

# **Filesystem Hierarchy Standard**

**LSB Workgroup, The Linux Foundation**

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LSB Workgroup, The Linux Foundation

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## Abstract

This standard consists of a set of requirements and guidelines for file and directory placement under UNIX-like operating systems. The guidelines are intended to support interoperability of applications, system administration tools, development tools, and scripts as well as greater uniformity of documentation for these systems.

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# Dedication

This release is dedicated to the memory of Christopher Yeoh, a long-time friend and colleague, and one of the original editors of the FHS. Without his dedication this work would not have been possible.

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# Chapter 1. Introduction

## 1.1. Purpose

This standard enables:

- Software to predict the location of installed files and directories, and
- Users to predict the location of installed files and directories.

We do this by:

- Specifying guiding principles for each area of the filesystem,
- Specifying the minimum files and directories required,
- Enumerating exceptions to the principles, and
- Enumerating specific cases where there has been historical conflict.

The FHS document is used by:

- Independent software suppliers to create applications which are FHS compliant, and work with distributions which are FHS compliant,
- OS creators to provide systems which are FHS compliant, and
- Users to understand and maintain the FHS compliance of a system.

The FHS document has a limited scope:

- Local placement of local files is a local issue, so FHS does not attempt to usurp system administrators.
- FHS addresses issues where file placements need to be coordinated between multiple parties such as local sites, distributions, applications, documentation, etc.

## 1.2. Conventions

We recommend that you read a typeset version of this document rather than the plain text version. In the typeset version, the names of files and directories are displayed in a constant-width font.

Components of filenames that vary are represented by a description of the contents enclosed in "<" and ">" characters, *<thus>*. Electronic mail addresses are also enclosed in "<" and ">" but are shown in the usual typeface.

Optional components of filenames are enclosed in "[" and "]" characters and may be combined with the "<" and ">" convention. For example, if a filename is allowed to occur either with or without an extension, it might be represented by *<filename>[.<extension>]*.

Variable substrings of directory names and filenames are indicated by "\*".

The sections of the text marked as *Rationale* are explanatory and are non-normative.



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# Chapter 2. The Filesystem

This standard assumes that the operating system underlying an FHS-compliant file system supports the same basic security features found in most UNIX filesystems.

It is possible to define two independent distinctions among files: shareable vs. unshareable and variable vs. static. In general, files that differ in either of these respects should be located in different directories. This makes it easy to store files with different usage characteristics on different filesystems.

"Shareable" files are those that can be stored on one host and used on others. "Unshareable" files are those that are not shareable. For example, the files in user home directories are shareable whereas device lock files are not.

"Static" files include binaries, libraries, documentation files and other files that do not change without system administrator intervention. "Variable" files are files that are not static.

## Rationale

Shareable files can be stored on one host and used on several others. Typically, however, not all files in the filesystem hierarchy are shareable and so each system has local storage containing at least its unshareable files. It is convenient if all the files a system requires that are stored on a foreign host can be made available by mounting one or a few directories from the foreign host.

Static and variable files should be segregated because static files, unlike variable files, can be stored on read-only media and do not need to be backed up on the same schedule as variable files.

Historical UNIX-like filesystem hierarchies contained both static and variable files under both `/usr` and `/etc`. In order to realize the advantages mentioned above, the `/var` hierarchy was created and all variable files were transferred from `/usr` to `/var`. Consequently `/usr` can now be mounted read-only (if it is a separate filesystem). Variable files have been transferred from `/etc` to `/var` over a longer period as technology has permitted.

Here is an example of a FHS-compliant system. (Other FHS-compliant layouts are possible.)

	<b>shareable</b>	<b>unshareable</b>
static	<code>/usr</code> <code>/opt</code>	<code>/etc</code> <code>/boot</code>
variable	<code>/var/mail</code> <code>/var/spool/news</code>	<code>/var/run</code> <code>/var/lock</code>

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# Chapter 3. The Root Filesystem

## 3.1. Purpose

The contents of the root filesystem must be adequate to boot, restore, recover, and/or repair the system.

- To boot a system, enough software and data must be present on the root partition to mount other filesystems. This includes utilities, configuration, boot loader information, and other essential start-up data. `/usr`, `/opt`, and `/var` are designed such that they may be located on other partitions or filesystems.
- To enable recovery and/or repair of a system, those utilities needed by an experienced maintainer to diagnose and reconstruct a damaged system must be present on the root filesystem.
- To restore a system, those utilities needed to restore from system backups (on floppy, tape, etc.) must be present on the root filesystem.

### Rationale

The minimum requirements for the root filesystem should be as small as reasonably possible, but no smaller. While many users may not want the extra complexity of a partitioned system, the option to keep the root small should be preserved for several reasons:

- It is occasionally mounted from very small media.
- The root filesystem contains many system-specific configuration files. Possible examples include a kernel that is specific to the system, a specific hostname, etc. This means that the root filesystem isn't always shareable between networked systems. Keeping it small on servers in networked systems minimizes the amount of lost space for areas of unshareable files. It also allows workstations with smaller local hard drives.
- While you may have the root filesystem on a large partition, and may be able to fill it to your heart's content, there will be people with smaller partitions. If you have more files installed, you may find incompatibilities with other systems using root filesystems on smaller partitions. If you are a developer then you may be turning your assumption into a problem for a large number of users.
- Disk errors that corrupt data on the root filesystem are a greater problem than errors on any other partition. A small root filesystem is less prone to corruption as the result of a system crash.

These considerations must be balanced against the need for a minimally useful operating environment, for the sake of the boot process as well as in failure recovery situations.

Applications must never create or require special files or subdirectories in the root directory. Other locations in the FHS hierarchy provide more than enough flexibility for any package.

### Rationale

There are several reasons why creating a new subdirectory of the root filesystem is prohibited:

- It demands space on a root partition which the system administrator may want kept small and simple for either performance or security reasons.

- It evades whatever discipline the system administrator may have set up for distributing standard file hierarchies across mountable volumes.

Distributions should not create new directories in the root hierarchy without extremely careful consideration of the consequences including for application portability.

## 3.2. Requirements

The following directories, or symbolic links to directories, are required in /.

Directory	Description
bin	Essential command binaries
boot	Static files of the boot loader
dev	Device files
etc	Host-specific system configuration
lib	Essential shared libraries and kernel modules
media	Mount point for removable media
mnt	Mount point for mounting a filesystem temporarily
opt	Add-on application software packages
run	Data relevant to running processes
sbin	Essential system binaries
srv	Data for services provided by this system
tmp	Temporary files
usr	Secondary hierarchy
var	Variable data

Each directory listed above is specified in detail in separate subsections below. /usr and /var each has a complete section in this document due to the complexity of those directories.

## 3.3. Specific Options

The following directories, or symbolic links to directories, must be in /, if the corresponding subsystem is installed:

Directory	Description
home	User home directories (optional)
lib<qual>	Alternate format essential shared libraries (optional)
root	Home directory for the root user (optional)

Each directory listed above is specified in detail in separate subsections below.

## 3.4. /bin : Essential user command binaries (for use by all users)

### 3.4.1. Purpose

/bin contains commands that may be used by both the system administrator and by users, but which are required when no other filesystems are mounted (e.g. in single user mode). It may also contain commands which are used indirectly by scripts.<sup>1</sup>

### 3.4.2. Requirements

There must be no subdirectories in /bin.

The following commands, or symbolic links to commands, are required in /bin:

Command	Description
<b>cat</b>	Utility to concatenate files to standard output
<b>chgrp</b>	Utility to change file group ownership
<b>chmod</b>	Utility to change file access permissions
<b>chown</b>	Utility to change file owner and group
<b>cp</b>	Utility to copy files and directories
<b>date</b>	Utility to print or set the system data and time
<b>dd</b>	Utility to convert and copy a file
<b>df</b>	Utility to report filesystem disk space usage
<b>dmesg</b>	Utility to print or control the kernel message buffer
<b>echo</b>	Utility to display a line of text
<b>false</b>	Utility to do nothing, unsuccessfully
<b>hostname</b>	Utility to show or set the system's host name
<b>kill</b>	Utility to send signals to processes
<b>ln</b>	Utility to make links between files
<b>login</b>	Utility to begin a session on the system
<b>ls</b>	Utility to list directory contents
<b>mkdir</b>	Utility to make directories
<b>mknod</b>	Utility to make block or character special files
<b>more</b>	Utility to page through text
<b>mount</b>	Utility to mount a filesystem
<b>mv</b>	Utility to move/rename files
<b>ps</b>	Utility to report process status
<b>pwd</b>	Utility to print name of current working directory
<b>rm</b>	Utility to remove files or directories

---

<sup>1</sup> Command binaries that are not essential enough to place into /bin must be placed in /usr/bin, instead. Items that are required only by non-root users (the X Window System, chsh, etc.) are generally not essential enough to be placed into the root partition.

Command	Description
<b>rmdir</b>	Utility to remove empty directories
<b>sed</b>	The `sed' stream editor
<b>sh</b>	POSIX compatible command shell
<b>stty</b>	Utility to change and print terminal line settings
<b>su</b>	Utility to change user ID
<b>sync</b>	Utility to flush filesystem buffers
<b>true</b>	Utility to do nothing, successfully
<b>umount</b>	Utility to unmount file systems
<b>uname</b>	Utility to print system information

If **/bin/sh** is not the POSIX compatible shell command itself, it must be a hard or symbolic link to the real shell command.

The **[** and **test** commands must be placed together in either **/bin** or **/usr/bin**.

### Rationale

Various shells behave differently when called as **sh**, so as to preserve POSIX compatibility while allowing changes or extensions to POSIX when desired.

The requirement for the **[** and **test** commands to be included as binaries (even if implemented internally by the shell) is shared with the POSIX.1-2008 standard.

## 3.4.3. Specific Options

The following programs, or symbolic links to programs, must be in **/bin** if the corresponding subsystem is installed:

Command	Description
<b>csh</b>	The C shell (optional)
<b>ed</b>	The `ed' editor (optional)
<b>tar</b>	The tar archiving utility (optional)
<b>cpio</b>	The cpio archiving utility (optional)
<b>gzip</b>	The GNU compression utility (optional)
<b>gunzip</b>	The GNU uncompression utility (optional)
<b>zcat</b>	The GNU uncompression utility (optional)
<b>netstat</b>	The network statistics utility (optional)
<b>ping</b>	The ICMP network test utility (optional)

**/bin/csh** may be a symbolic link to **/bin/tcsh** or **/usr/bin/tcsh**.

### Rationale

The **tar**, **gzip** and **cpio** commands have been added to make restoration of a system possible (provided that **/** is intact).

Conversely, if no restoration from the root partition is ever expected, then these binaries might be omitted (e.g., a ROM chip root, mounting **/usr** through NFS). If restoration of a system

is planned through the network, then **ftp** or **tftp** (along with everything necessary to get an ftp connection) must be available on the root partition.

## 3.5. /boot : Static files of the boot loader

### 3.5.1. Purpose

This directory contains everything required for the boot process except configuration files not needed at boot time and the map installer. Thus `/boot` stores data that is used before the kernel begins executing user-mode programs. This may include saved master boot sectors and sector map files.

Programs necessary to arrange for the boot loader to be able to boot a file must be placed in `/sbin`. Configuration files for boot loaders that are not required at boot time must be placed in `/etc`.

### 3.5.2. Specific Options

The operating system kernel must be located in either `/` or `/boot`.

Certain architectures may have other requirements for `/boot` related to limitations or expectations specific to that architecture. These requirements are not enumerated here; distributions are allowed to add requirements as needed to enable system startup on these architectures.

## 3.6. /dev : Device files

### 3.6.1. Purpose

The `/dev` directory is the location of special or device files.

### 3.6.2. Specific Options

If it is possible that devices in `/dev` will need to be manually created, `/dev` must contain a command named `MAKEDEV`, which can create devices as needed. It may also contain a `MAKEDEV.local` for any local devices.

If required, `MAKEDEV` must have provisions for creating any device that may be found on the system, not just those that a particular distribution installs.

## 3.7. /etc : Host-specific system configuration

### 3.7.1. Purpose

The `/etc` hierarchy contains configuration files. A "configuration file" is a local file used to control the operation of a program; it must be static and cannot be an executable binary.<sup>2</sup>

It is recommended that files be stored in subdirectories of `/etc` rather than directly in `/etc`.

### 3.7.2. Requirements

No binaries may be located under `/etc`.

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<sup>2</sup> To be clear, `/etc` may contain executable scripts, such as the command scripts commonly called by `init` to start and shut down the system and start daemon processes. "Executable binary" in this context refers to direct machine code or pseudocode not in a human-readable format, such as native ELF executables.

The following directories, or symbolic links to directories are required in `/etc`:

Directory	Description
<code>opt</code>	Configuration for <code>/opt</code>

### 3.7.3. Specific Options

The following directories, or symbolic links to directories must be in `/etc`, if the corresponding subsystem is installed:

Directory	Description
<code>X11</code>	Configuration for the X Window system (optional)
<code>sgml</code>	Configuration for SGML (optional)
<code>xml</code>	Configuration for XML (optional)

The following files, or symbolic links to files, must be in `/etc` if the corresponding subsystem is installed:<sup>3</sup>

File	Description
<code>csh.login</code>	Systemwide initialization file for C shell logins (optional)
<code>exports</code>	NFS filesystem access control list (optional)
<code>fstab</code>	Static information about filesystems (optional)
<code>ftusers</code>	FTP daemon user access control list (optional)
<code>gateways</code>	File which lists gateways for routed (optional)
<code>gettydefs</code>	Speed and terminal settings used by getty (optional)
<code>group</code>	User group file (optional)
<code>host.conf</code>	Resolver configuration file (optional)
<code>hosts</code>	Static information about host names (optional)
<code>hosts.allow</code>	Host access file for TCP wrappers (optional)
<code>hosts.deny</code>	Host access file for TCP wrappers (optional)
<code>hosts.equiv</code>	List of trusted hosts for rlogin, rsh, rcp (optional)
<code>hosts.lpd</code>	List of trusted hosts for lpd (optional)
<code>inetd.conf</code>	Configuration file for inetd (optional)
<code>inittab</code>	Configuration file for init (optional)
<code>issue</code>	Pre-login message and identification file (optional)
<code>ld.so.conf</code>	List of extra directories to search for shared libraries (optional)
<code>motd</code>	Post-login message of the day file (optional)
<code>mtab</code>	Dynamic information about filesystems (optional)
<code>mtools.conf</code>	Configuration file for mtools (optional)

<sup>3</sup> Systems that use the shadow password suite will have additional configuration files in `/etc` (`/etc/shadow` and others) and programs in `/usr/sbin` (`useradd`, `usermod`, and others).

File	Description
networks	Static information about network names (optional)
passwd	The password file (optional)
printcap	The lpd printer capability database (optional)
profile	Systemwide initialization file for sh shell logins (optional)
protocols	IP protocol listing (optional)
resolv.conf	Resolver configuration file (optional)
rpc	RPC protocol listing (optional)
securetty	TTY access control for root login (optional)
services	Port names for network services (optional)
shells	Pathnames of valid login shells (optional)
syslog.conf	Configuration file for syslogd (optional)

mtab does not fit the static nature of `/etc`: it is excepted for historical reasons.<sup>4</sup>

## 3.7.4. `/etc/opt` : Configuration files for `/opt`

### 3.7.4.1. Purpose

Host-specific configuration files for add-on application software packages must be installed within the directory `/etc/opt/<subdir>`, where `<subdir>` is the name of the subtree in `/opt` where the static data from that package is stored.

### 3.7.4.2. Requirements

No structure is imposed on the internal arrangement of `/etc/opt/<subdir>`.

If a configuration file must reside in a different location in order for the package or system to function properly, it may be placed in a location other than `/etc/opt/<subdir>`.

#### Rationale

Refer to the rationale for `/opt`.

## 3.7.5. `/etc/X11` : Configuration for the X Window System (optional)

### 3.7.5.1. Purpose

`/etc/X11` is the location for all X11 host-specific configuration. This directory is necessary to allow local control if `/usr` is mounted read only.

### 3.7.5.2. Specific Options

The following files, or symbolic links to files, must be in `/etc/X11` if the corresponding subsystem is installed:

<sup>4</sup> On some Linux systems, this may be a symbolic link to `/proc/mounts`, in which case this exception is not required.



File	Description
<code>xorg.conf</code>	The configuration file for X.org versions 7 and later (optional)
<code>Xmodmap</code>	Global X11 keyboard modification file (optional)

Subdirectories of `/etc/X11` may include those for `xdm` and for any other programs (some window managers, for example) that need them.<sup>5</sup>

## 3.7.6. `/etc/sgml` : Configuration files for SGML (optional)

### 3.7.6.1. Purpose

Generic configuration files defining high-level parameters of the SGML systems are installed here. Files with names `*.conf` indicate generic configuration files. File with names `*.cat` are the DTD-specific centralized catalogs, containing references to all other catalogs needed to use the given DTD. The super catalog file `catalog` references all the centralized catalogs.

## 3.7.7. `/etc/xml` : Configuration files for XML (optional)

### 3.7.7.1. Purpose

Generic configuration files defining high-level parameters of the XML systems are installed here. Files with names `*.conf` indicate generic configuration files. The super catalog file `catalog` references all the centralized catalogs.

## 3.8. `/home` : User home directories (optional)

### 3.8.1. Purpose

`/home` is a fairly standard concept, but it is clearly a site-specific filesystem.<sup>6</sup> The setup will differ from host to host. Therefore, no program should assume any specific location for a home directory, rather it should query for it.<sup>7</sup>

### 3.8.2. Requirements

User specific configuration files for applications are stored in the user's home directory in a file that starts with the `'.'` character (a "dot file"). If an application needs to create more than one dot file then they should be placed in a subdirectory with a name starting with a `'.'` character, (a "dot directory"). In this case the configuration files should not start with the `'.'` character.<sup>8</sup>

<sup>5</sup> `/etc/X11/xdm` holds the configuration files for `xdm`. These are most of the files previously found in `/usr/lib/X11/xdm`. Some local variable data for `xdm` is stored in `/var/lib/xdm`.

<sup>6</sup> Different people prefer to place user accounts in a variety of places. This section describes only a suggested placement for user home directories; nevertheless we recommend that all FHS-compliant distributions use this as the default location for user home directories. Non-login accounts created for administrative purposes often have their home directories elsewhere.

On smaller systems, each user's home directory is typically implemented as a subdirectory directly under `/home`, for example `/home/smith`, `/home/torvalds`, `/home/operator`, etc. On large systems (especially when the `/home` directories are shared amongst many hosts using NFS) it is useful to subdivide user home directories. Subdivision may be accomplished by using subdirectories such as `/home/staff`, `/home/guests`, `/home/students`, etc.

<sup>7</sup> To find a user's home directory, use a library function such as `getpwent`, `getpwent_r` or `fgetpwent` rather than relying on `/etc/passwd` because user information may be stored remotely using systems such as NIS.

<sup>8</sup> It is recommended that, apart from autosave and lock files, programs should refrain from creating non dot files or directories in a home directory without user consent.

### 3.8.3. Home Directory Specifications and Conventions

A number of efforts have been made in the past to standardize the layout of home directories, including the XDG Base Directories specification<sup>9</sup> and the GLib conventions on user directory contents.<sup>10</sup> Additional efforts in this direction are possible in the future. To accommodate software which makes use of these specifications and conventions, distributions may create directory hierarchies which follow the specifications and conventions. Those directory hierarchies may be located underneath home directories.

## 3.9. /lib : Essential shared libraries and kernel modules

### 3.9.1. Purpose

The `/lib` directory contains those shared library images needed to boot the system and run the commands in the root filesystem, ie. by binaries in `/bin` and `/sbin`.<sup>11</sup>

### 3.9.2. Requirements

At least one of each of the following filename patterns are required (they may be files, or symbolic links):

File	Description
<code>libc.so.*</code>	The dynamically-linked C library (optional)
<code>ld*</code>	The execution time linker/loader (optional)

If a C preprocessor is installed, `/lib/cpp` must be a reference to it, for historical reasons.<sup>12</sup>

### 3.9.3. Specific Options

The following directories, or symbolic links to directories, must be in `/lib`, if the corresponding subsystem is installed:

Directory	Description
<code>modules</code>	Loadable kernel modules (optional)

## 3.10. /lib<qual> : Alternate format essential shared libraries (optional)

### 3.10.1. Purpose

There may be one or more variants of the `/lib` directory on systems which support more than one binary format requiring separate libraries.<sup>13</sup>

<sup>9</sup>Found at <http://standards.freedesktop.org/basedir-spec/basedir-spec-latest.html> and <http://www.freedesktop.org/wiki/Software/xdg-user-dirs>.

<sup>10</sup>A description of GLib's conventions can be found in the documentation for GUserDirectory, at <http://developer.gnome.org/glib/unstable/glib-Miscellaneous-Utility-Functions.html#GUserDirectory>.

<sup>11</sup> Shared libraries that are only necessary for binaries in `/usr` (such as any X Window binaries) must not be in `/lib`. Only the shared libraries required to run binaries in `/bin` and `/sbin` may be here. In particular, the library `libm.so.*` may also be placed in `/usr/lib` if it is not required by anything in `/bin` or `/sbin`.

<sup>12</sup> The usual placement of this binary is `/usr/bin/cpp`.

<sup>13</sup> This is commonly used for 64-bit or 32-bit support on systems which support multiple binary formats, but require libraries of the same name. In this case, `/lib32` and `/lib64` might be the library directories, and `/lib` a symlink to one of them.

## 3.10.2. Requirements

If one or more of these directories exist, the requirements for their contents are the same as the normal `/lib` directory, except that `/lib<qual>/cpp` is not required.<sup>14</sup>

## 3.11. `/media` : Mount point for removable media

### 3.11.1. Purpose

This directory contains subdirectories which are used as mount points for removable media such as floppy disks, cdroms and zip disks.

#### Rationale

Historically there have been a number of other different places used to mount removable media such as `/cdrom`, `/mnt` or `/mnt/cdrom`. Placing the mount points for all removable media directly in the root directory would potentially result in a large number of extra directories in `/`. Although the use of subdirectories in `/mnt` as a mount point has recently been common, it conflicts with a much older tradition of using `/mnt` directly as a temporary mount point.

### 3.11.2. Specific Options

The following directories, or symbolic links to directories, must be in `/media`, if the corresponding subsystem is installed:

Directory	Description
<code>floppy</code>	Floppy drive (optional)
<code>cdrom</code>	CD-ROM drive (optional)
<code>cdrecorder</code>	CD writer (optional)
<code>zip</code>	Zip drive (optional)

On systems where more than one device exists for mounting a certain type of media, mount directories can be created by appending a digit to the name of those available above starting with '0', but the unqualified name must also exist.<sup>15</sup>

## 3.12. `/mnt` : Mount point for a temporarily mounted filesystem

### 3.12.1. Purpose

This directory is provided so that the system administrator may temporarily mount a filesystem as needed. The content of this directory is a local issue and should not affect the manner in which any program is run.

---

<sup>14</sup> `/lib<qual>/cpp` is still permitted: this allows the case where `/lib` and `/lib<qual>` are the same (one is a symbolic link to the other).

<sup>15</sup> A compliant distribution with two CDROM drives might have `/media/cdrom0` and `/media/cdrom1` with `/media/cdrom` a symlink to either of these.

This directory must not be used by installation programs: a suitable temporary directory not in use by the system must be used instead.

## 3.13. /opt : Add-on application software packages

### 3.13.1. Purpose

/opt is reserved for the installation of add-on application software packages.

A package to be installed in /opt must locate its static files in a separate /opt/<package> or /opt/<provider> directory tree, where <package> is a name that describes the software package and <provider> is the provider's LANANA registered name.

### 3.13.2. Requirements

Directory	Description
<package>	Static package objects
<provider>	LANANA registered provider name

The directories /opt/bin, /opt/doc, /opt/include, /opt/info, /opt/lib, and /opt/man are reserved for local system administrator use. Packages may provide "front-end" files intended to be placed in (by linking or copying) these reserved directories by the local system administrator, but must function normally in the absence of these reserved directories.

Programs to be invoked by users must be located in the directory /opt/<package>/bin or under the /opt/<provider> hierarchy. If the package includes UNIX manual pages, they must be located in /opt/<package>/share/man or under the /opt/<provider> hierarchy, and the same substructure as /usr/share/man must be used.

Package files that are variable (change in normal operation) must be installed in /var/opt. See the section on /var/opt for more information.

Host-specific configuration files must be installed in /etc/opt. See the section on /etc for more information.

No other package files may exist outside the /opt, /var/opt, and /etc/opt hierarchies except for those package files that must reside in specific locations within the filesystem tree in order to function properly. For example, device lock files must be placed in /var/lock and devices must be located in /dev.

Distributions may install and otherwise manage software in /opt under an appropriately registered subdirectory.

#### Rationale

The use of /opt for add-on software is a well-established practice in the UNIX community. The System V Application Binary Interface [AT&T 1990], based on the System V Interface Definition (Third Edition), provides for an /opt structure very similar to the one defined here.

The Intel Binary Compatibility Standard v. 2 (iBCS2) also provides a similar structure for /opt.

Generally, all data required to support a package on a system must be present within `/opt/<package>`, including files intended to be copied into `/etc/opt/<package>` and `/var/opt/<package>` as well as reserved directories in `/opt`.

The minor restrictions on distributions using `/opt` are necessary because conflicts are possible between distribution-installed and locally-installed software, especially in the case of fixed pathnames found in some binary software.

The structure of the directories below `/opt/<provider>` is left up to the packager of the software, though it is recommended that packages are installed in `/opt/<provider>/<package>` and follow a similar structure to the guidelines for `/opt/<package>`. A valid reason for diverging from this structure is for support packages which may have files installed in `/opt/<provider>/lib` or `/opt/<provider>/bin`.

## 3.14. `/root` : Home directory for the root user (optional)

### 3.14.1. Purpose

The root account's home directory may be determined by developer or local preference, but this is the recommended default location.<sup>16</sup>

## 3.15. `/run` : Run-time variable data

### 3.15.1. Purpose

This directory contains system information data describing the system since it was booted. Files under this directory must be cleared (removed or truncated as appropriate) at the beginning of the boot process.

The purposes of this directory were once served by `/var/run`. In general, programs may continue to use `/var/run` to fulfill the requirements set out for `/run` for the purposes of backwards compatibility. Programs which have migrated to use `/run` should cease their usage of `/var/run`, except as noted in the section on `/var/run`.

Programs may have a subdirectory of `/run`; this is encouraged for programs that use more than one run-time file. Users may also have a subdirectory of `/run`, although care must be taken to appropriately limit access rights to prevent unauthorized use of `/run` itself and other subdirectories.<sup>17</sup>

### 3.15.2. Requirements

Process identifier (PID) files, which were originally placed in `/etc`, must be placed in `/run`. The naming convention for PID files is `<program-name>.pid`. For example, the **crond** PID file is named `/run/crond.pid`.

---

<sup>16</sup>If the home directory of the root account is not stored on the root partition it will be necessary to make certain it will default to `/` if it cannot be located.

We recommend against using the root account for tasks that can be performed as an unprivileged user, and that it be used solely for system administration. For this reason, we recommend that subdirectories for mail and other applications not appear in the root account's home directory, and that mail for administration roles such as root, postmaster, and webmaster be forwarded to an appropriate user.

<sup>17</sup>`/run` should not be writable for unprivileged users; it is a major security problem if any user can write in this directory. User-specific subdirectories should be writable only by each directory's owner.

The internal format of PID files remains unchanged. The file must consist of the process identifier in ASCII-encoded decimal, followed by a newline character. For example, if **crond** was process number 25, `/run/crond.pid` would contain three characters: two, five, and newline.

Programs that read PID files should be somewhat flexible in what they accept; i.e., they should ignore extra whitespace, leading zeroes, absence of the trailing newline, or additional lines in the PID file. Programs that create PID files should use the simple specification located in the above paragraph.

System programs that maintain transient UNIX-domain sockets must place them in this directory or an appropriate subdirectory as outlined above.

## 3.16. /sbin : System binaries

### 3.16.1. Purpose

Utilities used for system administration (and other root-only commands) are stored in `/sbin`, `/usr/sbin`, and `/usr/local/sbin`. `/sbin` contains binaries essential for booting, restoring, recovering, and/or repairing the system in addition to the binaries in `/bin`.<sup>18</sup> Programs executed after `/usr` is known to be mounted (when there are no problems) are generally placed into `/usr/sbin`. Locally-installed system administration programs should be placed into `/usr/local/sbin`.<sup>19</sup>

### 3.16.2. Requirements

There must be no subdirectories in `/sbin`.

The following commands, or symbolic links to commands, are required in `/sbin`:

Command	Description
<b>shutdown</b>	Command to bring the system down.

### 3.16.3. Specific Options

The following files, or symbolic links to files, must be in `/sbin` if the corresponding subsystem is installed:

Command	Description
<b>fastboot</b>	Reboot the system without checking the disks (optional)
<b>fasthalt</b>	Stop the system without checking the disks (optional)

<sup>18</sup> Originally, `/sbin` binaries were kept in `/etc`.

<sup>19</sup> Deciding what things go into "`sbin`" directories is simple: if a normal (not a system administrator) user will ever run it directly, then it must be placed in one of the "`bin`" directories. Ordinary users should not have to place any of the `sbin` directories in their path.

For example, files such as **chfn** which users only occasionally use must still be placed in `/usr/bin`. **ping**, although it is absolutely necessary for root (network recovery and diagnosis) is often used by users and must live in `/bin` for that reason.

We recommend that users have read and execute permission for everything in `/sbin` except, perhaps, certain `setuid` and `setgid` programs. The division between `/bin` and `/sbin` was not created for security reasons or to prevent users from seeing the operating system, but to provide a good partition between binaries that everyone uses and ones that are primarily used for administration tasks. There is no inherent security advantage in making `/sbin` off-limits for users.

Command	Description
<code>fdisk</code>	Partition table manipulator (optional)
<code>fsck</code>	File system check and repair utility (optional)
<code>fsck.*</code>	File system check and repair utility for a specific filesystem (optional)
<code>getty</code>	The getty program (optional)
<code>halt</code>	Command to stop the system (optional)
<code>ifconfig</code>	Configure a network interface (optional)
<code>init</code>	Initial process (optional)
<code>mkfs</code>	Command to build a filesystem (optional)
<code>mkfs.*</code>	Command to build a specific filesystem (optional)
<code>mkswap</code>	Command to set up a swap area (optional)
<code>reboot</code>	Command to reboot the system (optional)
<code>route</code>	IP routing table utility (optional)
<code>swapon</code>	Enable paging and swapping (optional)
<code>swapoff</code>	Disable paging and swapping (optional)
<code>update</code>	Daemon to periodically flush filesystem buffers (optional)

## 3.17. /srv : Data for services provided by this system

### 3.17.1. Purpose

`/srv` contains site-specific data which is served by this system.

#### Rationale

This main purpose of specifying this is so that users may find the location of the data files for a particular service, and so that services which require a single tree for readonly data, writable data and scripts (such as cgi scripts) can be reasonably placed. Data that is only of interest to a specific user should go in that users' home directory. If the directory and file structure of the data is not exposed to consumers, it should go in `/var/lib`.

The methodology used to name subdirectories of `/srv` is unspecified as there is currently no consensus on how this should be done. One method for structuring data under `/srv` is by protocol, eg. `ftp`, `rsync`, `www`, and `cvs`. On large systems it can be useful to structure `/srv` by administrative context, such as `/srv/physics/www`, `/srv/compsci/cvs`, etc. This setup will differ from host to host. Therefore, no program should rely on a specific subdirectory structure of `/srv` existing or data necessarily being stored in `/srv`. However `/srv` should always exist on FHS compliant systems and should be used as the default location for such data.

Distributions must take care not to remove locally placed files in these directories without administrator permission.<sup>20</sup>

<sup>20</sup> This is particularly important as these areas will often contain both files initially installed by the distributor, and those added by the administrator.

## 3.18. /tmp : Temporary files

### 3.18.1. Purpose

The `/tmp` directory must be made available for programs that require temporary files.

Programs must not assume that any files or directories in `/tmp` are preserved between invocations of the program.

#### **Rationale**

IEEE standard POSIX.1-2008 lists requirements similar to the above section.

Although data stored in `/tmp` may be deleted in a site-specific manner, it is recommended that files and directories located in `/tmp` be deleted whenever the system is booted.

FHS added this recommendation on the basis of historical precedent and common practice, but did not make it a requirement because system administration is not within the scope of this standard.



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# Chapter 4. The /usr Hierarchy

## 4.1. Purpose

/usr is the second major section of the filesystem. /usr is shareable, read-only data. That means that /usr should be shareable between various FHS-compliant hosts and must not be written to. Any information that is host-specific or varies with time is stored elsewhere.

Large software packages must not use a direct subdirectory under the /usr hierarchy.

## 4.2. Requirements

The following directories, or symbolic links to directories, are required in /usr.

Directory	Description
bin	Most user commands
lib	Libraries
local	Local hierarchy (empty after main installation)
sbin	Non-vital system binaries
share	Architecture-independent data

## 4.3. Specific Options

Directory	Description
games	Games and educational binaries (optional)
include	Header files included by C programs
libexec	Binaries run by other programs (optional)
lib<qual>	Alternate Format Libraries (optional)
src	Source code (optional)

An exception is made for the X Window System because of considerable precedent and widely-accepted practice.

The following symbolic links to directories may be present. This possibility is based on the need to preserve compatibility with older systems until all distribution can be assumed to use the /var hierarchy.

```
/usr/spool -> /var/spool
/usr/tmp -> /var/tmp
/usr/spool/locks -> /var/lock
```

Once a system no longer requires any one of the above symbolic links, the link may be removed, if desired.

## 4.4. /usr/bin : Most user commands

### 4.4.1. Purpose

This is the primary directory of executable commands on the system.

## 4.4.2. Requirements

There must be no subdirectories in `/usr/bin`.

## 4.4.3. Specific Options

The following files, or symbolic links to files, must be in `/usr/bin`, if the corresponding subsystem is installed:

Command	Description
<code>perl</code>	The Practical Extraction and Report Language (optional)
<code>python</code>	The Python interpreted language (optional)
<code>tcsh</code>	Simple shell containing Tcl interpreter (optional)
<code>wish</code>	Simple Tcl/Tk windowing shell (optional)
<code>expect</code>	Program for interactive dialog (optional)

### Rationale

In many executable scripts, the interpreter to be invoked to execute the script is specified using `#!path_to_interpreter` on the first line of a script. To make such scripts portable among different systems, it is advantageous to standardize the interpreter locations. The shell interpreter is already fixed in `/bin` by this specification, but interpreters for Perl, Python, Tcl and expect may be installed in various places. The locations specified here may be implemented as symbolic links to the physical location of the interpreters.

## 4.5. /usr/include : Directory for standard include files.

### 4.5.1. Purpose

This is where all of the system's general-use include files for the C programming language should be placed.

### 4.5.2. Specific Options

The following directories, or symbolic links to directories, must be in `/usr/include`, if the corresponding subsystem is installed:

Directory	Description
<code>bsd</code>	BSD compatibility include files (optional)

## 4.6. /usr/lib : Libraries for programming and packages

### 4.6.1. Purpose

`/usr/lib` includes object files and libraries.<sup>1</sup> On some systems, it may also include internal binaries that are not intended to be executed directly by users or shell scripts.<sup>2</sup>

Applications may use a single subdirectory under `/usr/lib`. If an application uses a subdirectory, all architecture-dependent data exclusively used by the application must be placed within that subdirectory.<sup>3</sup>

### 4.6.2. Specific Options

For historical reasons, `/usr/lib/sendmail` must be a symbolic link which resolves to the *sendmail*-compatible command provided by the system's mail transfer agent, if the latter exists.<sup>4 5</sup>

## 4.7. /usr/libexec : Binaries run by other programs (optional)

### 4.7.1. Purpose

`/usr/libexec` includes internal binaries that are not intended to be executed directly by users or shell scripts. Applications may use a single subdirectory under `/usr/libexec`.

Applications which use `/usr/libexec` in this way must not also use `/usr/lib` to store internal binaries, though they may use `/usr/lib` for the other purposes documented here.

#### Rationale

Some previous versions of this document did not support `/usr/libexec`, despite it being standard practice in a number of environments.<sup>6</sup> To accommodate this restriction, it became common practice to use `/usr/lib` instead. Either practice is now acceptable, but each application must choose one way or the other to organize itself.

---

<sup>1</sup> Miscellaneous architecture-independent application-specific static files and subdirectories must be placed in `/usr/share`.

<sup>2</sup> See below, in the `/usr/libexec` section, for a discussion of `/usr/lib` vs. `/usr/libexec` for executable binaries.

<sup>3</sup> For example, the `perl5` subdirectory for Perl 5 modules and libraries.

<sup>4</sup> Some executable commands such as **makewhatis** and **sendmail** have also been traditionally placed in `/usr/lib`. **makewhatis** is an internal binary and must be placed in a binary directory; users access only **catman**. Newer **sendmail** binaries are now placed by default in `/usr/sbin`. Additionally, systems using a *sendmail*-compatible mail transfer agent must provide `/usr/sbin/sendmail` as the **sendmail** command, either as the executable itself or as a symlink to the appropriate executable.

<sup>5</sup> Host-specific data for the X Window System must not be stored in `/usr/lib/X11`. Host-specific configuration files such as `xorg.conf` must be stored in `/etc/X11`. This includes configuration data such as `system.twmrc` even if it is only made a symbolic link to a more global configuration file (probably in `/usr/lib/X11`).

<sup>6</sup> See, for example, the "GNU Coding Standards" from the Free Software Foundation.

## 4.8. /usr/lib<qual> : Alternate format libraries (optional)

### 4.8.1. Purpose

`/usr/lib<qual>` performs the same role as `/usr/lib` for an alternate binary format, except that the symbolic links `/usr/lib<qual>/sendmail` and `/usr/lib<qual>/X11` are not required.<sup>7</sup>

## 4.9. /usr/local : Local hierarchy

### 4.9.1. Purpose

The `/usr/local` hierarchy is for use by the system administrator when installing software locally. It needs to be safe from being overwritten when the system software is updated. It may be used for programs and data that are shareable amongst a group of hosts, but not found in `/usr`.

Locally installed software must be placed within `/usr/local` rather than `/usr` unless it is being installed to replace or upgrade software in `/usr`.<sup>8</sup>

### 4.9.2. Requirements

The following directories, or symbolic links to directories, must be in `/usr/local`

Directory	Description
<code>bin</code>	Local binaries
<code>etc</code>	Host-specific system configuration for local binaries
<code>games</code>	Local game binaries
<code>include</code>	Local C header files
<code>lib</code>	Local libraries
<code>man</code>	Local online manuals
<code>sbin</code>	Local system binaries
<code>share</code>	Local architecture-independent hierarchy
<code>src</code>	Local source code

No other directories, except those listed below, may be in `/usr/local` after first installing a FHS-compliant system.

### 4.9.3. Specific Options

If directories `/lib<qual>` or `/usr/lib<qual>` exist, the equivalent directories must also exist in `/usr/local`.

<sup>7</sup> The case where `/usr/lib` and `/usr/lib<qual>` are the same (one is a symbolic link to the other) these files and the per-application subdirectories will exist.

<sup>8</sup> Software placed in `/` or `/usr` may be overwritten by system upgrades (though we recommend that distributions do not overwrite data in `/etc` under these circumstances). For this reason, local software must not be placed outside of `/usr/local` without good reason.

`/usr/local/etc` may be a symbolic link to `/etc/local`.

### **Rationale**

The consistency of `/usr/local/etc` is beneficial to installers, and is already used in other systems. As all of `/usr/local` needs to be backed up to reproduce a system, it introduces no additional maintenance overhead, but a symlink to `/etc/local` is suitable if systems want all their configuration under one hierarchy.

Note that `/usr/etc` is still not allowed: programs in `/usr` should place configuration files in `/etc`.

If the directory `/usr/share/color` exists as specified in this document, then the directory `/usr/local/share/color` must also exist, governed by the same rules as `/usr/share/color`.

### **Rationale**

This usage allows the sysadmin a place to install color profiles manually when necessary.

## **4.9.4. /usr/local/share : Local architecture-independent hierarchy**

The requirements for the contents of this directory are the same as for `/usr/share`.

## **4.10. /usr/sbin : Non-essential standard system binaries**

### **4.10.1. Purpose**

This directory contains any non-essential binaries used exclusively by the system administrator. System administration programs that are required for system repair, system recovery, mounting `/usr`, or other essential functions must be placed in `/sbin` instead.<sup>9</sup>

### **4.10.2. Requirements**

There must be no subdirectories in `/usr/sbin`.

## **4.11. /usr/share : Architecture-independent data**

### **4.11.1. Purpose**

The `/usr/share` hierarchy is for all read-only architecture independent data files.<sup>10</sup>

---

<sup>9</sup> Locally installed system administration programs should be placed in `/usr/local/sbin`.

<sup>10</sup> Much of this data originally lived in `/usr` (`man`, `doc`) or `/usr/lib` (`dict`, `terminfo`, `zoneinfo`).

This hierarchy is intended to be shareable among all architecture platforms of a given OS; thus, for example, a site with i386, Alpha, and PPC platforms might maintain a single `/usr/share` directory that is centrally-mounted. Note, however, that `/usr/share` is generally not intended to be shared by different OSes or by different releases of the same OS.

Any program or package which contains or requires data that doesn't need to be modified should store that data in `/usr/share` (or `/usr/local/share`, if installed locally). It is recommended that a subdirectory be used in `/usr/share` for this purpose. Applications using a single file may use `/usr/share/misc`.

Game data stored in `/usr/share/games` must be purely static data. Any modifiable files, such as score files, game play logs, and so forth, should be placed in `/var/games`.

## 4.11.2. Requirements

The following directories, or symbolic links to directories, must be in `/usr/share`

Directory	Description
<code>man</code>	Online manuals
<code>misc</code>	Miscellaneous architecture-independent data

## 4.11.3. Specific Options

The following directories, or symbolic links to directories, must be in `/usr/share`, if the corresponding subsystem is installed:

Directory	Description
<code>color</code>	Color management information (optional)
<code>dict</code>	Word lists (optional)
<code>doc</code>	Miscellaneous documentation (optional)
<code>games</code>	Static data files for <code>/usr/games</code> (optional)
<code>info</code>	Primary directory for GNU Info system (optional)
<code>locale</code>	Locale information (optional)
<code>nls</code>	Message catalogs for Native language support (optional)
<code>ppd</code>	Printer definitions (optional)
<code>sgml</code>	SGML data (optional)
<code>terminfo</code>	Directories for terminfo database (optional)
<code>tmac</code>	troff macros not distributed with groff (optional)
<code>xml</code>	XML data (optional)
<code>zoneinfo</code>	Timezone information and configuration (optional)

It is recommended that application-specific, architecture-independent directories be placed here. Such directories include **groff**, **perl**, **ghostscript**, **texmf**, and **kbd** (Linux) or **syscons** (BSD). They may, however, be placed in `/usr/lib` for backwards compatibility, at the distributor's discretion. Similarly, a `/usr/lib/games` hierarchy may be used in addition to the `/usr/share/games` hierarchy if the distributor wishes to place some game data there.

## 4.11.4. /usr/share/color : Color management information (optional)

### 4.11.4.1. Purpose

This directory is the home for ICC color management files installed by the system.

### 4.11.4.2. Specific Options

The following directories must be in `/usr/share/color`, if the corresponding subsystem is installed:

Directory	Description
<code>icc</code>	ICC color profiles (optional)

The top-level directory `/usr/share/color` must not contain any files; all files should be in subdirectories of `/usr/share/color`.

## 4.11.5. /usr/share/dict : Word lists (optional)

### 4.11.5.1. Purpose

This directory is the home for word lists on the system; Traditionally this directory contains only the English words file, which is used by **look(1)** and various spelling programs. `words` may use either American or British spelling.

#### Rationale

The reason that only word lists are located here is that they are the only files common to all spell checkers.

### 4.11.5.2. Specific Options

The following files, or symbolic links to files, must be in `/usr/share/dict`, if the corresponding subsystem is installed:

File	Description
<code>words</code>	List of English words (optional)

Sites that require both American and British spelling may link `words` to `-/usr/share/dict/american-english` or `-/usr/share/dict/british-english`.

Word lists for other languages may be added using the English name for that language, e.g., `/usr/share/dict/french`, `/usr/share/dict/danish`, etc. These should, if possible, use a character set based on Unicode, with the UTF-8 character set being the preferred option.

Other word lists must be included here, if present.

## 4.11.6. /usr/share/man : Manual pages

### 4.11.6.1. Purpose

This section details the organization for manual pages throughout the system, including `/usr/share/man`. Also refer to the section on `/var/cache/man`.

The primary <mandir> of the system is /usr/share/man. /usr/share/man contains manual information for commands and data under the / and /usr filesystems.<sup>11</sup>

Manual pages are stored in <mandir>/<locale>/man<section>/<arch>. An explanation of <mandir>, <locale>, <section>, and <arch> is given below.

A description of each section follows:

- **man1:** User programs Manual pages that describe publicly accessible commands are contained in this chapter. Most program documentation that a user will need to use is located here.
- **man2:** System calls This section describes all of the system calls (requests for the kernel to perform operations).
- **man3:** Library functions and subroutines Section 3 describes program library routines that are not direct calls to kernel services. This and chapter 2 are only really of interest to programmers.
- **man4:** Special files Section 4 describes the special files, related driver functions, and networking support available in the system. Typically, this includes the device files found in /dev and the kernel interface to networking protocol support.
- **man5:** File formats The formats for many data files are documented in the section 5. This includes various include files, program output files, and system files.
- **man6:** Games This chapter documents games, demos, and generally trivial programs. Different people have various notions about how essential this is.
- **man7:** Miscellaneous Manual pages that are difficult to classify are designated as being section 7. The troff and other text processing macro packages are found here.
- **man8:** System administration Programs used by system administrators for system operation and maintenance are documented here. Some of these programs are also occasionally useful for normal users.

### 4.11.6.2. Specific Options

The following directories, or symbolic links to directories, must be in /usr/share/<mandir>/<locale>, unless they are empty:<sup>12</sup>

Directory	Description
man1	User programs (optional)
man2	System calls (optional)
man3	Library calls (optional)
man4	Special files (optional)
man5	File formats (optional)
man6	Games (optional)
man7	Miscellaneous (optional)
man8	System administration (optional)

The component <section> describes the manual section.

---

<sup>11</sup>Obviously, there are no manual pages in / because they are not required at boot time nor are they required in emergencies. Really.

<sup>12</sup>For example, if /usr/share/man has no manual pages in section 4 (Devices), then /usr/share/man/man4 may be omitted.



Provisions must be made in the structure of /usr/share/man to support manual pages which are written in different (or multiple) languages. These provisions must take into account the storage and reference of these manual pages. Relevant factors include language (including geographical-based differences), and character code set.

This naming of language subdirectories of /usr/share/man is based on Appendix E of the POSIX 1003.1 standard which describes the locale identification string — the most well-accepted method to describe a cultural environment. The <locale> string is:

```
<language>[_<territory>][.<character-set>][,<version>]
```

The <language> field must be taken from ISO 639 (a code for the representation of names of languages). It must be two characters wide and specified with lowercase letters only.

The <territory> field must be the two-letter code of ISO 3166 (a specification of representations of countries), if possible. (Most people are familiar with the two-letter codes used for the country codes in email addresses.) It must be two characters wide and specified with uppercase letters only.<sup>13</sup>

The <character-set> field must represent the standard describing the character set. If the <character-set> field is just a numeric specification, the number represents the number of the international standard describing the character set. It is recommended that this be a numeric representation if possible (ISO standards, especially), not include additional punctuation symbols, and that any letters be in lowercase.

A parameter specifying a <version> of the profile may be placed after the <character-set> field, delimited by a comma. This may be used to discriminate between different cultural needs; for instance, dictionary order versus a more systems-oriented collating order. This standard recommends not using the <version> field, unless it is necessary.

Systems which use a unique language and code set for all manual pages may omit the <locale> substring and store all manual pages in <mandir>. For example, systems which only have English manual pages coded with ASCII, may store manual pages (the man<section> directories) directly in /usr/share/man. (That is the traditional circumstance and arrangement, in fact.)

Countries for which there is a well-accepted standard character code set may omit the <character-set> field, but it is strongly recommended that it be included, especially for countries with several competing standards.

Various examples:

Language	Territory	Character Set	Directory
English	—	ASCII	/usr/share/man/en
English	United Kingdom	Unicode UTF-8	/usr/share/man/en_GB.10646
English	United States	ASCII	/usr/share/man/en_US
French	Canada	ISO 8859-1	/usr/share/man/fr_CA.88591
French	France	ISO 8859-1	/usr/share/man/fr_FR.88591
German	Germany	ISO 646	/usr/share/man/de_DE.646

<sup>13</sup> A major exception to this rule is the United Kingdom, which is 'GB' in the ISO 3166, but 'UK' for most email addresses.

Language	Territory	Character Set	Directory
German	Germany	ISO 6937	/usr/share/man/ de_DE.6937
German	Germany	ISO 8859-1	/usr/share/man/ de_DE.88591
German	Switzerland	ISO 646	/usr/share/man/ de_CH.646
Japanese	Japan	JIS	/usr/share/man/ja_JP.jis
Japanese	Japan	SJIS	/usr/share/man/ja_JP.sjis
Japanese	Japan	UJIS (or EUC-J)	/usr/share/man/ja_JP.ujis
Japanese	Japan	Unicode UTF-16	/usr/share/man/ ja_JP.10646

Similarly, provision must be made for manual pages which are architecture-dependent, such as documentation on device-drivers or low-level system administration commands. These must be placed under an <arch> directory in the appropriate man<section> directory; for example, a man page for the i386 `ctrlaltdel(8)` command might be placed in `/usr/share/man/<locale>/man8/i386/ctrlaltdel.8`.

Manual pages for commands and data under `/usr/local` are stored in `/usr/local/man` or `/usr/local/share/man`. All manual page hierarchies in the system must have the same structure as `/usr/share/man`, as this structure is expected by commands which consume manual page content.<sup>14</sup>

The cat page sections (`cat<section>`) containing formatted manual page entries are also found within subdirectories of `<mandir>/<locale>`, but are not required nor may they be distributed in lieu of nroff source manual pages.

The numbered sections "1" through "8" are traditionally defined. In general, the file name for manual pages located within a particular section end with `.<section>`.

In addition, some large sets of application-specific manual pages have an additional suffix appended to the manual page filename. For example, the MH mail handling system manual pages must have `mh` appended to all MH manuals. All X Window System manual pages must have an `x` appended to the filename.

The practice of placing various language manual pages in appropriate subdirectories of `/usr/share/man` also applies to the other manual page hierarchies, such as `/usr/local/man`. (This portion of the standard also applies later in the section on the optional `/var/cache/man` structure.)

## 4.11.7. /usr/share/misc : Miscellaneous architecture-independent data

This directory contains miscellaneous architecture-independent files which don't require a separate subdirectory under `/usr/share`.

### 4.11.7.1. Specific Options

The following files, or symbolic links to files, must be in `/usr/share/misc`, if the corresponding subsystem is installed:

<sup>14</sup> `/usr/local/man` is deprecated and may be dropped in a future version of this specification.

File	Description
ascii	ASCII character set table (optional)
termcap	Terminal capability database (optional)
termcap.db	Terminal capability database (optional)

Other (application-specific) files may appear here, but a distributor may place them in `/usr/lib` at their discretion.<sup>15 16</sup>

## 4.11.8. /usr/share/ppd : Printer definitions (optional)

### 4.11.8.1. Purpose

`/usr/share/ppd` contains PostScript Printer Definition (PPD) files, which are used as descriptions of printer drivers by many print systems. PPD files may be placed in this directory, or in a subdirectory.

## 4.11.9. /usr/share/sgml : SGML data (optional)

### 4.11.9.1. Purpose

`/usr/share/sgml` contains architecture-independent files used by SGML applications, such as ordinary catalogs (not the centralized ones, see `/etc/sgml`), DTDs, entities, or style sheets.

### 4.11.9.2. Specific Options

The following directories, or symbolic links to directories, must be in `/usr/share/sgml`, if the corresponding subsystem is installed:

Directory	Description
docbook	docbook DTD (optional)
tei	tei DTD (optional)
html	html DTD (optional)
mathml	mathml DTD (optional)

Other files that are not specific to a given DTD may reside in their own subdirectory.

## 4.11.10. /usr/share/xml : XML data (optional)

### 4.11.10.1. Purpose

`/usr/share/xml` contains architecture-independent files used by XML applications, such as ordinary catalogs (not the centralized ones, see `/etc/sgml`), DTDs, entities, or style sheets.

<sup>15</sup> Some such files include: `airport`, `birthtoken`, `eqnchar`, `getopt`, `gprof.callg`, `gprof.flat`, `inter.phone`, `ipfw.samp.filters`, `ipfw.samp.scripts`, `keycap.pcv`, `mail.help`, `mail.tildehelp`, `man.template`, `map3270`, `mdoc.template`, `more.help`, `na.phone`, `nslookup.help`, `operator`, `scsi_modes`, `sendmail.hf`, `style`, `units.lib`, `vgrindefs`, `vgrindefs.db`, `zipcodes`.

<sup>16</sup> Historically, the `magic` file was placed in `/usr/share/misc`, but modern variants of the `file` command use several files and place them in `/usr/share/file`. For compatibility, distribution may create a symlink at `/usr/share/misc/magic`, pointing to `/usr/share/file/magic`.

### 4.11.10.2. Specific Options

The following directories, or symbolic links to directories, must be in `/usr/share/xml`, if the corresponding subsystem is installed:

Directory	Description
<code>docbook</code>	docbook XML DTD (optional)
<code>xhtml</code>	XHTML DTD (optional)
<code>mathml</code>	MathML DTD (optional)

## 4.12. /usr/src : Source code (optional)

### 4.12.1. Purpose

Source code may be placed in this subdirectory, only for reference purposes.<sup>17</sup>

---

<sup>17</sup> Generally, source should not be built within this hierarchy.

---

# Chapter 5. The /var Hierarchy

## 5.1. Purpose

`/var` contains variable data files. This includes spool directories and files, administrative and logging data, and transient and temporary files.

Some portions of `/var` are not shareable between different systems. For instance, `/var/log`, `/var/lock`, and `/var/run`. Other portions may be shared, notably `/var/mail`, `/var/cache/man`, `/var/cache/fonts`, and `/var/spool/news`.

`/var` is specified here in order to make it possible to mount `/usr` read-only. Everything that once went into `/usr` that is written to during system operation (as opposed to installation and software maintenance) must be in `/var`.

If `/var` cannot be made a separate partition, it is often preferable to move `/var` out of the root partition and into the `/usr` partition. (This is sometimes done to reduce the size of the root partition or when space runs low in the root partition.) However, `/var` must not be linked to `/usr` because this makes separation of `/usr` and `/var` more difficult and is likely to create a naming conflict. Instead, link `/var` to `/usr/var`.

Applications must generally not add directories to the top level of `/var`. Such directories should only be added if they have some system-wide implication, and in consultation with the FHS mailing list.

## 5.2. Requirements

The following directories, or symbolic links to directories, are required in `/var`:

Directory	Description
<code>cache</code>	Application cache data
<code>lib</code>	Variable state information
<code>local</code>	Variable data for <code>/usr/local</code>
<code>lock</code>	Lock files
<code>log</code>	Log files and directories
<code>opt</code>	Variable data for <code>/opt</code>
<code>run</code>	Data relevant to running processes
<code>spool</code>	Application spool data
<code>tmp</code>	Temporary files preserved between system reboots

Several directories are 'reserved' in the sense that they must not be used arbitrarily by some new application, since they would conflict with historical and/or local practice. They are:

```
/var/backups  
/var/cron  
/var/messages  
/var/preserve
```

## 5.3. Specific Options

The following directories, or symbolic links to directories, must be in `/var`, if the corresponding subsystem is installed:

Directory	Description
<code>account</code>	Process accounting logs (optional)
<code>crash</code>	System crash dumps (optional)
<code>games</code>	Variable game data (optional)
<code>mail</code>	User mailbox files (optional)
<code>yp</code>	Network Information Service (NIS) database files (optional)

## 5.4. /var/account : Process accounting logs (optional)

### 5.4.1. Purpose

This directory holds the current active process accounting log and the composite process usage data (as used in some UNIX-like systems by `lastcomm` and `sa`).

## 5.5. /var/cache : Application cache data

### 5.5.1. Purpose

`/var/cache` is intended for cached data from applications. Such data is locally generated as a result of time-consuming I/O or calculation. The application must be able to regenerate or restore the data. Unlike `/var/spool`, the cached files can be deleted without data loss. The data must remain valid between invocations of the application and rebooting the system.

Files located under `/var/cache` may be expired in an application specific manner, by the system administrator, or both. The application must always be able to recover from manual deletion of these files (generally because of a disk space shortage). No other requirements are made on the data format of the cache directories.

#### Rationale

The existence of a separate directory for cached data allows system administrators to set different disk and backup policies from other directories in `/var`.

### 5.5.2. Specific Options

Directory	Description
<code>fonts</code>	Locally-generated fonts (optional)
<code>man</code>	Locally-formatted manual pages (optional)
<code>www</code>	WWW proxy or cache data (optional)

Directory	Description
<package>	Package specific cache data (optional)

### 5.5.3. /var/cache/fonts : Locally-generated fonts (optional)

#### 5.5.3.1. Purpose

The directory `/var/cache/fonts` should be used to store any dynamically-created fonts. In particular, all of the fonts which are automatically generated by **mktexpk** must be located in appropriately-named subdirectories of `/var/cache/fonts`.<sup>1</sup>

#### 5.5.3.2. Specific Options

Other dynamically created fonts may also be placed in this tree, under appropriately-named subdirectories of `/var/cache/fonts`.

### 5.5.4. /var/cache/man : Locally-formatted manual pages (optional)

#### 5.5.4.1. Purpose

This directory provides a standard location for sites that provide a read-only `/usr` partition, but wish to allow caching of locally-formatted man pages. Sites that mount `/usr` as writable (e.g., single-user installations) may choose not to use `/var/cache/man` and may write formatted man pages into the `cat<section>` directories in `/usr/share/man` directly. We recommend that most sites use one of the following options instead:

- Preformat all manual pages alongside the unformatted versions.
- Allow no caching of formatted man pages, and require formatting to be done each time a man page is brought up.
- Allow local caching of formatted man pages in `/var/cache/man`.

The structure of `/var/cache/man` needs to reflect both the fact of multiple man page hierarchies and the possibility of multiple language support.

Given an unformatted manual page that normally appears in `<path>/man/<locale>/man<section>`, the directory to place formatted man pages in is `/var/cache/man/<catpath>/<locale>/cat<section>`, where `<catpath>` is derived from `<path>` by removing any leading `usr` and/or trailing `share` pathname components. (Note that the `<locale>` component may be missing.)<sup>2</sup>

Man pages written to `/var/cache/man` may eventually be transferred to the appropriate preformatted directories in the source man hierarchy or expired; likewise formatted man pages in the source man hierarchy may be expired if they are not accessed for a period of time.

<sup>1</sup> This standard does not currently incorporate the TeX Directory Structure (a document that describes the layout TeX files and directories), but it may be useful reading. It is located at <ftp://ctan.tug.org/tex/>

<sup>2</sup> For example, `/usr/share/man/man1/ls.1` is formatted into `/var/cache/man/cat1/ls.1`, and `/usr/X11R6/man/<locale>/man3/XtClass.3x` into `/var/cache/man/X11R6/<locale>/cat3/XtClass.3x`.

If preformatted manual pages come with a system on read-only media (a CD-ROM, for instance), they must be installed in the source man hierarchy (e.g. `/usr/share/man/cat<section>`). `/var/cache/man` is reserved as a writable cache for formatted manual pages.

### Rationale

Release 1.2 of this standard specified `/var/catman` for this hierarchy. The path has been moved under `/var/cache` to better reflect the dynamic nature of the formatted man pages. The directory name has been changed to `man` to allow for enhancing the hierarchy to include post-processed formats other than "cat", such as PostScript, HTML, or DVI.

## 5.6. /var/crash : System crash dumps (optional)

### 5.6.1. Purpose

This directory holds system crash dumps. As of the date of this release of the standard, system crash dumps were not supported under Linux but may be supported by other systems which may comply with the FHS.

## 5.7. /var/games : Variable game data (optional)

### 5.7.1. Purpose

Any variable data relating to games in `/usr` should be placed here. `/var/games` should hold the variable data previously found in `/usr`; static data, such as help text, level descriptions, and so on, must remain elsewhere, such as `/usr/share/games`.

### Rationale

`/var/games` has been given a hierarchy of its own, rather than leaving it underneath `/var/lib` as in release 1.2 of this standard. The separation allows local control of backup strategies, permissions, and disk usage, as well as allowing inter-host sharing and reducing clutter in `/var/lib`. Additionally, `/var/games` is the path traditionally used by BSD.

## 5.8. /var/lib : Variable state information

### 5.8.1. Purpose

This hierarchy holds state information pertaining to an application or the system. State information is data that programs modify while they run, and that pertains to one specific host. Users must never need to modify files in `/var/lib` to configure a package's operation, and the specific file hierarchy used to store the data must not be exposed to regular users.<sup>3</sup>

State information is generally used to preserve the condition of an application (or a group of inter-related applications) between invocations and between different instances of the same application. State information should generally remain valid after a reboot, should not be logging output, and should not be spooled data.

An application (or a group of inter-related applications) must use a subdirectory of `/var/lib` for its data. There is one required subdirectory, `/var/lib/misc`, which is intended for state files that don't need

---

<sup>3</sup> Data with exposed filesystem structure should be stored in `/srv`.



a subdirectory; the other subdirectories should only be present if the application in question is included in the distribution.<sup>4</sup>

`/var/lib/<name>` is the location that must be used for all distribution packaging support. Different distributions may use different names, of course.

## 5.8.2. Requirements

The following directories, or symbolic links to directories, are required in `/var/lib`:

Directory	Description
<code>misc</code>	Miscellaneous state data

## 5.8.3. Specific Options

The following directories, or symbolic links to directories, must be in `/var/lib`, if the corresponding subsystem is installed:

Directory	Description
<code>&lt;editor&gt;</code>	Editor backup files and state (optional)
<code>&lt;pkgtool&gt;</code>	Packaging support files (optional)
<code>&lt;package&gt;</code>	State data for packages and subsystems (optional)
<code>color</code>	Color management information (optional)
<code>hwclock</code>	State directory for hwclock (optional)
<code>xdm</code>	X display manager variable data (optional)

## 5.8.4. `/var/lib/<editor>` : Editor backup files and state (optional)

### 5.8.4.1. Purpose

These directories contain saved files generated by any unexpected termination of an editor (e.g., **elvis**, **jove**, **nvi**).

Other editors may not require a directory for crash-recovery files, but may require a well-defined place to store other information while the editor is running. This information should be stored in a subdirectory under `/var/lib` (for example, GNU Emacs would place lock files in `/var/lib/emacs/lock`).

Future editors may require additional state information beyond crash-recovery files and lock files — this information should also be placed under `/var/lib/<editor>`.

### Rationale

Previous Linux releases, as well as all commercial vendors, use `/var/preserve` for `vi` or its clones. However, each editor uses its own format for these crash-recovery files, so a separate directory is needed for each editor.

<sup>4</sup> An important difference between this version of this standard and previous ones is that applications are now required to use a subdirectory of `/var/lib`.

Editor-specific lock files are usually quite different from the device or resource lock files that are stored in `/var/lock` and, hence, are stored under `/var/lib`.

## 5.8.5. `/var/lib/color` : Color management information (optional)

### 5.8.5.1. Purpose

This directory is the home for ICC color management files installed dynamically. This directory shall be laid out using the same rules as the `/usr/share/color` directory.

## 5.8.6. `/var/lib/hwclock` : State directory for `hwclock` (optional)

### 5.8.6.1. Purpose

This directory contains the file `/var/lib/hwclock/adjtime`.

#### Rationale

In FHS 2.1, this file was `/etc/adjtime`, but as `hwclock` updates it, that was obviously incorrect.

## 5.8.7. `/var/lib/misc` : Miscellaneous variable data

### 5.8.7.1. Purpose

This directory contains variable data not placed in a subdirectory in `/var/lib`. An attempt should be made to use relatively unique names in this directory to avoid namespace conflicts.<sup>5</sup>

## 5.9. `/var/lock` : Lock files

### 5.9.1. Purpose

Lock files should be stored within the `/var/lock` directory structure.

Lock files for devices and other resources shared by multiple applications, such as the serial device lock files that were originally found in either `/usr/spool/locks` or `/usr/spool/uucp`, must now be stored in `/var/lock`. The naming convention which must be used is "LCK.." followed by the base name of the device. For example, to lock `/dev/ttyS0` the file "LCK..ttyS0" would be created.<sup>6</sup>

The format used for the contents of such lock files must be the HDB UUCP lock file format. The HDB format is to store the process identifier (PID) as a ten byte ASCII decimal number, with a trailing newline. For example, if process 1230 holds a lock file, it would contain the eleven characters: space, space, space, space, space, space, one, two, three, zero, and newline.

---

<sup>5</sup>This hierarchy should contain files stored in `/var/db` in current BSD releases. These include `locate.database` and `mountdtab`, and the kernel symbol database(s).

<sup>6</sup>Then, anything wishing to use `/dev/ttyS0` can read the lock file and act accordingly (all locks in `/var/lock` should be world-readable).

## 5.10. /var/log : Log files and directories

### 5.10.1. Purpose

This directory contains miscellaneous log files. Most logs must be written to this directory or an appropriate subdirectory.

### 5.10.2. Specific Options

The following files, or symbolic links to files, must be in `/var/log`, if the corresponding subsystem is installed:

File	Description
<code>lastlog</code>	record of last login of each user
<code>messages</code>	system messages from <b>syslogd</b>
<code>wtmp</code>	record of all logins and logouts

## 5.11. /var/mail : User mailbox files (optional)

### 5.11.1. Purpose

The mail spool must be accessible through `/var/mail` and the mail spool files must take the form `<username>`.<sup>7</sup>

User mailbox files in this location must be stored in the standard UNIX mailbox format.

#### Rationale

The logical location for this directory was changed from `/var/spool/mail` in order to bring FHS in-line with nearly every UNIX distribution. This change is important for inter-operability since a single `/var/mail` is often shared between multiple hosts and multiple UNIX distribution (despite NFS locking issues).

It is important to note that there is no requirement to physically move the mail spool to this location. However, programs and header files must be changed to use `/var/mail`.

## 5.12. /var/opt : Variable data for /opt

### 5.12.1. Purpose

Variable data of the packages in `/opt` must be installed in `/var/opt/<subdir>`, where `<subdir>` is the name of the subtree in `/opt` where the static data from an add-on software package is stored, except where superseded by another file in `/etc`. No structure is imposed on the internal arrangement of `/var/opt/<subdir>`.

#### Rationale

Refer to the rationale for `/opt`.

---

<sup>7</sup>Note that `/var/mail` may be a symbolic link to another directory.

## 5.13. /var/run : Run-time variable data

### 5.13.1. Purpose

This directory was once intended for system information data describing the system since it was booted. These functions have been moved to /run; this directory exists to ensure compatibility with systems and software using an older version of this specification.

### 5.13.2. Requirements

In general, the requirements for /run shall also apply to /var/run. It is valid to implement /var/run as a symlink to /run.

The utmp file, which stores information about who is currently using the system, is located in this directory.

Programs should not access both /var/run and /run directly, except to access /var/run/utmp.<sup>8</sup>

## 5.14. /var/spool : Application spool data

### 5.14.1. Purpose

/var/spool contains data which is awaiting some kind of later processing. Data in /var/spool represents work to be done in the future (by a program, user, or administrator); often data is deleted after it has been processed.<sup>9</sup>

### 5.14.2. Specific Options

The following directories, or symbolic links to directories, must be in /var/spool, if the corresponding subsystem is installed:

Directory	Description
lpd	Printer spool directory (optional)
mqueue	Outgoing mail queue (optional)
news	News spool directory (optional)
rwho	Rwhod files (optional)
uucp	Spool directory for UUCP (optional)

### 5.14.3. /var/spool/lpd : Line-printer daemon print queues (optional)

#### 5.14.3.1. Purpose

The lock file for **lpd**, `lpd.lock`, must be placed in `/var/spool/lpd`. It is suggested that the lock file for each printer be placed in the spool directory for that specific printer and named `lock`.

<sup>8</sup>This is to prevent confusion about where transient files are located. In general, a program should use either /var/run or /run to access these files, not both.

<sup>9</sup>UUCP lock files must be placed in /var/lock. See the above section on /var/lock.

### 5.14.3.2. Specific Options

Directory	Description
printer	Spools for a specific printer (optional)

## 5.14.4. /var/spool/rwho : Rwho files (optional)

### 5.14.4.1. Purpose

This directory holds the **rwho** information for other systems on the local net.

#### Rationale

Some BSD releases use `/var/rwho` for this data; given its historical location in `/var/spool` on other systems and its approximate fit to the definition of 'spooled' data, this location was deemed more appropriate.

## 5.15. /var/tmp : Temporary files preserved between system reboots

### 5.15.1. Purpose

The `/var/tmp` directory is made available for programs that require temporary files or directories that are preserved between system reboots. Therefore, data stored in `/var/tmp` is more persistent than data in `/tmp`.

Files and directories located in `/var/tmp` must not be deleted when the system is booted. Although data stored in `/var/tmp` is typically deleted in a site-specific manner, it is recommended that deletions occur at a less frequent interval than `/tmp`.

## 5.16. /var/yp : Network Information Service (NIS) database files (optional)

### 5.16.1. Purpose

Variable data for the Network Information Service (NIS), formerly known as the Sun Yellow Pages (YP), must be placed in this directory.

#### Rationale

`/var/yp` is the standard directory for NIS (YP) data and is almost exclusively used in NIS documentation and systems.<sup>10</sup>

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<sup>10</sup> NIS should not be confused with Sun NIS+, which uses a different directory, `/var/nis`.

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# Chapter 6. Operating System Specific Annex

This section is for additional requirements and recommendations that only apply to a specific operating system. The material in this section should never conflict with the base standard.

## 6.1. Linux

This is the annex for the Linux operating system.

### 6.1.1. / : Root directory

On Linux systems, if the kernel is located in /, we recommend using the names `vmlinux` or `vmlinuz`, which have been used in recent Linux kernel source packages.

### 6.1.2. /bin : Essential user command binaries (for use by all users)

Linux systems which require them place these additional files into `/bin`:

- `setserial`

### 6.1.3. /dev : Devices and special files

The following devices must exist under `/dev`.

- `/dev/null` All data written to this device is discarded. A read from this device will return an EOF condition.
- `/dev/zero` This device is a source of zeroed out data. All data written to this device is discarded. A read from this device will return as many bytes containing the value zero as was requested.
- `/dev/tty` This device is a synonym for the controlling terminal of a process. Once this device is opened, all reads and writes will behave as if the actual controlling terminal device had been opened.

#### Rationale

Previous versions of the FHS had stricter requirements for `/dev`. Other devices may also exist in `/dev`. Device names may exist as symbolic links to other device nodes located in `/dev` or subdirectories of `/dev`. There is no requirement concerning major/minor number values.

### 6.1.4. /etc : Host-specific system configuration

Linux systems which require them place these additional files into `/etc`.

- `lilo.conf`

## 6.1.5. /proc : Kernel and process information virtual filesystem

The `proc` filesystem is the de-facto standard Linux method for handling process and system information, rather than `/dev/kmem` and other similar methods. We strongly encourage this for the storage and retrieval of process information as well as other kernel and memory information.

## 6.1.6. /sbin : Essential system binaries

Linux systems place commands relating to filesystem maintenance and boot loader management into `/sbin`.

Optional files for `/sbin`:

- Static binaries:
  - **ldconfig**
  - **sln**
  - **ssync**

Static **ln** (**sln**) and static **sync** (**ssync**) are useful when things go wrong. The primary use of **sln** (to repair incorrect symlinks in `/lib` after a poorly orchestrated upgrade) is no longer a major concern now that the **ldconfig** program (usually located in `/usr/sbin`) exists and can act as a guiding hand in upgrading the dynamic libraries. Static **sync** is useful in some emergency situations. Note that these need not be statically linked versions of the standard **ln** and **sync**, but may be.

The **ldconfig** binary is optional for `/sbin` since a site may choose to run **ldconfig** at boot time, rather than only when upgrading the shared libraries. (It's not clear whether or not it is advantageous to run **ldconfig** on each boot.) Even so, some people like **ldconfig** around for the following (all too common) situation:

1. I've just removed `/lib/<file>`.
2. I can't find out the name of the library because **ls** is dynamically linked, I'm using a shell that doesn't have **ls** built-in, and I don't know about using "**echo \***" as a replacement.
3. I have a static **sln**, but I don't know what to call the link.

- Miscellaneous:
  - **ctrlaltdel**
  - **kbdrate**

So as to cope with the fact that some keyboards come up with such a high repeat rate as to be unusable, **kbdrate** may be installed in `/sbin` on some systems.

Since the default action in the kernel for the Ctrl-Alt-Del key combination is an instant hard reboot, it is generally advisable to disable the behavior before mounting the root filesystem in read-write mode. Some **init** suites are able to disable Ctrl-Alt-Del, but others may require the **ctrlaltdel** program, which may be installed in `/sbin` on those systems.

## 6.1.7. /sys : Kernel and system information virtual filesystem

The `sys` filesystem is the location where information about devices, drivers, and some kernel features is exposed. Its underlying structure is determined by the particular Linux kernel being used at the moment, and is otherwise unspecified.

## 6.1.8. /usr/include : Header files included by C programs

These symbolic links are required if a C or C++ compiler is installed and only for systems not based on `glibc`.

```
/usr/include/asm -> /usr/src/linux/include/asm-<arch>  
/usr/include/linux -> /usr/src/linux/include/linux
```

## 6.1.9. /usr/src : Source code

For systems based on `glibc`, there are no specific guidelines for this directory. For systems based on Linux `libc` revisions prior to `glibc`, the following guidelines and rationale apply:

The only source code that should be placed in a specific location is the Linux kernel source code. It is located in `/usr/src/linux`.

If a C or C++ compiler is installed, but the complete Linux kernel source code is not installed, then the include files from the kernel source code must be located in these directories:

```
/usr/src/linux/include/asm-<arch>  
/usr/src/linux/include/linux
```

<arch> is the name of the system architecture.

### Note

`/usr/src/linux` may be a symbolic link to a kernel source code tree.

### Rationale

It is important that the kernel include files be located in `/usr/src/linux` and not in `/usr/include` so there are no problems when system administrators upgrade their kernel version for the first time.

## 6.1.10. /var/spool/cron : cron and at jobs

This directory contains the variable data for the `cron` and `at` programs.



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# Chapter 7. Appendix

## 7.1. The FHS mailing list

The FHS mailing list is located at [fhs-discuss@lists.linuxfoundation.org](mailto:fhs-discuss@lists.linuxfoundation.org) (subscription required as a spam limitation measure). Mailing list subscription information, archives, etc. are at <https://lists.linux-foundation.org/mailman/listinfo/fhs-discuss> [<https://lists.linux-foundation.org/mailman/listinfo/fhs-discuss>]

## 7.2. Background of the FHS

The process of developing a standard filesystem hierarchy began in August 1993 with an effort to restructure the file and directory structure of Linux. The FSSTND, a filesystem hierarchy standard specific to the Linux operating system, was released on February 14, 1994. Subsequent revisions were released on October 9, 1994 and March 28, 1995.

In early 1995, the goal of developing a more comprehensive version of FSSTND to address not only Linux, but other UNIX-like systems was adopted with the help of members of the BSD development community. As a result, a concerted effort was made to focus on issues that were general to UNIX-like systems. In recognition of this widening of scope, the name of the standard was changed to Filesystem Hierarchy Standard or FHS for short.

Volunteers who have contributed extensively to this standard are listed at the end of this document. This standard represents a consensus view of those and other contributors.

Thanks to Network Operations at the University of California at San Diego, and later to SourceForge, who allowed us to use their excellent mailing list servers during earlier phases of development.

## 7.3. General Guidelines

Here are some of the guidelines that have been used in the development of this standard:

- Solve technical problems while limiting transitional difficulties.
- Make the specification reasonably stable.
- Gain the approval of distributors, developers, and other decision-makers in relevant development groups and encourage their participation.
- Provide a standard that is attractive to the implementors of different UNIX-like systems.

## 7.4. Scope

This document specifies a standard filesystem hierarchy for FHS filesystems by specifying the location of files and directories, and the contents of some system files.

This standard has been designed to be used by system integrators, package developers, and system administrators in the construction and maintenance of FHS compliant filesystems. It is primarily intended to be a reference and is not a tutorial on how to manage a conforming filesystem hierarchy.

The FHS grew out of earlier work on FSSTND, a filesystem organization standard for the Linux operating system. It builds on FSSTND to address interoperability issues not just in the Linux community but in a

wider arena including 4.4BSD-based operating systems. It incorporates lessons learned in the BSD world and elsewhere about multi-architecture support and the demands of heterogeneous networking.

Although this standard is more comprehensive than previous attempts at filesystem hierarchy standardization, periodic updates may become necessary as requirements change in relation to emerging technology. It is also possible that better solutions to the problems addressed here will be discovered so that our solutions will no longer be the best possible solutions. Supplementary drafts may be released in addition to periodic updates to this document. However, a specific goal is backwards compatibility from one release of this document to the next.

Comments related to this standard are welcome. Any comments or suggestions for changes may be directed to the FHS mailing list, or filed as bugs, or both. Typographical or grammatical comments should be filed as bugs. The bugtracker is at <http://bugs.linuxfoundation.org> - use the category FHS.

Before sending mail to the mailing list it is requested that you first glance at the mailing list archives to avoid excessive re-discussion of old topics.

Questions about how to interpret items in this document may occasionally arise. If you have need for a clarification, please contact the FHS mailing list. Since this standard represents a consensus of many participants, it is important to make certain that any interpretation also represents their collective opinion. For this reason it may not be possible to provide an immediate response unless the inquiry has been the subject of previous discussion.

## 7.5. Acknowledgments

The developers of the FHS wish to thank the developers, system administrators, and users whose input was essential to this standard. We wish to thank each of the contributors who helped to write, compile, and compose this standard.

The FHS Group also wishes to thank those Linux developers who supported the FSSTND, the predecessor to this standard. If they hadn't demonstrated that the FSSTND was beneficial, the FHS could never have evolved.

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