=1
```

A.4. Adding a Node Using a Copy of an Existing System Disk

On VSI OpenVMS x86-64 systems, if you use a copy of an existing system disk as the initial system disk of a new node that is being added to a cluster, you must perform an additional step, which is changing the label for the memory disk. Follow these steps (which assume that the new system disk is DKA300:, and it is not already mounted):

1. Identify a system disk for VM2, <VM2_sysdisk_name>.
2. To copy DKA0: (system disk of VM1) to DKA300: (this will become system disk of VM2), type in the following commands:

```
$ MOUNT/FOREIGN DKA300:
$ BACKUP/IMAGE/IGNORE=INTERLOCK DKA0: DKA300:
```

3. To be able to change the label of DKA300:, first type in the following commands:

```
$ DISMOUNT DKA300:
$ MOUNT DKA300/OVERRIDE=ID
```

4. Change the label to <VM2_nodename>_V92.

5. Dismount the disk again and enter:

```
$ MOUNT/SYSTEM DKA300: <VM2_nodename>_V92
```

6. Connect and mount the memory disk container file using the following commands:

```
$ LD CONNECT DKA300:[VMS$COMMON,SYS$LDR]SYSSMD.DSK LDM LDDEV
$ MOUNT/OVER=ID LDDEV
```

7. Note the label of the memory disk. It will be of the form "MD20345927FD". Change the last letter to create a unique name. For example:

```
$ SET VOLUME LDDEV /LABEL=MD20345927FE
```

8. This gets a unique volume label into `<VM2_sysdisk_name>`'s memory disk. Before dismounting the memory disk or the system disk, update several parameters, including SCSNODE and SCSSYSTEMID:

```
$ MCR SYSGEN
SYSGEN> USE LDDEV:[SYS0.SYSEXE]X86_64VMSSYS.PAR
SYSGEN> SET SCSNODE "<VM2_nodename>"
SYSGEN> SET SCSSYSTEMID <VM2_SCSSYSTEMID>
SYSGEN> SET VOTES 0
SYSGEN> WRITE LDDEV:[SYS0.SYSEXE]X86_64VMSSYS.PAR
SYSGEN> EXIT
```

9. Dismount the memory disk before completing the other setup tasks for the new system disk.

```
$ DISMOUNT LDDEV
$ LD DISCONNECT LDDEV
```

A.5. Creating the Second Virtual Machine

1. Before you start, shut down and power off the VM you are currently running (VM1).
2. Go into VM1 Settings, click Storage and remove disk `<VM2_sysdisk_name>` (you will need to use that disk in the new VM).
3. The process of creating VM2 is mostly the same as VM1 (as described in *Section A.2, "Creating the First Virtual Machine"*), with a few differences:
 - VM's name is `<VM2_name>`.
 - Add three disks to its SATA controller: `<VM2_sysdisk_name>.VMDK` and `<VM2_paging_disk_name>.VMDK` (as hard disks), and an empty optical drive.
 - Under Network, set the MAC address for Adapter 3 to `<VM2_DECnet_MAC_address>`, which translates to DECnet address `<VM2_DECnet_address>` or SCSSYSTEMID `<VM2_SCSSYSTEMID>`. (See earlier footnote).
 - Under Ports, use port numbers `<VM2_port_number_1>` and `<VM2_port_number_2>`.
4. Start VM1 again. Allow it to boot completely.
5. Start VM2 and perform steps 2 through 4 from *Section A.3, "Starting the Virtual Machine"* of this document, so that the default action on Close is Power Off instead of Save.
6. Restart VM2 and connect VM2's COM1 port.
7. Locate and start the boot manager as for VM1. Enable auto-boot and set Flags to 800.
8. Then boot DKA0:.

At this point, you should have a two-node cluster, running off separate system disks.

A.6. Finalizing Cluster Setup

Perform the following system management tasks as follows:

1. Initialize and mount the paging disk on each system, then create PAGEFILE.SYS and SYSDUMP.DMP in [SYS0.SYSEXEXE] for each one.
2. Use 1,000,000 blocks for each file. Also, create a [SYSMGR] directory on this disk as a place to save dumps from SDA.

On VM1, enter the following:

```
$ INITIALIZE DKA100: <VM1_nodename>_PAGE
$ MOUNT/SYSTEM DKA100: <VM1_nodename>_PAGE
$ CREATE/DIRECTORY DKA100:[SYS0.SYSEXEXE]
$ MCR SYSGEN
SYSGEN> CREATE DKA100:[SYS0.SYSEXEXE]PAGEFILE.SYS/SIZE=1000000
SYSGEN> CREATE DKA100:[SYS0.SYSEXEXE]SYSDUMP.DMP/SIZE=1000000
SYSGEN> EXIT
$ CREATE/DIRECTORY DKA100:[SYSMGR]
```

Repeat these commands on VM2 using <VM2_nodename>_PAGE.

3. Edit SYPAGSWPFILES.COM to install the page file.

On VM1, type in:

```
$ mount/system dka100: <VM1_nodename>_page
$ mcr sysgen install dka100:[sys0.sysexex]pagefile.sys/page
```

On VM2, type in:

```
$ mount/system dka100: <VM2_nodename>_page
$ mcr sysgen install dka100:[sys0.sysexex]pagefile.sys/page
```

4. During the installation of OpenVMS, a minimal pagefile was created on the system disk. Use the SHOW MEMORY command to confirm the exact location. You may want to delete this (which is now on both system disks), and you should do this by renaming the file (to PAGEFILE.TMP, for example), then rebooting each system before deleting the renamed file.
5. To set up the dump device, enter the following command on both systems:


```
$ SET DUMP_OPTIONS/DEVICE=DKA100:
```
6. Update MODPARAMS.DAT on each node for the changes that have been made. The following lists are taken from the MODPARAMS contents generated by the installation and running CLUSTER_CONFIG_LAN.COM:

Common to both nodes	VM1 only	VM2 only
WINDOW_SYSTEM=1	SCSNODE="<VM1_nodename>"	SCSNODE="<VM2_nodename>"
DISK_QUORUM=""	SCSSYSTEMID=	SCSSYSTEMID=
NISCS_LOAD_PEA0=1	<VM1_SCSSYSTEMID>	<VM2_SCSSYSTEMID>
VAXCLUSTER=2	VOTES=1	VOTES=0
EXPECTED_VOTES=1		
MSCP_LOAD=1		
MSCP_SERVE_ALL=5		
INTERCONNECT="NI"		

Common to both nodes	VM1 only	VM2 only
BOOTNODE="NO"		
TTY_TYPAHDSZ=512		
TTY_BUF=132		

Note

Some of these values may not have been set to the desired values (probably MSCP_SERVE_ALL, TTY_TYPAHDSZ, and TTY_BUF). You need to edit both copies of MODPARAMS.DAT and use SYSGEN to update the values in use. Do not forget to enter WRITE CURRENT.

- To set the terminal (and any other) features you want, create a SYLOGIN.COM and/or LOGIN.COM. Among other things, we use:

```
$ SET TERMINAL/WIDTH=132/PAGE=48/INSERT/INQUIRE
```

The values above match the PuTTY setup of the terminal window used in these instructions.

- Set up TCP/IP Services and enter the command @TCPIP\$CONFIG.COM:

- Set Domain to <your_domain_name>
- Set IE0 to <VM1_TCPIP_address_1>/24 = <VM1_nodename> and <VM2_TCPIP_address_1>/24 = <VM2_nodename> (mask = 255.255.255.0). VirtualBox works with 10.0.2.15 and similar addresses.
- Set IE1 to static addresses that work with your local host's network, so you can issue a TELNET command to each node from your local host (but leave the node name associated with IE0). These are <VM1_TCPIP_address_2> and <VM2_TCPIP_address_2>.
- Set IE2 to "No TCP/IP", this adapter is for DECnet.
- Set Default route to an appropriate gateway value. VirtualBox works with 10.0.2.2.
- Set DNS to your extended network's name servers' addresses.
- Make sure FTP and TELNET are both set as CLIENT and SERVER.

- Set up DECnet IV using NETCONFIG.COM and start it with STARTNET.COM:

- Set <VM1_nodename> = <VM1_DECnet_address> and <VM2_nodename> = <VM2_DECnet_address>
- Define LINE and CIRCUIT EIA-2 only (STATE ON)
- Define the other node in the NODE database.

On VM1, enter:

```
$ MCR NCP DEFINE NODE <VM2_DECnet_address> NAME <VM2_nodename>
```

On VM2, enter:

```
$ MCR NCP DEFINE NODE <VM1_DECnet_address> NAME <VM1_nodename>
```

At this point, we have a two-node cluster, with each node running from its own system disk. Each node has a private page/dump disk. The first node (VM1) also has the kit ISO as a third disk (optical drive). For symmetry, the second node (VM2) also has an empty optical drive. For safety, only VM1 has a cluster vote.

A.7. Saving Your Cluster Setup

At this point, it's worth saving all the work that's been done so far. The following method is the easiest way to save the current VMS cluster setup (however, note that it does not save any of the VirtualBox VM configuration data).

Shut down and power off both nodes. Then create a ZIP file of the four DSK files:

- `<VM1_sysdisk_name>.DSK`
- `<VM1_paging_disk_name>.DSK`
- `<VM2_sysdisk_name>.DSK`
- `<VM2_paging_disk_name>.DSK`

Perform the following steps:

1. Use the `CLUSTER_SHUTDOWN` and `POWER_OFF` options in `SHUTDOWN.COM`. Once the virtual machines have exited, use the host to create the ZIP file.
2. On Windows 10, open your "VirtualBox VMs" folder, select all four files, and right-click the selection.
3. In "Send to", choose "Compressed (Zipped) folder".
4. The ZIP file is named after one of the files, so when the ZIP file is populated, rename it.

Note

If you need to restore just one disk from here, that does not mean you have to restore all of them. Simply navigate to the ZIP folder and drag the disk file you need back to the original folder to overwrite it.
