

# FileMaker Server Backups

By:

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**F**ileMaker Server offers many features that make it the true cornerstone of a secure and stable solution deployment, and chief among them is the ability to perform and validate backups.

Back in 2004 FileMaker® Server 7 introduced a new “live backup” mechanism that significantly reduced the impact on the connected users. In FileMaker® Server 12 that mechanism is fine-tuned to back up only those *files* whose data were modified since the last backup, while keeping the whole solution file set intact for each backup.

In addition FileMaker Server 12 introduces a completely new backup mechanism that only backs up changed *data* and rolls it into a full backup set so that you will always have a set of files that is no older than a specified interval.

Note the emphasis that we placed on “files” for the enhancements to the regular backup feature and to “data” for the new progressive backup feature. That distinction will become clear further on in this document.

## Changes to the regular backup Mechanism

Since FileMaker Server 7 the regular backup schedule that is available through the Admin Console worked as follows:

- At the start of the schedule it starts copying the files over to their backup location, without interrupting the user’s connections to the files. The users can continue to make any and all changes to the files that their privileges allow.

- At the very end of the backup, FileMaker Server briefly pauses the client’s connections to the file so that it can write the changes to the

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backed up files that were made to the live files since the beginning of the backup schedule.

The process is designed to minimize the time that the users are unable to write changes to the files during a backup. At the end of the process you have a full copy of each of the files in the backup process.

If your solution is big and you take many backups during the day, then this can eat up a lot of disk space, and it can cause performance degradation to the server while the backup happens.

FileMaker Server 12 addresses this issue. During each regular backup (the backups that you see in the schedules list – see Figure 1), FileMaker Server will now make a copy only of the files that were changed since the last backup. Files that were *not* changed since the last backup do *NOT* get copied but are hard-linked to the new backup set. The overall result is that each backup set contains *all* your files but the act of backing up is faster and also use less hard disk space if you have files with data that did not change since the last backup.

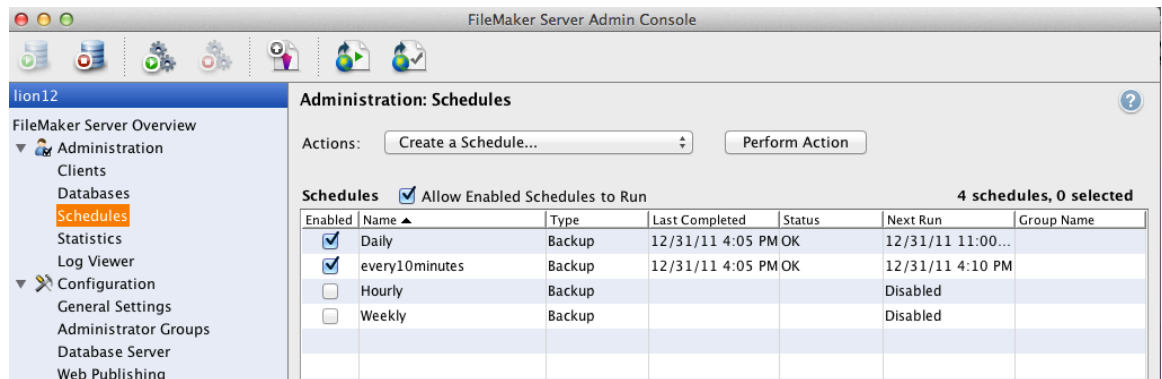


Figure 1 - regular backups in the Schedules list

“Hard links” are at the core of the modified backup behavior. Hard links are a feature of the OS file system (NTFS on Windows, HFS+ on OS X) that allows one physical file, occupying some hard disk real estate, to appear in different folders not as a shortcut or an alias, but as if it were a real file. The difference is important, because a hard link allows for all file-level operations like copying, moving and deleting the file and adding it to an archive such as a zip file. A shortcut just lets you open the file.

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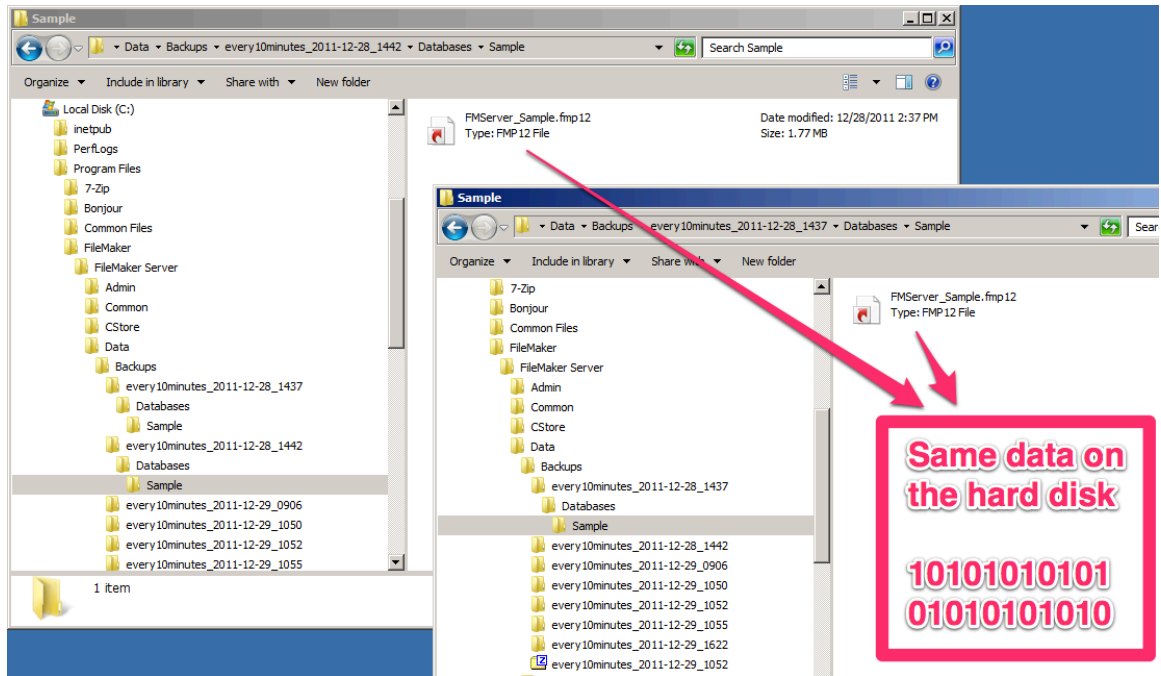


Figure 2 - hard linked files in Windows<sup>1</sup>

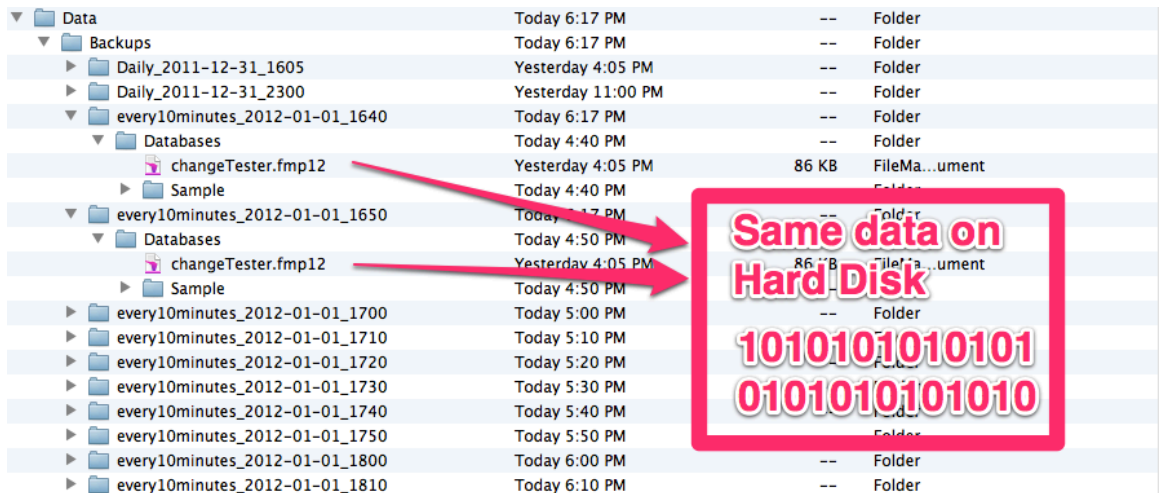


Figure 3 - hard linked files in OS X

It is fair to say that in both OS X and Windows all files as they appear in the Finder and Windows Explorer really are hard links. Each file's data on the hard disk is represented by at least one file name in a folder, and that's a hard link.

Using hard links avoids duplicate files' occupying a lot of hard disk space. In particular when it comes to FileMaker Server 12 backups, it speeds up the backup

<sup>1</sup> The "0101010101" in the screenshot denotes the binary data on the hard disk.

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process by not having to find and occupy hard disk real estate for data that has not changed.

So how can you tell if a file as you see it in Finder or Windows Explorer is really one of potentially multiple hard links?

On OS X you can see the number of hard links from the terminal: navigate to the folder where the file is and type in

```
ls -al
```

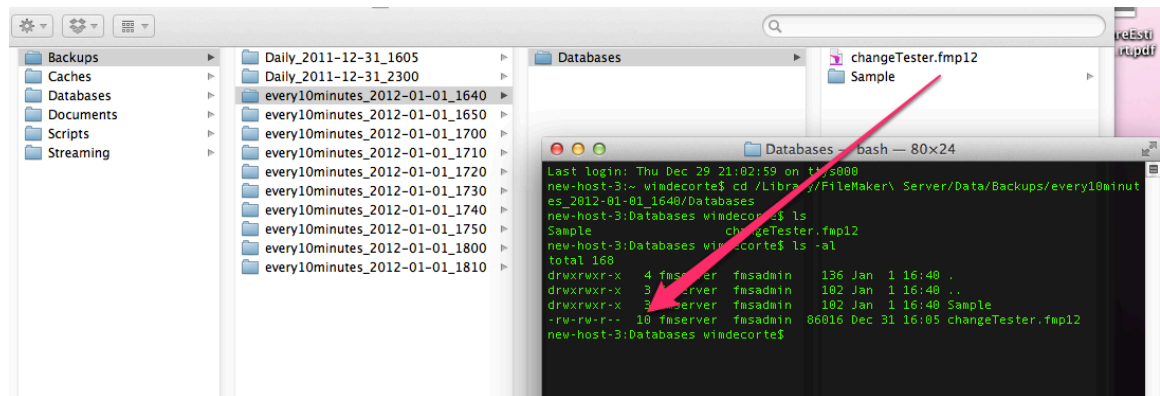


Figure 4 - showing the number of hard links in OS X

The number indicated in Figure 4 shows the number of hard links for that particular file. In this case there are 10, meaning that the file that we are backing up has not changed in the last 10 backups.<sup>2</sup>

On Windows you also need to use the command line interface to check the hard links. The command to use is:

```
fsutil hardlink list <the full path and name of the file to check>
```

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<sup>2</sup> Note that the number that shows next to a directory/folder entry - the ones that start with a "d" as the very first character on the line is not the number of hard links but the number of files in that folder.

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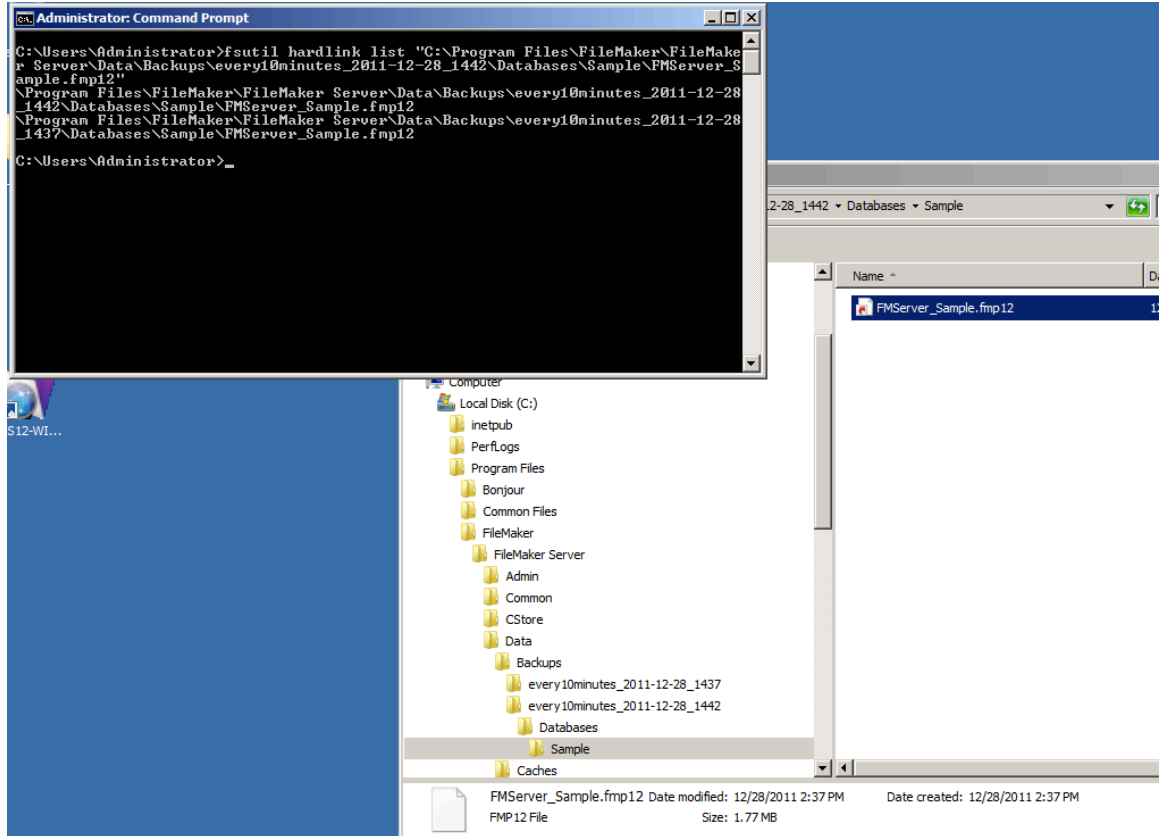


Figure 5 - showing the hard links on Windows

This command will show you a list of all hard links that the OS has for this particular file. In this case there are two hard links pointing to the same bit of hard disk data.

FileMaker Server 12 will also log an event with ID 758 in its event log whenever it creates a hard link during the backup process (Figure 6).

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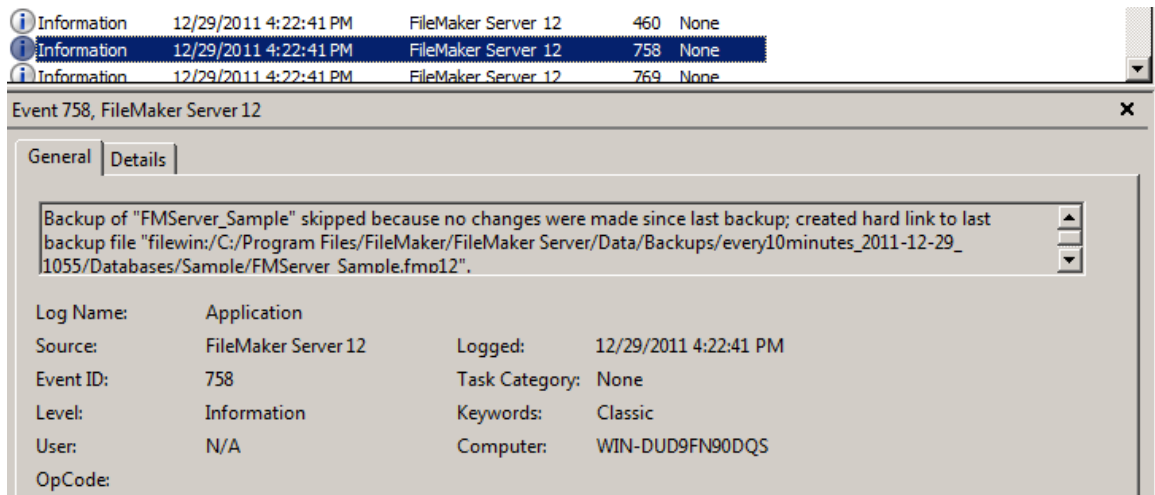


Figure 6 - FileMaker Server 12 logs the creation of a hard link

### Some implications...

So what happens really if you open up and modify one of the two hard linked files listed in Figure 5? What happens if you copy, move or delete one of the files?

**First off, do not move the file. Always make a copy and use that copy.**

If you open a backed up file directly from its backup folder and in any way try to modify it you will see the following warning if the file is hard linked to any other backup set. The same dialog will appear if your opening script tries to edit or create records and you don't have "set error capture" on in the script.<sup>3</sup> If you've moved a file from a backup location to the FileMaker Server live folder then FileMaker Server will log a similar warning in the event log and will open the file in read-only mode.

The logged event (ID 771) will say "Opened database "xyz" read only because it has multiple hard links and may be a FileMaker Server backup file. You must make a copy of the file and open the copy to make changes."

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<sup>3</sup> If you do have "set error capture on" in your opening script it will silently generate an error #6 for each data edit.

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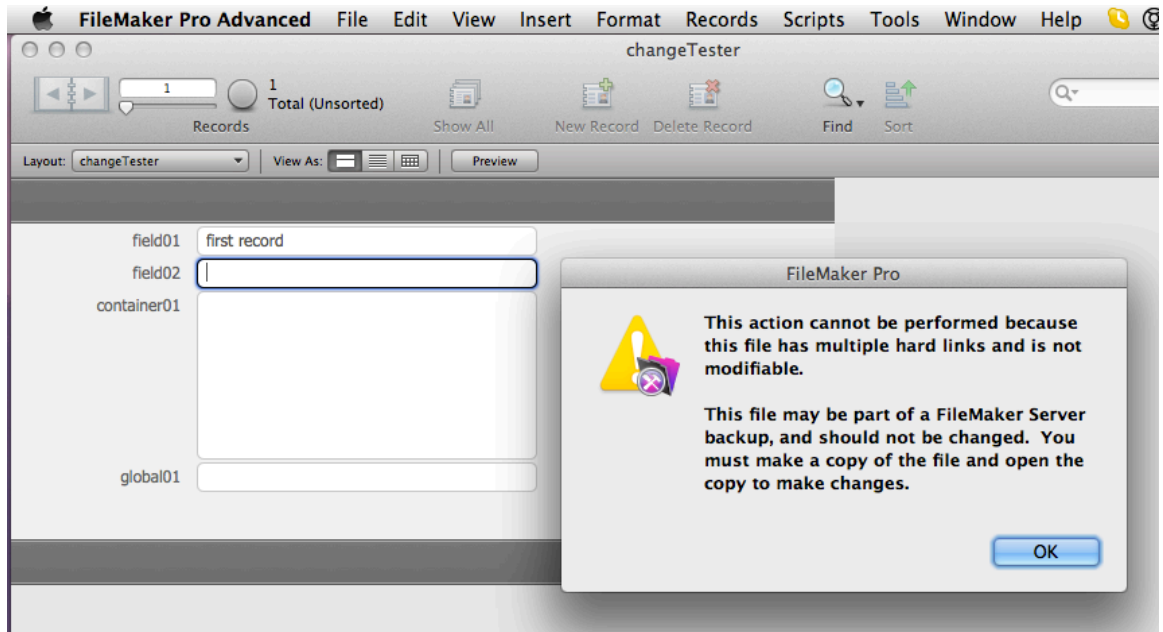


Figure 7 - warning when trying to modify a backup file that is hard linked.

FileMaker protects the integrity of your backups, because if you could change this file, you would in effect have changed the same file in *every* backup where it has a hard link.

As you can see in Figure 7, the warning tells you to create a copy before making any changes. If you copy a hard link file to a new folder, the operating system will duplicate the file on the hard disk so that it is not hard linked anymore. It is then safe to modify the copied file without your changes affecting any of your existing backup sets.

Note that you will not get this warning if the backed up file had been changed between backups, because then you have a fresh copy of the file, not a hard link to an existing file. As a general rule<sup>4</sup> of best practice though, always copy the backed up file to somewhere else before opening it up, whether it is hard linked or not. This is the only way you can absolutely preserve the integrity of your backup.

Moving a hard linked file backup file however is *not* safe. **Do not move these files at all. Always make a copy and then move that copy.** Moving the file only updates the hard link but does not create a new copy of it. If you move a backup file

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<sup>4</sup> See <http://fmforums.com/forum/blog/13/entry-91-Back-me-up-don't-take-me-out-are-you-never-gonna-do-that/>

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and then edit it, all hard linked files in all backup sets will have been edited but you will not get a warning like the one in Figure 7.

Deleting a file with hard links merely decreases the hard link count, it does not delete the underlying file until the file path and name that you are deleting is the last entry in the list of paths referring to that bit of hard disk space.

Note that the same applies to any Remote Container data from your containers. Remote Containers is a new feature of FileMaker Pro 12 that stores the content of the containers on FileMaker Server, outside of the FileMaker files. It is something you enable on the “storage” tab of the container field options (Figure 8).

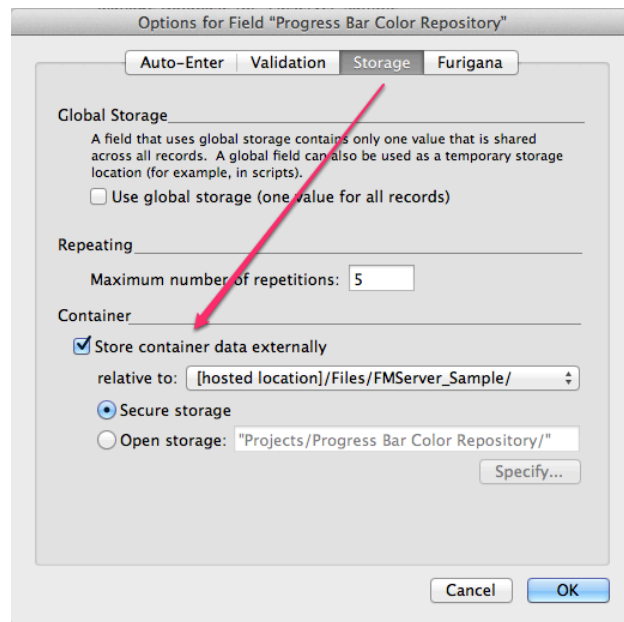


Figure 8 - Remote container feature

With this feature enabled you will see some new folders on FileMaker Server, all prefixed with “RC\_” which is where the container data is stored. (Figure 9).



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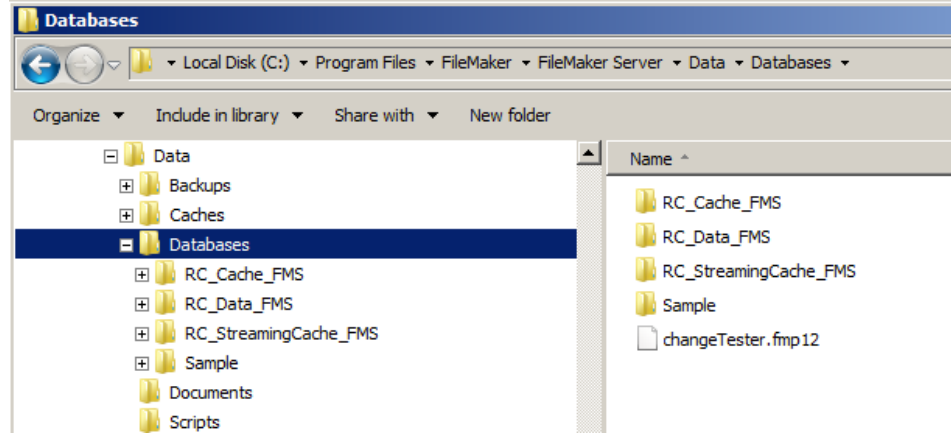


Figure 9 - Remote container folders on FileMaker Server

Those folders are backed up by the regular backup schedules. Container data that is not changed from one backup to the next is hard linked to the last backup in the same way as the FileMaker files are.

If you have FileMaker solutions with a lot of embedded container data, then you will benefit a lot from this new behavior. Since the container is now stored outside the FileMaker file itself, none of it will be backed up if it wasn't changed. Additionally, the file size is now much smaller if you use remote containers instead of embedded images.

Finally, there is one more important fact about hard links as used by FileMaker Server: only files that belong to the same backup schedule are hard linked to each other. If the same file is part of different backups then there will never be a hard link to that file from the different schedules.

### Other Changes

In the backup schedule you can specify how many backups you want to keep. In order to do this FileMaker Server puts each backup in a date and time stamped folder. If you use shell scripts, batch files or VBScripts/Applescripts to zip a backup set, this functionality can make it hard to locate the most recent backup set.

FileMaker Server 12 now lets us specify "0" as the number of backup sets to keep (Figure 10) and this puts the backup in a folder that is not date & time stamped.

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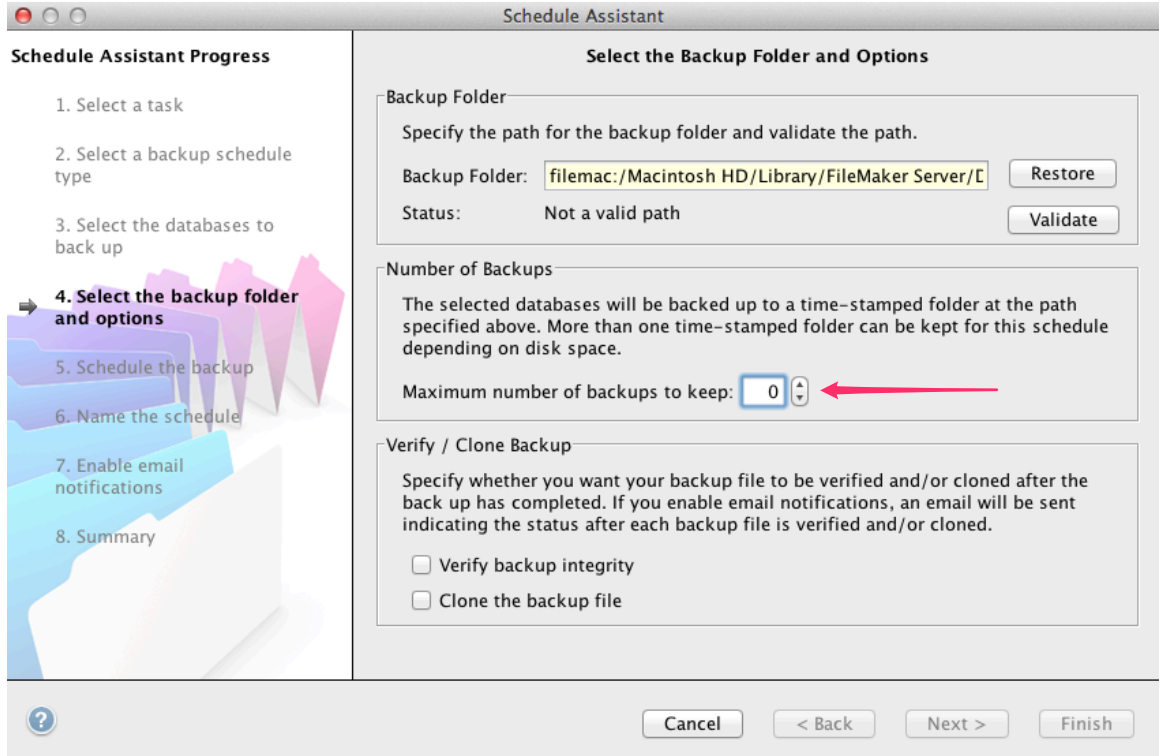


Figure 10 - keeping 0 backup sets

Figure 11 below shows the result of a backup scheduled with the keep property set to zero:

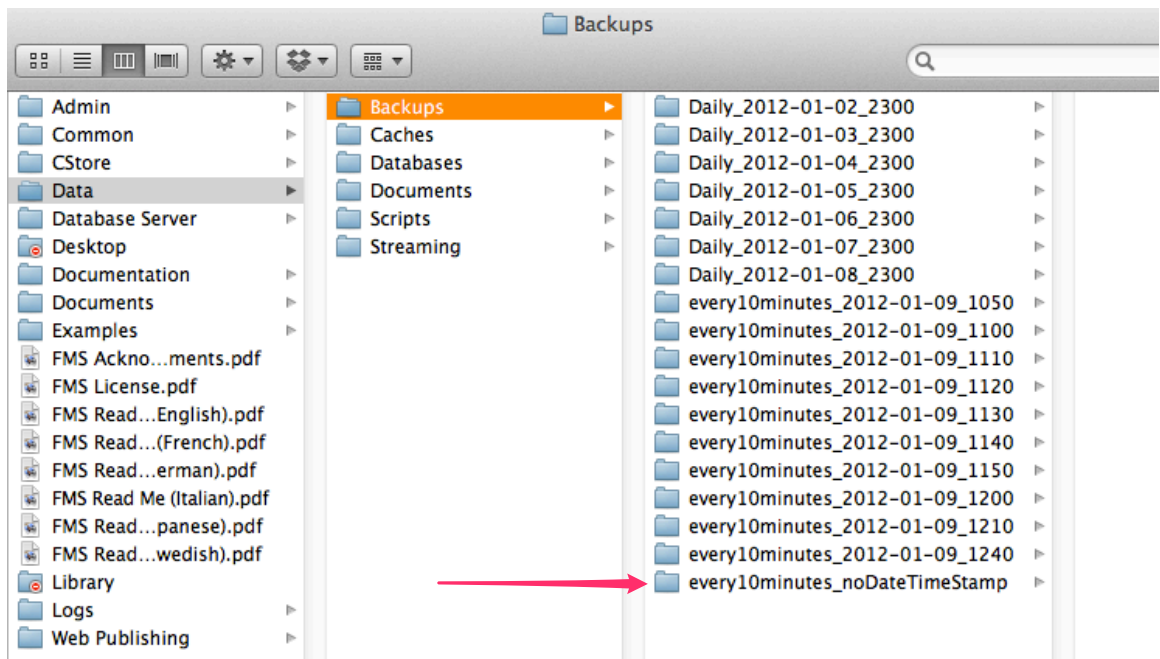


Figure 11 - a backup to a folder that is not date/time stamped

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The command line interface has also been updated to allow the backup command to also use “0 backups” and avoid the date and time stamp on the backup folder. Running the schedule again will of course overwrite the existing backup.

The following command will result in a backup of all hosted files to a folder named “Databases” in the default backup folder (Figure 12). Note that we used the option to skip the date and time stamp on the folder. If we run the command again, we will overwrite the backup in that folder.

```
fmsadmin backup -k 0
```

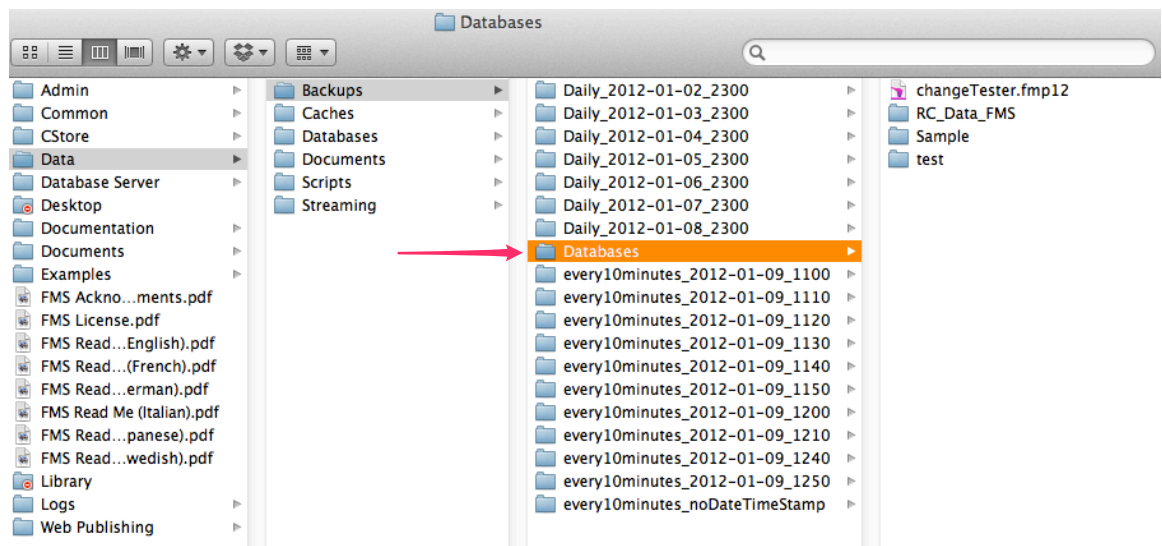


Figure 12 - the result of a backup run from the command line, using the "keep 0 backups" option

## The new Progressive backup mechanism

FileMaker Server 12 introduces a brand new backup feature to complement the two existing mechanisms, and it is called “progressive backups”. It is available from the Folders tab on the Database Server configuration area of the Admin Console.

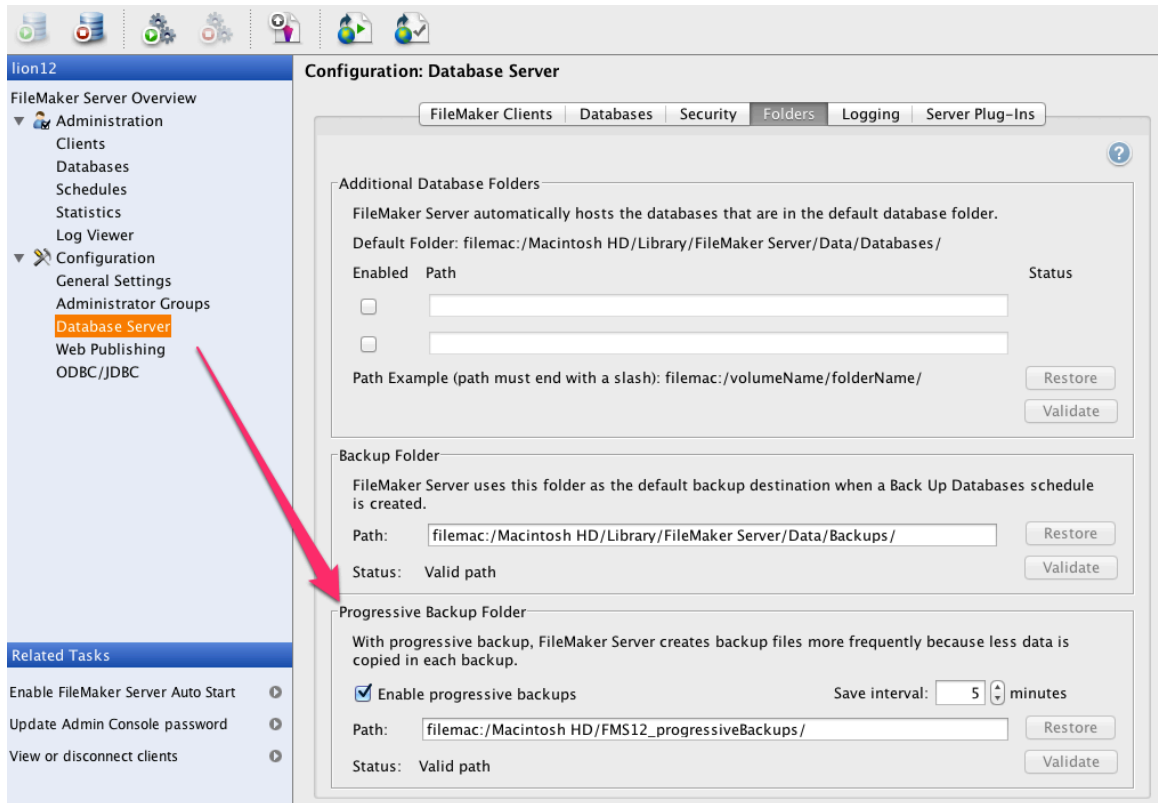


Figure 13 - the new Progressive Backup feature

With this feature toggled on, FileMaker Server will keep track of all the changes that are made to any of the files on your server and at the specified interval use that change log to update a backup so that you will always have a backup that is as recent as that interval.

To maximize the availability of that “rolling” or “incremental” backup, FileMaker Server actually starts off with two full backups and leapfrogs the changes into one of the two backups. That means that at any time after FileMaker Server applies the change log to the backup you will have a backup as of that moment and one that is as old as the interval (5 minutes in case of Figure 13). Figure 14 shows the two date and time-stamped backups available in the progressive backup folder.

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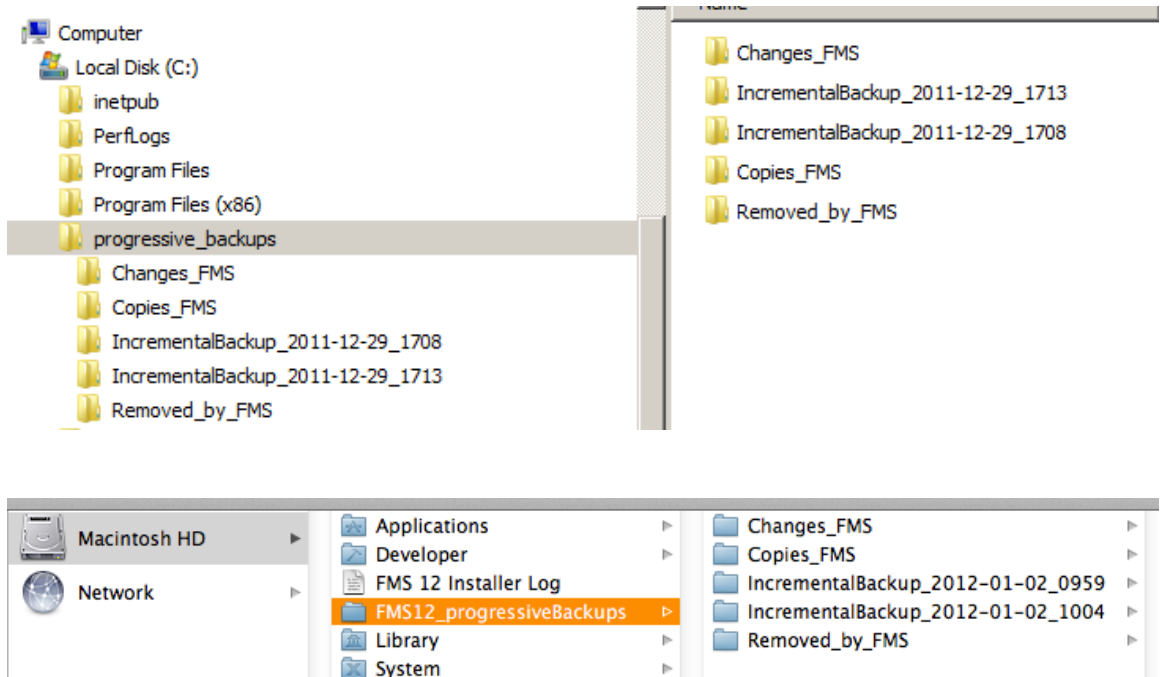


Figure 14 - the two backup sets in the progressive backup folder

Note the wording on this screenshot (Figure 15)

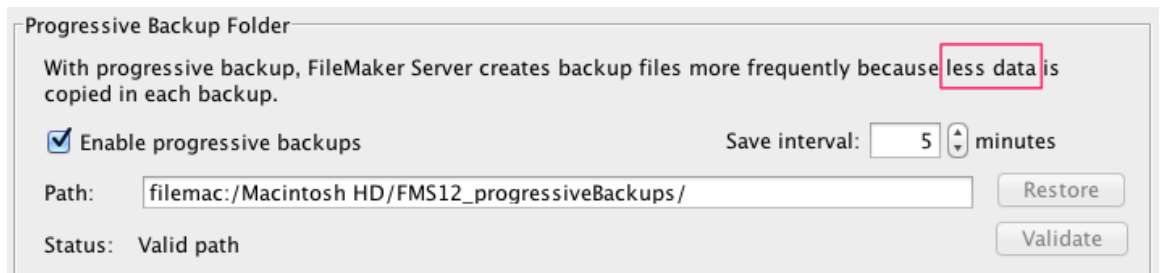


Figure 15 - wording on the Progressive Backup feature

“Less Data” does not mean that the backup size will be smaller. It means that in the act of backing up, less data are transferred to the backup set than with the regular backup schedules. The progressive backup feature actually keeps two full backup sets and typically will be bigger than a regular backup set that contains hard linked files. What it does mean is that the time it takes to back up is *significantly faster since it only backs up the actual changes that were made.*

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FileMaker Server does not keep a history of changes over time. It collects the changes during the interval, applies them to the backup when the interval elapses and then starts all over again.

### Some implications

Unlike regular backups, with the progressive backup:

- You can not specify a start and end time
- You cannot target just some of your files. It is a server-wide setting that applies to all the hosted files on that server

The folder that you specify:

- Has to be **outside** the normal FileMaker Server folder structure. You cannot for instance pick the regular FileMaker Server backup folder.
- On OS X you will need to make sure that user “fmsadmin” of group “fmserver” has read, write and execute privileges to the folder that you specify before enabling the feature (see Figure 16). Without those privileges, you will not be able to validate the path. If you are unsure what privileges to apply then check those on the regular FileMaker Server backup folder and set the same privileges on your progressive backup folder.

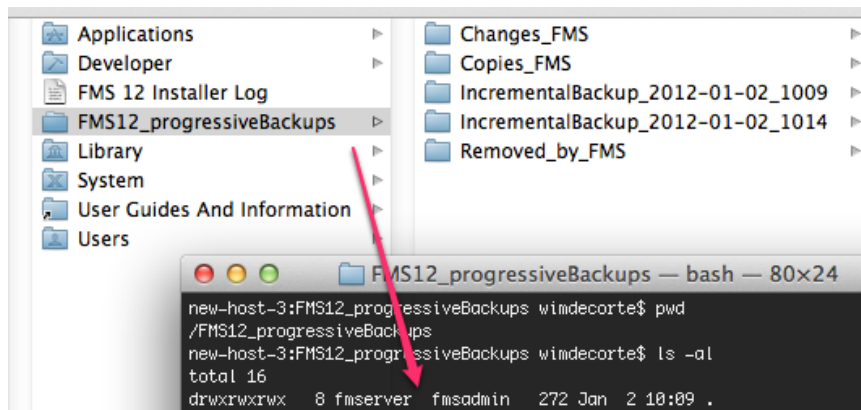


Figure 16 - necessary privileges on the progressive backup folder

- Make absolutely sure that nothing touches the progressive backup folder or its subfolders. So no OS file sharing, virus scan, indexing or

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the like. If you have set virus scanning exclusions by file type and not by folder then make sure to exclude the new file extensions \*.fxl and \*.fxz.

The interval is set by default to 5 minutes. You can set to anything between 1 minute and 60 as appropriate but be aware that there is definite performance issue on a busy server with many files. The ideal interval is something that you need to decide on taking into effect the business requirements and the effect on the performance.

To increase the stability of FileMaker Server 12, the progressive backup functionality runs completely in its own process so that it can be started, stopped and restarted without affecting any other part of FileMaker Server.

## Conclusion

To recap, in FileMaker Server 12 we now have three different backup mechanisms available to us:

- The “old style” pre-FileMaker Server 7 mechanism of pausing-copying-resuming the files. This is not available through the Admin Console but can be done as before through the *fmsadmin* command line in a Windows batch file or an OS X shell script.
- The live backup mechanism introduced with FileMaker Server 7 and enhanced in this new version to only backup changed files (note that we are saying “files” and not data. Even if a single character in a single field in a single record changes, the whole file will be backed up).
- The brand new incremental backup option that will backup only actual data changes and roll them into a backup copy of your solution so that the backup is never older than the interval you set.

A good Disaster Recovery strategy will consist of a combination of all three features or at the very least a combination of regular backups and progressive backups. We do not recommend using just progressive backups as the only backup mechanism.

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Overall, backups in FileMaker Server 12 promise to be faster and offer a new valuable option to reduce down time and data loss when you need to restore from a backup.

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### ABOUT WIM DECORTE

Wim Decorte is a Senior Architect and Senior Technical Project Lead at Soliant Consulting Inc, a long-standing reputable FileMaker development company and a Platinum member of the FileMaker Business Alliance.

Wim is a FileMaker 7, 8, 9, 10 and 11 Certified Developer and the author of numerous Tech Briefs and articles on FileMaker Server. He is also a frequent speaker at the FileMaker Developer Conference and at FileMaker Developer groups throughout the world. For his numerous contributions to the FileMaker community he was awarded with the FileMaker Excellence Award in 2002. In addition to being a renowned expert on FileMaker Server, Wim also specializes in integrating FileMaker with other applications and systems across many technologies. His pet project is the open source fmDotNet connector class that he created ([www.fmdotnet.org](http://www.fmdotnet.org)). Sometimes referred to as the *Developer's developer*, Wim has been a true nomadic developer trekking from Belgium to Canada, through Germany to Holland, and from Bermuda to his current home on the East Coast.

### ABOUT STEVEN H. BLACKWELL

Steven H. Blackwell is a Platinum Member Emeritus of the FileMaker Business Alliance, the first person ever so designated by FileMaker, Inc. in August 2011. From May of 2007 until October of 2011, he was a Platinum Level Member of the FileMaker Business Alliance. From December of 1997 to April of 2007, he was a Partner Level Member of both the Claris Solutions Alliance (CSA) and the FileMaker Solutions Alliance (FSA). He has been developing business management solutions in FileMaker® Pro and its predecessor applications since 1986.

He is the author of the definitive volume *FileMaker Security: The Book*, available at [www.filemakersecurity.com](http://www.filemakersecurity.com). He is the creator and author of the new FileMaker Security Blog [<http://fmforums.com/forum/blog/13-filemaker-security-blog/>]