AVS 5.6 FOR COMPAQ TRU64 UNIX ALPHA

CHAPTER FOUR

Introduction

This chapter describes AVS 5.6 as it runs on Compaq Tru64 UNIX Alpha AXP workstations (note Compaq Tru64 UNIX was previously called Digital UNIX or OSF/1 and is equivalent). It covers hardware and software prerequisites needed to run AVS; differences and special considerations for running AVS on this platform; and known problems.

AVS5.6 NOTE: The supported operating system has been updated from Compaq Tru64 UNIX 4.0D to 5.1 and libraries have been compiled with the 6.3 compiler. The supported version of OpenGL is 1.1. AVSGraph has been updated to use Toolmaster 7.2.

NOTE: Additional information on using AVS under X windows, general programming considerations, and bugs fixed in AVS 5.6 can be found in the *AVS 5.6 on UNIX Platforms* chapter above.

Hardware Prerequisites

Workstation Models

This release AVS runs on Compaq 3000 Model 400 AXP, Compaq 3000 Model 500 AXP, and Compaq 4000 AXP computers using Compaq Tru64 UNIX 5.1.

Graphics Hardware

This release of AVS uses two mechanisms to produce its screen renderings of Geometry Viewer objects and scenes:

- a **software renderer** that implements a set of graphics primitives (polygons, lighting model, perspective, shading, color, etc.) in software, rendering the resulting image into an X Window System image.

The **software renderer** will work on any supported workstation model with an 8- or 24-plane color frame buffer, the XPutImage *xlib* call, and a local X server that supports them.

- a Compaq Tru64 UNIX OpenGL **hardware renderer** that uses the Compaq Open3D graphics library and will take advantage of any Compaq Corporation graphics hardware using shared libraries.

  The OpenGL **hardware renderer** will work with any graphics adapter supported by Compaq Open3D, particularly the ZLX and Powerstorm graphics adapters. For more information, see the section on Compaq Tru64 UNIX OpenGL support below.

In most cases, AVS automatically detects which graphics subsystem is present and initializes the correct renderer(s).

See the subsequent section on "Software Prerequisites" for the system software needed to be able to use the hardware rendering capability.

Memory

This version of AVS requires a minimum of 32 megabytes of physical memory to run properly. More real memory will improve performance. In addition to real memory requirements, there is a minimum system swap space size requirement that is described below.

Total System Memory

To see how much memory is on your system, use the *uerf -R* **|** *more* command as root. This lists the system boot log. Look for lines like the following:

```
physical memory = 126.00 megabytes.
available memory = 106.23 megabytes.
```

The first figure is the total system memory, the second is the amount remaining after resident pages of the operating system have been loaded at boot time.

Memory Per Process

Compaq Tru64 UNIX systems can restrict the amount of memory available to any given process on a per-shell basis. There is both a "hard" system limit, and a "soft" system limit.

To see the "soft" limit, enter this *csh* command:

```
limit
```

This produces an output like the following:

```
cputime       unlimited
filesize      unlimited
datasize      131072 kbytes   <-- memory limit
stacksize     2048 kbytes
coredumpsize  unlimited
memoryuse     unlimited
descriptors   4096
```

The same command, entered as root, shows the system hard limits.

Generally, the system default is ample. If it is not, you can increase the limit for the duration of the shell by typing, for example:

```
limit datasize 500000
```

which increases the limit for that shell to 500000 kbytes. To increase the system's hard limit, use the *doconfig* command described in the Compaq publications *Guide to Installing Compaq Tru64 UNIX* and *Guide to System Administration*.

Disk Space

It requires approximately 71 megabytes of disk storage to install AVS from the release CD. More disk storage may be required for swap space (see below).

Swap Space

Recommended Swap Space Size

Many of the algorithms used in AVS modules are memory intensive. Scientific datasets, especially image and volume data, can grow quite rapidly. For example, while a single 64x64x64 element scalar byte field may take up 256 KB of memory, a 256x256x256 element scalar byte field takes up 16 MB, and a 512x512x512 element field takes up 128 MB.

It is recommended that a swap space of at least 128 MB be allocated on systems on which AVS is installed.

Determining Swap Space Size

You can determine the current memory utilization of your Compaq Tru64 UNIX system with the */usr/sbin/swapon -s* and *ps aux* commands.

Executing the following command will show you the the total amount of swap space available, as well as the amount of swap space which is reserved and free:

```
/usr/sbin/swapon -s
```

Executing the following command will give you information about the swap space (VSZ) and current swapped-in memory size (RSS) assigned to each process:

```
ps aux
```

Pre-allocated vs Use-as-Needed Swap Space

Compaq Tru64 UNIX systems can use one of two swap space allocation schemes. In "pre-allocated," the system must have available sufficient swap space to hold all processes running in memory at once. In "use as needed," swap space can be "overcommitted." This means that you can add the amount of memory to the amount of swap space to find the total space available to the process.

The default is pre-allocated. You can change this to use-as-needed. However, as noted below, an OS with use-as-needed swap space turned on may kill a process that requests more swap space than is available. This may be AVS, or it might be a critical system process whose demise could hang the system.

To switch from pre-allocated to use-as-needed, as root simply move the *swapdefaults* file aside and reboot the system:

```
mv /sbin/swapdefault  /sbin/swapdefault.old
sync
sync
reboot
```

Recognizing When You Have Run Out of Swap Space

When you run out of main memory or swap space, the symptoms can be varied.

- If AVS was making a memory allocation request when the shortage occurred, then you may receive an error message box from AVS to this effect:

```
"Failure allocating memory:
See Installation/Release Notes to increase swap space
and/or shared memory segment size"
```

or possibly a message in the terminal emulator window from which AVS was started like:

```
name@system [8] swap space below 10 percent free
Unable to obtain requested swap space
geom_file.c line 528, 5760 bytes
GEOM fatal error:  malloc fails allocating vert list
```

- If some other part of the system (such as the X server) was making the memory allocation request when the shortage occurred, then you will usually receive an error message such as "Not enough memory," or "Running out of swap space" in the terminal emulator window from which AVS was started.

When use-as-needed is enabled, in some cases, no error message will appear. Instead, the X server becomes extremely slow. Indeed, the OS may kill the process causing the swap. If this is a critical system process, such as the X server, the system may hang.

For help on configuring your system's swap device, refer to the *swapon* man page and the Compaq Tru64 UNIX *Advanced Installation Guide* and *Guide to Disk Maintenance.*

Software Prerequisites

Operating System: Compaq Tru64 UNIX

AVS 5.6 will run on version 5.1 of the Compaq Tru64 UNIX operating system; it will likely not run on earlier versions.

The *uname -r* command will show the current revision that is running on your workstation.

Graphics Software

OpenGL

Software Requirements:. If you will be doing hardware rendering, then you must have installed:

- Compaq Open3D providing OpenGL 1.1 for Compaq Tru64 UNIX on the system where AVS will *execute*. OpenGL is part of the Compaq Open3D package. To be able to use OpenGL, you must obtain and register an LMF PAK for Compaq Open3D.

- An OpenGL capable X server on the system where AVS will *display*.

If the system upon which AVS will *display* is not OpenGL capable, then AVS will only initialize its software renderer.

If the system upon which AVS will *display* is OpenGL capable, then AVS will try to initialize its OpenGL renderer. If it cannot find Compaq Open3D and no LMF PAK is registered, then AVS will fail. In this case, you must explicitly start AVS with the "no hardware rendering" option (*avs -nohw*) so that AVS will only initialize its software renderer. (See the "Starting AVS" chapter of the *AVS User's Guide* for more information.)

Finding Out if Software is Installed and Licensed. To find out whether Compaq Open3D is installed on your system, you can type:

```
setld -i | grep Open3D
```

and look for the appropriate OpenGL entries.

To find out whether Open3D software is licensed, as root type:

```
lmf list all
```

Again, look for the appropriate entries.

Performance. AVS 5.6 relies on shared libraries to access OpenGL so in most cases it will take advantage of the local graphics accelerator hardware. In some cases, OpenGL may not fully support the graphics hardware you are using and will not perform substantially better than the software renderer. Review the Compaq Open3D Release Notes to see which hardware is supported and what restrictions may apply to your system. In most installations, the release notes can be found in */usr/lib/OPEN3D*. The release notes can also be found online at *http://www.digital.com/info*. This web site can also be used to download the Open3D software.

Compaq OpenGL 4.7 issues. These are several issues reported in the Compaq Open3D 4.7 release notes that may affect AVS 5.6 users.

Front vs Back Orientation of Polygon Faces:

Problem Description:

According to the Compaq Open3D Version 4.7 Release notes, there are cases where Open3D will miscompute whether a polygon is front facing or back facing. According to section 2.5.10 of the release notes, the workaround is to edit the

/usr/lib/X11/Xserver.O3D.conf file and insert the following line:

```
DoFrontBackTestTheOpenGLWay  True
```

RGB Format:

Problem Description:

On all PowerStorm 4D40T, 4D50T, 4D60T options running under UNIX, there is also an 8-plane TrueColor visual *not* supported by OpenGL. This visual is in "BGR" format where the least-significant 2 bits are the blue component, the next 3 bits are the green component, and the most significant 3 bits are the red component.

Kanji Support. If you wish to use Kanji labels in the Compaq OpenGL hardware renderer you will need these system font files from the Compaq OpenGL/Japanese software subset:

```
font_jisx0201.fnt
font_jisx0208.fnt
```

They should be installed in directory:

```
/usr/lib/X11/strokefonts/pex
```

If you try to render Kanji strings without either font file, you will see raw 16-bit character codes rendered in a standard 8-bit font. If you only have one of the files installed correctly, you may get the following X error:

```
X Error of failed request:
  PEXFontError, specified font ID invalid
  Major opcode of failed request:  139 (X3D-PEX)
  Minor opcode of failed request:  88 (PEX_OpenFont)
```

Stereo

Compaq Tru64 UNIX Alpha now supports "stereo-in-a-window" stereo viewing. For general information on stereo support in AVS 5.6, see the "AVS 5.6 on UNIX Platforms" chapter. The following platform specific stereo information is from the OpenGL release notes:

Supported Hardware

This stereo implementation requires a PowerStorm 4D40T, 4D50T, or 4D60T graphics adapter and compatible MultiSync monitor, such as Digital's VRC15, VRC17, or VRC21 series monitors. StereoGraphics and NuVision stereo hardware are both supported by this implementation.

Note that the stereo connector on the back of the PowerStorm 4DT cards is different from the stereo connector on the back of other Digital graphics adapters. Contact the manufacturer of your stereo hardware to obtain the proper cables to connect your stereo hardware to your PowerStorm 4DxxT card. The cable should match the mini-DIN connector on the back of the PowerStorm card.

Supported Screen Resolutions and Refresh Rates

In order to support normal aspect ratio pixels in stereo mode, the frame buffer is divided into two full height left and right buffers. Because of the increased memory requirements associated with maintaining separate left and right buffers, the maximum screen resolution for each graphics adapter will be slightly smaller than in non-stereo mode.

Maximum Stereo Resolutions

PowerStorm Model	Planes Per Pixel	Max Resolution
4D60T	102	1280x1024
	128	1152x900
4D50T/4D40T	102	800x600
	128	800x600

To select a particular screen resolution and vertical refresh rate, use the ′- screen′ and ′-vsync′ command line options in the X server configuration file. To select an additional vertical refresh rate to be used when the screen is in stereo mode, use the ′-I -e3stereo <rate>′ command line arguments in the Xserver configuration file. Replace <rate> by one of the vertical refresh rates in the table below. Note that the maximum refresh rates indicated may not be supported by all hardware.

If you omit the ′-I -e3stereo <rate>′ arguments in the Xserver configuration file, the server will continue to use the same refresh rate that it was using when the screen was in monoscopic mode. This will be the value that was specified with the ′-vsync′ parameter, or the default refresh rate for this resolution.

The first time that the screen is switched into stereo mode, the Xserver will print out the refresh rate that is being used for stereo. If no ′-vsync′ or ′- e3stereo′ arguments were given, the Xserver will note that stereo mode is using the default refresh rate. This information can be found in the Xserver error log (*/var/dt/Xerrors* or */var/X11/xdm/xdm-errors*).

See your system administrator or refer to your documentation and release notes for more information on configuring the Xserver via the configuration file.

Shared Memory Usage

We recommend that your UNIX kernel be configured for at least 64 shared memory segments per process and that the maximum size of each segment to be 32MB. This can be done by increasing the shmseg system parameter to be at least 64, and the shmmax system parameter to be at least 33554432 (32MB). These parameters should be changed in your system configuration file. After the changes have been make to the configuration file, the UNIX kernel will need to be rebuilt, moved into the system area, and the machine will need to be rebooted.

For help on reconfiguring the UNIX kernel, refer to your UNIX *Guide to System Administration* manual or your *Guide to Installing Compaq Tru64 UNIX*.

Using AVS on Compaq Tru64 UNIX

The following sections describe in detail the differences between using AVS on a Compaq Tru64 UNIX Alpha AXP workstation and AVS as it is described in the standard documentation.

Peripherals

Dial Box

The Dial Box I/O device mentioned in the *AVS User's Guide* is not supported in this release of this product.

Spaceball

The Spaceball device is supported.

Colormap Sharing

Colormap sharing can be a problem if you are using a pseudo color visual type and have hardware rendering enabled. The current AVS system can only run if it can get 135 color table entries from the default X window colormap. If you are running other applications that make heavy use of the color map, this may prevent AVS from being able to start up. In particular, on 8 bit systems, you will be unable to run multiple AVS sessions simultaneously using the same display.

Renderers

See the "Graphics Software" section under "Software Prerequisites" section above for information on what software must be present to run different renderers.

Image Viewer

All functions and behavior in the Image Viewer are as described in the AVS *User's Guide*. The Image Viewer will use as many bits of color as are available on the graphics adapter.

If you are using Compaq ZLX hardware, consult the "Graphics Software" section above for important information about the Image Viewer.

Network Editor

The Network Editor functions as described in the AVS *User's Guide* and *Module Reference* manual, with these few exceptions:

Modules

The following modules documented in the *AVS Module Reference* manual do not appear in the AVS release for Compaq Tru64 UNIX because they require rendering features that are not supported in this release:

alpha blend (requires hardware-assisted alpha transparency)
transform pixmap (requires 2D texture mapping)

Remote Module Execution

This release of AVS 5.6 on Compaq Tru64 UNIX does not currently support DECnet remote module execution. Conventional remote module execution using "rsh" as described in the AVS *User's Guide* is supported however.

Image Output

While using a hardware renderer, if you are using the **image to postscript** module to get output from the **geometry viewer** module, or any of the Animation Application output modules such as **write frame seq**, all parts of the Geometry Viewer scene window must be visible. No parts of the display window can be off the screen or obscured by other windows. If they are, any module downstream of **geometry viewer** will not receive the off-screen or obscured portion of the pixmap.

Graph Viewer

There are no differences between AVS Graph Viewer behavior on Compaq Tru64 UNIX and the Graph Viewer descriptions in the AVS documentation.

Geometry Viewer

The Geometry Viewer (or the **geometry viewer** module) will be using either the software renderer or one of the two hardware renderers to produce the contents of its scene windows.

Rendering Features

The following table lists the rendering features described in the "Geometry Viewer" chapter of the *AVS User's Guide*, including new AVS features, down the left column, and the AVS software renderer, and the Compaq OpenGL hardware renderer across the top. The table intersections show which features are present on each platform, and draw your attention to more detailed explanations of behavior later in this section.

Table 4-1. Geometry Viewer Behavior

Rendering Feature	Software Renderer	Hardware Renderer (OpenGL)
Arbitrary Clip Planes	yes, 8 planes	no (note 1)
Geometric		
Volume Rendering	yes (note 2)	no (note 2)
Vertex Transparency	no (note 3)	no (note 3)
Vertex Colors	yes (note 4)	yes
Edit Property		
RGB/HSV Colors	yes (note 4)	yes
Ambient	yes	yes
Diffusion	yes	yes
Specular Highlights	yes	yes
Gloss	yes	yes
Transparency	yes (note 5)	yes
Metallic	yes	yes
Edit Texture	yes	no
2D Texture Mapping	yes	yes (note 8)
3D Texture Mapping	yes	no
Filtered Textures	no	yes
Tile Textures	no	no
Alpha Textures	yes	no
Rendering Options		
Points	yes	yes
Lines	yes	yes
Smooth Lines	no	no
No Lighting	yes	yes
Outline No Lighting	yes	yes
Flat Shading	yes	yes
Outline Flat	yes	yes
Gouraud Shading	yes	yes
Outline Gouraud	yes	yes
Phong Shading	no	no
Backface Properties		
Cull front	yes	no
Cull back	yes	yes
Flip normals	yes	no
Lights		
Number of Sources	8	8
Ambient	yes	yes
Directional	yes	yes
Bi-Directional	yes	yes, up to 3
Point	yes	yes
Spot	no	yes
Light Colors	yes	yes

Table 4-2. Geometry Viewer Behavior Across Platforms (continued)

Rendering Feature	Software Renderer	Hardware Renderer (OpenGL)
Cameras		
Depth Cue	yes	yes
Global Anti-Alias	no	no
Accelerate	no	no
Perspective	yes	yes
Axes for Scene	yes	yes
Front/Back Clipping	yes	yes
Sorted Transparency	no	no
Polygonal Spheres	yes (note 6)	no
Double Buffer	no	yes (note 7)
Stereo	no	yes
Labels		
Drop Shadow	no	no
Title	yes	yes
Stroke	no	yes
Kanji	yes (note 8)	no

Notes

1. Arbitrary clipping planes are used by the **clip geom** module.

2. "Volume Rendering" is here defined in a very narrow sense: support of a specific option to the **GEOMedit_texture_options** call that is used by the **volume render** module. The fact that the hardware renderer does not support this form of volume rendering only means that it cannot use one of the features of the **volume render** module; it does not mean that the hardware renderer cannot render volumes of data using other rendering techniques.

3. Vertex transparency is used by the **colorize geom** module.

4. When using the software renderer, the number of colors that will appear on the screen (216 pseudocolor, 16,777,216 true color, or some number in between) is dependent upon the X server visual support present on the *display* hardware. Internally, 24-bit true color is always used and will be output on the **geometry viewer** module's image output port.

5. The software renderer supports single-pass transparency. Single-pass transparency correctly renders a transparent surface that is over an opaque surface. (Multi-pass transparency is required to correctly render multiple overlapping transparent surfaces.)

6. A feature in the software renderer is the ability to render spheres directly instead of subdividing them into polygons. This saves a tremendous amount of memory when rendering spheres. The algorithm's execution speed is bound by the size of the spheres it has to render. This feature may be disabled by toggling the **Polygonal Spheres** button under the Cameras menu. Spheres will now be rendered by subdividing them into polygons. Double Buffering is supported on both types of hardware renderer, and is on by default.

7. Label color may be affected by the use of 2D texture mapping.

Programming Considerations

AVS, its modules and component libraries were compiled using the Compaq C compiler (6.3-026) and the standard Unix C libraries located in */lib/libc*. Its FORTRAN components were compiled using the Compaq FORTRAN 77 compiler (5.3).

Compiling and Linking Modules

Note: Please see the information on "GEOMint_color" in Chapter 3, *AVS5.6 on UNIX Platforms* for an issue that will affect modules using the GEOM library on 64 bit platforms.

Use the Example Makefile as Template

You should use the makefile in *<installdir>/avs/examples/Makefile* as the template for your own FORTRAN and C module makefiles. This makefile in turn includes the file *<installdir>/avs/include/Makeinclude* that contains additional macro definitions appropriate to the Compaq Tru64 UNIX platform.

FORTRAN Modules

On 32-bit platforms, pointer and integer data types are the same size and have historically been used as if they were the same. On most 64-bit platforms (Compaq Tru64 UNIX and SGI N64 (*SGN64*)) pointers are 8 bytes and integers are 4 bytes; the two data types can NOT be used interchangeably. See the section on "FORTRAN Modules on 64-bit systems" in the *UNIX Platforms* chapter for critical information on this topic.

AVS on Compaq Tru64 UNIX: Known Problems

This is the list of known problems for AVS 5.6 on the Compaq Tru64 UNIX platforms.

Problem: Label color affected by 2D texture mapping

Problem Description:

Use of 2D Texture mapping in a view may affect the color of labels in the same view.

X10051: va_args does not work with doubles

Problem Description:

Compaq Tru64 UNIX va_args doesn't work with doubles. AVS uses va_args for **AVSmessage** functions, so modules using **AVSerror** to print out doubles will have problems on this platform.

X10277: FORTRAN field modules may dump core

Problem Description:

When you use a module written in FORTRAN that uses **AVSFIELD_POINTS_OFFSET**, if AVS is using shared memory for field data transfer, then the module will core dump. Shared memory transfer of data for fields is the default.

Workaround 1: Run AVS with -noshm.

Workaround 2: Use %VAL as an alternate technique for writing FORTRAN modules. For an example of how to rewrite your FORTRAN modules to use this technique, look at the example module in *$AVS_PATH/examples/test_fld2_f.f*. On Compaq Tru64 UNIX systems, this example will be compiled so that the **use_offset** parameter switches the code between the %VAL and the **AVSFIELD_POINTS_OFFSET** examples. When you are using shared memory transfer, when you toggle the **use_offsets** button on the module control panel, the module will dump core.

X10301: Module Generator FORTRAN should use integer∗8

Problem Description:

The Module Generator fails to provide special %IFDEF statements for pointer parameters like the example FORTRAN modules do or to directly use INTEGER∗8. Example:

```
      integer function colorizer2(in_field, cmap, out_field)
C %IFDEF ALPHA_OSF
      integer*8 in_field, cmap, out_field
C %ELSE
```

```
C      integer in_field, cmap, out_field
C %ENDIF ALPHA_OSF
```

X10766: Certain float fields can crash AVS

Problem Description:

A floating point exception can be generated by several standard field modules in response to extreme data values which should be still representable by the machine's floating point specification.

AVS on Compaq Tru64 UNIX: Fixed Problems

This is the list of fixed problems for AVS 5.6 on the Compaq Tru64 UNIX platform.

27654: Memory Allocation Debugging with MEM_DEFS_ENABLE doesn't work

Problem Description:

This feature provides memory allocation verification and history reporting that help users isolate problems in their own modules; it is described in the *AVS Developer's Guide*, Chapter 4, "Advanced Topics". It was disabled in AVS5.5 because of compilation problems on 64-bit platforms.

The compilation issues have been resolved and the feature is now enabled in AVS5.6. Add the "-DMEM_DEFS_ENABLED" flag to your compilation flags, then at runtime enable the AVS_MEM_* environment variables.