

2. Machine Preparation

Prior to Jaleo installation, you should review your machine setup. Jaleo, as any digital video postproduction application, is a resource-intensive application. Proper setup of the machine is thus of great importance.

2.1 Hardware Configuration

Your workstation needs to be configured to use its disk space and memory efficiently for Jaleo. Jaleo needs a lot of disk space, and you can configure this disk space in different ways. In general, it is highly recommended to have at least one disk drive in addition to the system disk. How this “data drive” can be configured we will discuss in “Further Disk Space Considerations” on page 10.

2.1.1 Obtaining System Hardware Configuration Information

You can easily get a complete list of the hardware configuration of your system by opening a shell window and typing

```
hinv
```

The `hinv` command (“hardware inventory”) will print out a complete list of all internal and external hardware devices, as well as of the basic system components, like CPU type, memory graphics boards etc. It will also give you a list of all SCSI controllers and the connected drives.

Note that `hinv` can also be run from the system monitor, that is you can get hardware configuration information easily from a system that currently is not in a bootable state.

2.1.2 Basic System Disk Setup

A UNIX system disk is usually divided in at least two partitions for various parts of the operating system and for user data etc. Unfortunately, the basic disk setup can not be changed without reinstalling the operating system. If you are not familiar with the process of setting up a system disk, you should ask your dealer or distributor to set up the disk for you according to the recommendations given here. We recommend a system disk setup of the following style:

- One large combined user and root partition. This partition has the partition number 0 on SGI systems.
- A swap partition (see “Swap Space” on page 10 for more information) that has at least a size of two times main memory. Swap partitions have partition number 1 on SGI systems.

Choice of File System

Silicon Graphics currently offers two file systems to choose from. The older `efs` file system can deal with partitions up to 8 Gigabyte logical size. The new `xfs` file system offers much larger possible size and some additional features as well, among them improved performance, improved capabilities for error recovery and special sub-partitions for guaranteed rate IO. The guaranteed rate IO will be discussed in a section below (see “Further Disk Space Considerations” on page 10), but it does not need to be taken into account for the decision of the file system type on a normal system disk.

For normal system disks with a system partition that is not larger than 8 Gigabyte, `efs` still is a reasonable choice. For larger file systems `xf`s must be used. `xf`s can also be used for smaller file systems and is supposed to offer slightly better performance and better recovery performance. If in doubt, contact your SGI distributor and ask for their file system type recommendation for your given configuration.

Creating Partitions

To set up the disk partitioning, use the SGI disk partitioning tool `fx`. It needs to be started in stand-alone mode from CD-ROM if you have to change a default SGI system. Consult the SGI Software Installation Guide for more information. After changing the disk partitioning setup, you will have to reinstall system software. Again, see the appropriate SGI manual for more information.

An example on partitioning for the simple case of creating an option drive for special use with Jaleo can be found in “Configuring Jaleo for Raw Device Operation” on page 53.

Here, only two hints:

- The SGI disk tool `fx` offers a suitable default option for the file system layout of the system disk. Select the `rootdisk` option in the `repartition` menu of `fx` to achieve this layout. You can then resize the swap space using `resize`. Do not forget to select the option `sync` in the `label` menu to write out changes.
- After changing the partitions of a disk that already had a valid UNIX file system before, the installation software often does not automatically rebuild the filing system before attempting installation. You *must* rebuild the file system prior to reinstalling the operating system, because the old setup values will be invalid with the new partition scheme and sooner or later (most probably: sooner) will cause a serious problem. You can do so in a shell that can be opened from the `admin` menu of the `inst` software installation program that you will need to use from the systems prom monitor to reinstall. `Umount` the newly created root partition, use the `mkfs` program to build a new filesystem and remount it to `/root`.

Again, if you do not have principal knowledge about the UNIX installation process on SGI systems, we strongly recommend to ask you dealer or distributor to setup the system for you.

On Partition Concepts

Partition layout on UNIX system at first look is a little bit puzzling, because partitions can be overlapping. On SGI systems there is always one partition for the whole disk (Number 10) that is practically *never* used explicitly. Another partition, 8, is also always present. It is the volume header, 2 MBytes, large, that contains basic volume information. It also usually must *not* be touched. The other partitions commonly used are 0, 1, 6 and 7. For system drives you can either use 0 and 1 or 0, 1 and 6. For option drives you use partition 7.

In UNIX jargon, 0 usually is the root partition, 1 is `swap` and 6 is `/usr`. Today, root and `/usr` are often created on the same partition, what has not been possible prior to IRIX 5.x

Note that 0, 1 and 6 use the same physical disk space as partition 7 and thus you never must attempt to use them at the same time - its a sure way to quick disaster. You can use either of the basic layout schemes - one large partition 7 to cover all the disk as an option drive, or the combination setting of 0 and 1 or 0, 1 and 6 for system drives.

2.1.3 Swap Space

Prior to installation, however, your system disk needs to be configured properly. An important configuration parameter for the system disk is the Swap Space. Swap Space is a designated area of the system disk that can be used by the UNIX operating system to “swap out” memory pages when system memory is filled to a large degree. For interactive programs like Jaleo, swapping activities are highly undesired because they degrade system performance considerably. Still, a sufficient swap space assignment is necessary. As a basic rule, for UNIX it is recommended to have a swap space that is at least two times as large as the system main memory. On SGI systems, there are three possible types of swap space:

- Swap Space in special reserved disk partitions. Swap partitions are fast, but on a system disk you can not change their size without reinstalling the operating system. For Jaleo operation, we highly recommend dedicated swap partitions.
- Swap Space can be set up in special system files in the normal UNIX filing system. This is slower than dedicated swap partitions and thus is not recommended for Jaleo operation. Swap space in files can be expanded at any time, even during system operation.
- Virtual swap space. This is a type of swap space that is not really there. The requirement for virtual swap space stems from a historical property of UNIX systems: Whenever a new process is started, it temporarily inherits a copy of all the memory resources of the process that created it. In many cases, however, especially when a large process starts a small utility program, this memory will never be accessed. To deal with this common case, IRIX, the SGI UNIX implementation, offers virtual swap space, a resource that is present logically but is only assigned to a process that very probably will never use it. Configuring a large virtual swap space can make a lot of sense for a Jaleo Workstation.

Typically, a Jaleo Composite Workstation will be equipped with a large amount of memory (for example, 96 MB). A general recommendation for UNIX workstations is:

- Swap Space should be two times system main memory.

If you have 96 MB memory, you should create a physical swap space of 200 MB and assign an additional virtual swap space of 200 MB.

On Jaleo PLUS systems, a minimum memory requirement is 256 MB of RAM, and 512 MB are certainly better. You may wish to setup swap space of 512 MB or even a Gigabyte. Using a 4 GB system disk thus makes a lot of sense.

Actual swap space setup can be a time consuming process (because it may involve the re-installation of the operating system) that is beyond the scope of this manual. If you do not know how to setup a UNIX system, you should ask your dealer or distributor to setup the system appropriately for you. For more information, consult the SGI system administration guide.

2.1.4 Further Disk Space Considerations

When installing and running Jaleo, you will need space for

- The Jaleo program files
- Your video and production data

There is no need to have both, program and data, on the same disk or disk partition. Here are some recommendations for a standard setup:

Jaleo Data

Jaleo data files come in two flavors:

- One type of files contains information about image and sound material and arrangements made from and effects applied to that material. These files are rather small. A typical environment file (environment files contain a complete description of a production in the reel window) is not larger than 30 KByte, rarely ever should these files grow to be larger than 100 KByte. Clip files that contain clip information are very small (smaller than a kilobyte). As you see, the various information files created with the Jaleo Environment do not require excessive disk space.
- The actual image and sound data itself. These data files can become very large. A second of full resolution PAL CCIR-601 images stored in RGBA format requires roughly 42 Megabyte of disk storage, and additionally preview images need to be stored. To prevent reprocessing of results already computed once, some disk space also needs to be dedicated to caching. If you are using a Cosmo Compress board to create compressed video images, your storage requirements will be lower, but still you will need a lot of disk space. In short, there are four types of data:
 - The full res video images
 - Preview images of reduced resolution for interactive operation
 - Cache data
 - Sound data

While storage of the information files is not very critical due to its modest disk space requirements, setup of image storage is of uttermost importance not only because of space considerations, but also to optimize image access times. Given the speed of todays processors, in some cases system throughput is not that much limited by the processing speed, but by the possible access times to the image data on the disk.

Note that Jaleo allows to decide on storage locations depending on a case-by-case basis. Once the storage system is setup, you can choose for each single clip you create where you want to have it stored. You can thus balance performance, price effectivity and practical considerations, as well as quality depending on the job at hand.

For image material, Jaleo offers the following storage options:

- Images can be stored on a normal file system. This is a convenient method, also it is not very fast. Temporary file system storage is once in a while necessary (for example during some material conversion or input/output processes), but due to speed limitations it is not the optimal solution for production. Specifically, in Jaleo PLUS realtime performance can not be achieved with image material stored on file systems, and multiprocessor usage is also severely slowed down by image load times.

File system storage is flexible though: All types of Jaleo data can be stored here, including full res images, previews, cache data and sound data. Sound data, actually, can only be stored on a file system.

Cosmo Compress-created image clips are stored in one large movie file. You can only store these movie files on file systems. It is not possible to use raw partitions for this purpose.

- Fullres images, previews and cache data can be stored on raw partitions. Raw partitions are disk partitions that are not managed by the very universal and flexible UNIX file system (there is a considerable performance penalty for the flexibility), but directly by Jaleo. For a more complete informal description on Raw partitions, see the introductory chapter of the users manual. Raw partition setup is discussed later in this guide (see “Configuring Jaleo for Raw Device Operation” on page 53). The main disadvantage of raw partitions as a storage location is that the normal UNIX tools can not be used for administration purposes. Jaleo thus comes with a set of raw partition image clip management tools.

Raw partitions can also be build from multiple disk drives, connected to multiple controllers. On large machines, one can achieve remarkable performance with this technique, enough to give realtime access to CCIR-601-format image material as required for Jaleo PLUS.

Even on Jaleo Composite systems, a certain amount of raw device storage is highly recommended, sufficient at least for caching purposes. System performance can be increased by also storing full res images and previews on a raw partition.

For Jaleo PLUS, a disk array operating as a raw device, typically using 4 SCSI controllers and at least 8 disks, is mandatory.

- Full res images can be kept on an external DDR. This is a solution that typically makes only sense as an additional alternative on Jaleo Composite setups. When capturing material from a DDR, Jaleo can be instructed only to create preview images from the material, and make a note of the fact that the original image is actually located on an external DDR. This can be a speed advantage if the data is not used heavily in multilayer setups where full res test renders are required very often. In general, as hard disk space on the computer side is usually much cheaper than DDR space, DDR setups are not of too much importance any more. DDR storage can not be used for preview images and cache data.

Preview Image Storage and Memory Requirements

It is *very* important to understand the impact of the storage location of preview image on system performance. Preview images should be stored on raw devices whenever possible for the following reason:

Preview images stored on a file system, be it in movie file format or as a sequence of single images, can, depending on you machine configuration, typically not be read quick enough for real time playback. Jaleo thus uses memory for intermediate storage in this case. This requires a substantial amount of memory (because even preview images are not exactly small in terms of main memory usage) and may thus lead to swapping activities, i.e. it may force the UNIX operating system to move memory pages to a swap device. Swapping is a comparatively slow process that will have a considerable impact on system interactivity.

Preview images stored on raw partitions can be played back without further demands on memory and thus greatly help to maintain high and stable system performance.

For Jaleo PLUS systems, raw partition storage for all material captured in real time is default anyway. To enable real time operations, raw disk configurations with sufficient performance for real time uncompressed CCIR-601 video are mandatory.

For Composite systems equipped with a Cosmo board, it is currently not possible to create preview files for compressed movies on raw partitions. Therefore, memory requirements for implicit caching will be a little bit higher than for uncompressed data.

Cache Recommendations

Talking about caching, there are two topics to take into consideration:

1. The explicit caching of effect or group clips that is activated using the cache function in the Clip menu of the reel. Explicit caching can be configured to use raw devices, file systems or memory. See “CACHEDEVICE” on page 47 and “MAXMEM” on page 49 for more information.
2. Implicit caching that is forced on the system by play back of clips that have their preview images stored in a non-raw disk location, i.e. as movie files or image sequences on the file system. Implicit caching always requires memory usage, although a configured raw device cache improves system performance. Implicit caching can be prevented by storing possibly all image clips and especially preview images on raw partitions. See “MAXMEM” on page 49 for more information. Note that cosmo-created clips including their previews can currently not be stored on raw partitions, thus demanding more memory for implicit caching.

For all Jaleo systems, you should possibly always setup the explicit cache to use a raw partition. Should this, for example in a very small Jaleo Composite configuration, not be possible, at least set up the cache to use the disk drive. Using main memory for caching is strictly discouraged. Whenever your memory is full, memory cache performance may, due to swapping, easily drop even below the level of uncached operations. To repeat, plan your system configuration to have enough raw device storage to make caching on a raw device possible. Explicit cache placement should be assigned in this priority:

1. Use raw partitions (highly recommended)
2. Use a file system partition
3. Use memory caching (discouraged)

The cache location is determined with the configuration parameters in the `.jaleorc` configuration file. See “Configuring Jaleo Operation using the `.jaleorc` File” on page 45 for more information.

Again, for image clips that have their preview images stored on file systems in no matter what format, a certain amount of implicit memory caching will occur. To prevent this, use raw device storage of clips wherever possible.

Disk Space Partitioning Recommendations for Jaleo Composite

- Place the Jaleo account with the Jaleo program files on your system disk, provided it is large enough. After Jaleo installation, you should have at least 1 Gigabyte free storage for your information files, sound data and temporary file system storage of images. As always, the more space you have, the better. If your system disk is to full due to requirements of other software packages, consider adding a second drive with a file system dedicated for Jaleo.

- Configure a second disk drive with at least 2 GB capacity as a raw partition. Note that you can combine multiple disk drives to a single “logical volume” to extend capacity. The raw partition will be used for full res image and preview storage, as well as for caches. As always, the more space you have, the better.
- Use your DDR as a secondary storage location when appropriate for the job at hand.

Disk Space Partitioning Recommendations for Jaleo PLUS

- Due to the large memory and swap space requirements on multi processor machines, you will probably always want to use a 4 GB system disk. On this disk you should be able to store the Jaleo software and still have enough temporary disk space. If you also have other applications that need disk space, consider adding a second file system disk dedicated to Jaleo.
- For real time operation, you must have an array of disk drives configured as a logical volume. Typically, you will have to stripe at least 8 drives over at least 4 controllers.

Network Drives

Giving a citation from a New York city traffic sign, one would be tempted to say: “Don’t even think of parking here”. Although using networked drives physically located on a remote system is technically perfectly possible, it should not be used unless you have a high performance network (FDDI or ATM) available. The performance penalty for network operation via the Ethernet is severe. This is not only due to the limited network bandwidth, but also to the fact that the Network File System, used to give transparent access to remote disk drives, does impose further performance cost. Using ATM or FDDI you can get closer to the performance of a normal file system disk, provided the server can deliver enough performance.

- If you plan to use ATM or FDDI, try to use the newest NFS release from Silicon Graphics, on both clients and servers, as it provides much better performance than previous releases.
- Use the new cache file system from SGI to cache often required files locally. You will need to dedicate some disk space to the network cache, but performance increase should be worth it.

Raw Devices Versus xfs

As mentioned above, the `xfs` file system offers guaranteed rate IO features that sound like an attractive feature for the high performance disk access as necessary for Jaleo PLUS and, to a lesser extend, Jaleo Composite.

To achieve guaranteed rate IO, the `xfs` file system must be configured with a special sub-partition (a real time partition). This partition, quite similar to raw devices, is not accessible for the majority of UNIX system tools. Some of the very basic UNIX commands can be applied to realtime partitions, but the majority of tools is not applicable.

The guaranteed rate IO features are primarily intended to prevent resource conflicts when for example a video server needs to produce a few dozen streams of compressed video from a single disk resource. In this situation, the `xfs` file system allows to register appropriate requests for resource bandwidth and makes sure that not more requests can be registered than can be fulfilled with the resources available. `xfs` realtime partitions do not, however, provide more performance than a simple raw device. They only deal with multiple clients trying to access the same scarce resource, imposing some hurdles for programs to accomplish that goal. For an application that

needs all the available IO bandwidth at once anyway, for example to produce a single stream of uncompressed video, the `xf86` guaranteed rate IO does not help, as there is nothing to negotiate.

Applications like Jaleo PLUS need all the IO bandwidth. Therefore, neither Jaleo PLUS nor Jaleo Composite use the `xf86` option of real time partitions for high performance image storage, because the same effect in the particular situation of full CCIR-601 digital video post production can be reached in a much simpler way by using raw devices.

2.2 Operating System Configuration

The minimum SGI IRIX release you need to run Jaleo software is IRIX 5.2. IRIX system software consists of a number of software subsets. Some of these subsets are mandatory, others are optional. Generally, the standard software subset collection contains most of the subsets required to run Jaleo. The following list contains the subsets required by Jaleo. On IRIX 5.2, you have to run the installation program `inst` from a shell, logged in as root, to install additional subsets. On IRIX 5.3 and later, you can also use the graphical application `swmgr` that allows very comfortable access to your software subsets. You will still have to log in as root. Unfortunately, `swmgr` gives different names to software subsystems than `inst`. To maintain compatibility, in the following sections, we use the names as given by `inst` and associated shell tools.

Note: Installation of mandatory system subsets is not possible from a normal user account. As mentioned in the sections above, if you are not familiar with SGI system setup, leave the necessary steps to you dealer or distributor.

To get a list of software subsets installed on your system, open a shell window and type:

```
versions -b
```

and hit return. A list of software subsets appear. Note: In the following list, we ignore all subsets that are mandatory or that are optional, but necessary to run the graphical X Windows desktop. An SGI system configured for shell only-operation is not suitable to run Jaleo. All respective subsets are definitely included in the default installation subsets of all SGI systems with built-in graphics.

These are the subsets to put attention on:

- `ViewKit_eoe`. This is a subset that is installed by default. SGI's desktop applications will not run without `ViewKit_eoe` installed.
- `dmmedia_eoe`. This subset is required to run applications that use SGI's digital media libraries.
- `il_eoe`. This subset is required by programs using the SGI ImageVision library.
- `inventor_eoe`. This subset is required by programs using IRIS Inventor.

If your system is equipped with video hardware, you will need the appropriate driver software. This software will be delivered with the respective boards. Typical subsystems are:

- `cosmo`. The driver for the cosmo compress board to work with Indy and Galileo video cards.
- `galileo`. The driver for the Indy and Galileo video board.
- `sirius`. The driver for the sirius board (Jaleo PLUS systems only)
- `vino`. The driver for the built-in Indy video system.

Useful software subsets, although not mandatory, are:

- `insight`. The IRIX online help system.
- `desktop_help`. The desktop help system
- `dmedia_tools`. SGIs media utility applications.
- `ee2_sw.imgtools` and `ee2_man.imgtools`. These are useful utility programs (shell level to deal with images of various formats and to do other useful stuff. For the user capable of using shell commands and shell scripts, those can be very valuable. Documentation for these programs can be found in the manual page section 7.