

**FILEMAKER SERVER
FOR RED HAT LINUX
- WHITE PAPER -**

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PURPOSE

The purpose of this white paper is to introduce FileMaker Server 5.5 for Red Hat Linux. General information about Linux and how to configure a system best for FileMaker Server is included. For more information about Red Hat Linux and its configuration, please refer to Red Hat's website (www.redhat.com). Other useful informational resources are the Linux usenet groups and books such as the Exam Cram for Red Hat Linux series. Much of the information found in this document comes from these sources.

FileMaker Server 5.5 is certified for Red Hat Linux version 7.0. For simplicity in this document, whenever Linux is mentioned, Red Hat Linux version 7.0 is implied. Several updates are available for the operating system. Be certain to visit Red Hat's web site for all the latest updates immediately following installation of the operating system.

It is assumed that the reader of this paper already has some experience with FileMaker Server 5.x on either Mac or Windows. For more information about FileMaker Server in general, please check the FileMaker web site for documentation and white papers regarding FileMaker Server.

HISTORY OF RED HAT LINUX

In 1990, Linus Torvalds, a university student from Finland, started a new operating system as a hobby. It was based on the Minix operating system. What he built originally has grown into what we know of as Linux through the help of thousands of developers worldwide through the collaborative efforts of the GNU Project.

Red Hat Linux, a distribution of Linus' new operating system, was started in 1994 by Bob Young and Mark Ewing. By the end of 1998, several large firms, including Intel and Netscape along with venture capital firms invested in Red Hat Inc. Now, Red Hat provides a distribution that is easy to install and maintain along with a high degree of technical support.

Linux popularity is growing dramatically. Its stability is one of its strongest points. Individual portions of the operating system can be reconfigured and restarted without restarting the entire system. It is a system built from the ground up as a multi-user, multi-tasking OS, giving it a great deal of power as a server environment. For this reason, FileMaker has chosen to develop FileMaker Server for Red Hat Linux.

FILE SYSTEM

The Linux file system is an interesting diversion from what Windows users are used to. Similar to DOS, a hierarchical directory system is in place, where every directory can contain files and/or other directories. All directories branch from the root directory (/). Following is a list of common RedHat Linux directories and their general usage.

DIRECTORY STRUCTURE	COMMON USAGE
/	Root - this is where everything starts.
/bin	Executable and binary files for everyone
/dev	Devices found on the machine are referenced here. (hda1 - IDE HD partition 1, fd0 = floppy drive, cdrom = CD-ROM, etc.)
/etc	Configuration files and boot scripts (/etc/rc.d/).
/sbin	System configuration and administrator executable files.
/home	General user directories are subdirectories of this. Also the default location for FTP and HTTP servers.
/lost+found	System directory for placing lost files found (or created) by disk errors and improper shutdowns.
/mnt	Directory for mounting drives such as the floppy, CD-ROM, or remote network drives. Each device would have a directory setup under /mnt.
/proc	Information about processes running on the machine, interrupt usage, I/O port usage, and CPU type.
/tmp	Directory created to hold temporary files.
/usr	Contains subdirectories for local programs and executables for user and admin commands. Contains binaries for X, games, shared libraries, and more.
/var	Short for "variable data", this is the location for spooling, logging, and other data. This is where the fmserver directory is created to house the FileMaker files to be hosted.
/opt	The preferred location for optional packages. Programs such as Applixware and KDE install here
/usr/local	This is where the administrator can install programs on the system. It's usually reserved for system-related programs. Most distributions don't use this much.
/usr/bin	Similar to /bin, this is where several user applications are installed. This is where FileMaker Server (fmserverd, fms_registration, and fmpasswd) is installed.

What is different about the Linux directory structure is the fact that any directory can actually be on different physical media. For example, we may decide to setup the system directories on one hard drive and the data directories on another drive. Rather than having a C: drive and a D: drive, the appropriate drive would be accessed by navigating to the directory. Each necessary partition of the hard drives must, therefore, be assigned to a directory in the system.

INSTALLATION

Red Hat Linux 7.0 has an easy installation procedure for most hardware. Simply put the CD in the drive and boot from that CD. A graphical interface will walk you through the process of installing the software. Since we are planning on making this a FileMaker Server, we will not discuss the possibilities of dual-booting, web serving, etc. as the server should be dedicated to FileMaker Server as with the other operating systems. However, the installer does recognize if another operating system is installed on a partition of the drive, and functions nicely with those other installations.

PARTITIONING

Linux uses standard DOS partitioning. This means four primary or extended partitions, extended partitions holding logical partitions (15 for SCSI and 63 for IDE per extended partition) can be on each drive. These partitions are referenced in Linux using a scheme that indicates which IDE or SCSI drive to use and which partition on the drive. IDE drives use the HD indicator and SCSI drives use SD. So the first partition of the first IDE drive in a system can be referenced as `/dev/hda1`. The third partition of the second SCSI drive is found at `/dev/sdb3`.

When installing Red Hat, you must configure the partitioning of the system. Of course the most simple partitioning would consist of one partition containing the root (`/`) and one for the swap. Separating some of the partitions could ease backup, enhance speed, or provide greater stability. For example, setting the root to the first IDE drive and `/var` to a SCSI drive would allow all the FileMaker data to be accessed via a separate controller than the system software. The following is one possible setup in a scenario with two drives:

DEVICE	DIRECTORY	MINIMUM SIZE	DESCRIPTION
hda1	/	~2GB	This will be where everything except the <code>/var</code> directory is stored.
sda1	/var	Depends on FileMaker files. 1G+FM files	This is where the FileMaker files will be hosted from (with other things in the <code>/var</code> directory).
hda2	<swap>	64M	This is where memory will swap to as needed.

Note: Swap memory should be 1 to 3 times RAM, 2 times RAM is recommended.

You could take this one step further to make only the FileMaker files setup on the second drive:

DEVICE	DIRECTORY	MINIMUM SIZE	DESCRIPTION
hda1	/	~2GB	This will be where everything except the /var directory is stored.
sda1	/var/fmserver	Depends on FileMaker files. Let it fill the drive	This is where the FileMaker files will be hosted from.
hda2	<swap>	64M	This is where memory will swap as needed.

It depends on the situation to determine how best to configure the drive partitions. The minimum is two partitions, one for the system, data, etc. and the other for the swap drive. A general recommendation for a FileMaker Server where there is only one physical drive would be to have a partition scheme as follows:

DIRECTORY	SIZE	TYPE	DESCRIPTION
/boot	20M	Linux Native	This is where the boot information is stored. It needs to be in the first 1024 cylinders.
/	1M Growable	Linux Native	This is where all applications and most data will reside.
/var/log	100M	Linux Native	This is where the log files will reside. It will be separate so if a log grows out of control the OS or FileMaker files will not be disturbed.
/var/fmserver	depends on size of hosted files. ex: 2000M	Linux Native	This is where FileMaker hosted files will reside, again, separated for safety and reliability. If this can be a separate physical drive, all the better.
<SWAP>	128M	Linux Swap	This is where the memory will swap as needed.

FILE SYSTEM

LILO (Linux Loader) is the Linux boot loader. It can be used in the multi-boot situation to allow the user to determine which operating system to boot. Within Linux alone, it can be used to determine which configuration to use when booting, so you can have multiple kernels configured on the machine. This is most likely going to be installed at the Master Boot Record (MBR) of the hard drive and point to the appropriate partition and boot string to start the operating system.

PACKAGES

When installing Red Hat Linux, several options exist for that installation. First, you can choose between a server, workstation, or custom installation. Any one of these will work, but for security purposes, we would suggest a custom installation, weeding out packages such as the web server, SQL server, etc. Keep in mind that you will probably want to move files to or from the server, so an FTP server package may be desirable. X-windows is a graphical interface, similar to Windows in that you can have multiple windows to different data available on the screen. Since it can be advantageous to your administration, install a Gnome or KDE environment. If you want to edit text files, a text editor is important; EMACS is an easy to learn option.

USING LINUX

Here are some starting reference guides to using Linux. Like it or not, you will have to use a command-line interface to operate Linux to some degree. The following are a few basic commands, their DOS equivalent (if possible), and a description:

LINUX	DOS	Description
ls	dir	directory listing. (-a for all files -l for more details)
cd <directory>	cd	changes directory. .=this directory, ..= parent, /=root cd with no directory goes to home.
mkdir <dirname>	md	make a directory
rmdir <dirname>	rd	remove a directory (-R for recursive to delete subordinate directories)
cp <source> <destination>	copy	copy a file or directory
mv <source> <destination>	move or ren	move or rename a file
rm <filename>	del	delete a file
more <filename>	type	list the contents of a file one page at a time
emacs <filename>	edit	easy to use text editor – use F10 to get menus
vi <filename>	edlin	not so easy to use text editor
man <topic>	help	Manuals for just about everything. xman in X-Windows is easier to manipulate.

One thing that is very useful with the text interface is the tab key. It will auto-complete text. For example, when in the /var directory, typing "cd fm<tab>" will fill in the rest of the statement to "cd fmserver/". If subdirectories exist in fmserver, they can be accessed with the tab button as well. This also works with applications, so if you type "fms<tab>" at a prompt, it will beep at you. Pressing tab again will show all options that match "fms*", fms_registration, fmserverd, and fmspasswd. Typing an additional "e<tab>" will fill in all of "fmserverd" because that is the only possible match.

INSTALLING SOFTWARE - RPM

This is where Red Hat has really made life easier (in the Linux realm). Software installation can be a difficult process, but the Red Hat Package Manager helps keep track of what software is installed, what dependencies exist, and where conflicts could occur. Software developers often package the necessary files into *.rpm packages. FileMaker Server is no exception.

The basic use of RPM is to install, remove, or upgrade software. The options for RPM that interest us are:

OPTION	DESCRIPTION
i	Install
v	Verbose
h	Show hash marks to indicate progress
e	Remove/Uninstall software
U	Upgrade
V or y	Verify installation

To install FileMaker Server, first navigate to the "fmserver-5.5-1.i386.rpm" file. Then type "rpm -ivh fmserver-5.5-1.i386.rpm".

FILEMAKER SERVER

REQUIREMENTS

As with other operating systems, FileMaker Server's hardware recommendations require understanding of one primary fact: FileMaker Server is a very I/O intensive application built to pass data between the local hard drive and networked clients. As a result, the most important considerations of the hardware revolve around the I/O components: hard drive and networking subsystems. A SCSI hard drive should be a minimum recommendation, with a RAID-5 configuration recommended. The network interface should be a good network card communicating to the network at the fastest speed available on that network. Finally, the CPU can be viewed as the least significant portion of the server, within reason.

REQUIREMENTS - CONTINUED

FileMaker Server works with the kernel versions 2.2.14 through 2.4.2 provided by Red Hat. It is certified on Red Hat Linux 6.2 and 7.0.

If you want to have the server publish to an LDAP server like Active Directory, the `openldap` package will need to be installed. Without it, the LDAP registration will fail and a log message will indicate that `openldap` was not installed.

INSTALLATION

FileMaker Server installs a few files. Three program files will be created, a directory to store the FileMaker databases to host, and a few secondary files necessary for the server to automatically be started at boot time. Here are the key files, including location, and their purpose:

FILE	Location	Purpose
<code>fmsserverd</code>	<code>/usr/bin</code>	FileMaker Server daemon – similar to the service on Windows or the application on Mac OS
<code>fmspasswd</code>	<code>/usr/bin</code>	Sets the password for FM Server remote administration
<code>fms_registration</code>	<code>/usr/bin</code>	The application used to register FileMaker Server with the appropriate install code.
<code>fmsserver.conf</code>	<code>/etc</code>	Configuration file
<code>events.log</code>	<code>/var/log/fmsserver</code>	Events log
<code>stats.log</code>	<code>/var/log/fmsserver</code>	Statistics log

One of the very first actions a new FileMaker Server administrator must take after installation is to register the software. To do this, the `fms_registration` application must be run as follows:

```
fms_registration <reg code> <path to fmsserverd (/usr/bin/fmsserverd by default)>
```

The `fmsserverd` application is the FileMaker Server daemon. This works similar to a service in Windows. It is intended to be loaded by the system upon starting. This is done through a series of scripts that are setup on every Linux system.

START-UP SCRIPTS

In the `/etc/rc.d/` directory are several directories containing scripts (and symbolic links to scripts) used to start up the operating system. The `init.d` subdirectory holds the scripts used, and the `rc?.d` directories contain symbolic links to these scripts to determine whether to stop or start the daemons with the scripts for each run-level. The run-levels allow different configurations.

START-UP SCRIPTS - CONTINUED

Following is a list of the run-levels and what they do:

RUN-LEVEL	TASK
0	Halt or shutdown the system
1	Single-user
2	Multi-user without networking
3	Multi-user with networking
4	not used
5	X11 (boot to X-windows)
6	Reboot

Switching from one level to another is done with the `init` command. For example, to switch to single-user mode (for full backup capabilities or for troubleshooting) type "`init 1`" as root.

When a run-level is started, the scripts in the appropriate `/etc/rc.d/rc?.d` directory are run. First, those starting with "K" are run in order of their number to stop processes. Then the "S" scripts are run to start other processes.

The FileMaker Server is started in the third and fifth run-levels and is stopped in all run-levels. The script used to control the daemon is located in the `/etc/rc.d/init.d` directory. So, the daemon can be controlled manually using the following script:

```
/etc/rc.d/init.d/fmserverd {start/stop/restart/reload/status}
```

FILEMAKER SERVER CONFIGURATION

To configure the server, a text file is used. This file, `/etc/fmserver.conf`, can be edited with your favorite text editor, `emacs` or `vi` for example. The file is fully self-documented, so configuration options should be easy to discern.

Remote administration is the only portion that needs additional set up steps. When remote administration is made available in the configuration file, a password must be given to the server. This password is encrypted. Therefore, an additional application is available to set the server's password. This application is `fmpasswd`. So, if remote administration is setup to be available and password protected in the `fmserver.conf` file, do not type the server password in the configuration file. Rather, save the file and run the `fmpasswd` application to set that password.

FILEMAKER HOSTED FILES

All files to be hosted by FileMaker Server should be placed under the `/var/fmserver` directory by default. When FileMaker Server daemon starts up, it will automatically open the files found here or in sub-directories one level deep. Optionally, the files can be opened or closed using the `fmserverd` application or using remote administration, just like other versions of FileMaker Server.

One very important note, the files being hosted must have a creator name and group of "fmserver" and must be editable by the same. An easy way to assure this is to always use the `fmserver` user to place the files on the server. If this was not done, then the process of changing the owner is fairly simple. The `chown` command is used to do this. To change the file "testhost.fp5" execute the command "`chown fmserver:fmserver testhost.fp5`". To change all files in the `fmserver` directory and subdirectories, use this command "`chown -R fmserver:fmserver /var/fmserver/*`", the `-R` meaning recursive directories.

Rights to the files require a little more information. Using the `-l` option for `ls`, you can see the rights a file has. Thinking of it as three sets of binary numbers is easiest. The first set is the owner's rights, the second the group's rights, and third is world rights. The three options are write, read, and execute for each group. The following representation shows this:

OWNER	GROUP	WORLD	PERMISSION CODE
Write	Write	Write	660
Read	Read	Read	
Exec	Exec	Exec	
4	4	0	
2	2	0	
0	0	0	

Changing the rights (or mode) is done through the `chmod` command. To make `testhost.fp5` ready to host, use "`chmod 660 testhost.fp5`". The recursive option will work for `chmod` as well to set all files with these permissions. Of course the passwording within FileMaker will protect the data within the file as with other operating systems.

FILEMAKER SERVER SCRIPTING

Scripting the FileMaker Server for backups or restarting is very similar to how FMS operated on Windows in version 3. The Linux operating system includes a method of scripting similar to batch files in DOS, and Linux also allows for these batch files to be run at a certain time, or multiple times using a tool called `cron`.

FILEMAKER SERVER SCRIPTING - CONTINUED

All scripts are text files. They must start with the string "#!/bin/sh" indicating what application to use to run the script. Following lines starting with a # will be comment lines. The rest is just a matter of executing system commands. Some logic is available, such as if statements, environment checks, etc. but that will not be covered here.

The following are very simple backup and restart scripts.

```
#!/bin/sh

# This script will pause the FileMaker Server and backup all files in the /var/fmserver
# directory to the /home/fmserver/backup directory.

fmserverd PAUSE
# pause the FM Server
cp -Rf /var/fmserver /home/fmserver/backup
# copies the entire directory structure, forcing existing data in /home... to be overwritten
fmserverd RESUME
# resume the FM Server
```

```
#!/bin/sh

# This script will restart the FileMaker Server daemon
/etc/init.d/fmserverd restart
# restarts the daemon
# causes the FM Server to reload all of the files in the /var/fmserver directory
```

To make this happen automatically, cron is used. In the /etc directory is a file called crontab. It contains a list of all files to be run at specific times. Simply edit this file to include your scripting at specific times. At the left of the file are five columns indicating when to perform the function. These columns are the minute, hour, month day, month, and weekday to perform the task. If the columns are 0 * * * *, then the task will occur every hour at the 0 minute. 15 12 * * * will happen at 12:15 daily. 30 18 * * 6 will occur at 6:30 PM every Friday.

One way this has been made easier are folders holding scripts which will run hourly, daily, or monthly. These folders are in /etc/cron.hourly, /etc/cron.daily, and /etc/cron.monthly. So, an hourly backup could be run by simply setting up a backup script in the /etc/cron.hourly folder.

Also available is the `at` command. It allows you to setup a command to execute at a specific time. It differs from `cron` in that `at` executes the command once at the given time and then is completed rather than making the command recurring. So, the administrator could have a script called "fmshutdown" and want it to run at midnight Friday so she can update files over the weekend: "`at -f fmshutdown midnight`" if today is Friday, "`at -f fmshutdown Friday midnight`" if not.

CONCLUSION

This document has communicated information about Red Hat Linux setup in very general terms with an eye toward setting the system up as a FileMaker Server. This server can be configured to provide FileMaker data to FileMaker Pro/Unlimited clients via TCP/IP networking, regardless of the operating system the client is running. The Linux server is very configurable, having been designed with the intent of running on a TCP/IP network. In the hands of an experienced administrator this system can be tweaked to top performance. With the addition of this operating system as a platform option for FileMaker Server, the total cost of implementing a large multi-user configuration of FileMaker with automated backups of live data and reliable connectivity may be greatly reduced.

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