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Abstract

In this paper, the dynamic nature of FAT32 file system is presented. The paper highlights the significant similarities and differences of various file systems used in storage media today. It reappraises the FAT32 File System and Techniques as a reliable file system to be used in storage media in the developing countries with erratic power supply. The File System used in a storage media is the foundation on which the operating system will be installed and subsequent programs and the Decision Support System (DSS), thus the foundation must be solid to provide the needed data and information storage security. FAT32 file system could offer such confidence. The data recovery capacities and compatibilities of FAT32 file system is enormous comparing with other file systems, especially in the developing countries where uninterrupted electricity supply is still hoped for. This paper concludes with the recommendations on the use of FAT32 file systems for better performance in designing and implementing of enterprise-wide Decision support system.

Key Words: File Allocation Table **(FAT)**, File System, Decision Support System **(DSS)**

Introduction

A file system is essentially a directory of data; they are ways to arrange files on a disk and store. You can think of it as white pages for the hard drive. If you want to get optimum performance from your PC, it's crucial that you understand the differences among the file systems so you can decide which one is right for you.

It is obvious that the security measures provided for a standard Decision Support System designed and implemented may be far from the consideration of the type of file system used in the storage media. Most dangerous situation with end users of Decision Support System is Hard Drive crash. If in the design of DSS, the type of file system is carefully considered, then system crashes and associated failures will not pose any problem for data recovery.

In this paper, various file systems available today are presented. We x-ray the significance and the consequences of each file system; finally, the FAT32 usage recommendation is suggested for developing countries with erratic power supply. It is only the FAT file system that can withstand such.

For a proper follow up of non Hardware or Software Engineering persons, who may not be familiar with the terminologies used, I want to briefly define and explain the main terms used in the paper.

Definition of Terms

At the installation process of a personal computer (PC), the storage media (Hard Drives) will be prepared for use. The preparation is done by partitioning. This partitioning could be done by one of the file systems available which includes FAT16, FAT32 and NTFS.

What is FAT?

FAT stands for File Allocation Table.

FAT16

The FAT16 (16bits FAT) file system was introduced way back with MS–DOS in 1981, and it's showing its age. It was designed originally to handle files on a floppy drive, and has had minor modifications over the years so it can handle hard disks, and even file names longer than the original limitation of 8.3 characters, but it's still the lowest common denominator. The biggest advantage of FAT16 is that it is compatible across a wide variety of operating systems, including Windows 95/98/Me, OS/2, Linux, and some versions of UNIX. The biggest problem of FAT16 is that it has a fixed maximum number of clusters per partition, so as hard disks get bigger and bigger, the size of each cluster has to get larger. In a 2–GB partition, each cluster is 32 kilobytes, meaning that even the smallest file on the partition will take up 32 KB of space. FAT16 also doesn't support compression, encryption, or advanced security using access control lists.

FAT32

The FAT32 file system, originally introduced in Windows 95 Service Pack 2, is really just an extension of the original FAT16 file system that provides for a much larger number of clusters per partition. As such, it greatly improves the overall disk utilization when compared to a FAT16 file system. However, FAT32 shares all of the other limitations of FAT16, and adds an important additional limitation—many operating systems that can recognize FAT16 will not work with FAT32—most notably Windows NT, but also Linux and UNIX as well. Now this isn't a problem if you're running FAT32 on a Windows XP computer and sharing your drive out to other computers on your network—they don't need to know (and generally don't really care) what your underlying file system is.

What is NTFS?

NTFS stands for New Technology File System.

The NTFS file system, introduced with first version of Windows NT, is a completely different file system from FAT. It provides for greatly increased security, file–by–file compression, quotas, and even encryption. It is the default file system for new installations of Windows XP, and if you're doing an upgrade from a previous version of Windows, you'll be asked if you want to convert your existing file systems to NTFS. Don't worry. If you've already upgraded to Windows XP and didn't do the conversion then, it's not a problem. You can convert FAT16 or FAT32 volumes to NTFS at any point. Just remember that you can't easily go back to FAT or FAT32 (without reformatting the drive or partition), not that I think you'll want to.

The NTFS file system is generally not compatible with other operating systems installed on the *same computer*, nor is it available when you've booted a computer from a floppy disk. For this reason, many system administrators, myself included, used to recommend that users format at least a small partition at the beginning of their main hard disk as FAT. This partition provided a place to store emergency recovery tools or special drivers needed for reinstallation, and was a mechanism for digging yourself out of the hole you'd just dug into. But with the enhanced recovery abilities built into Windows XP (more on that in a future column), I don't think it's necessary or desirable to create that initial FAT partition.

NTFS vs FAT32 File System.

If you are about to partition your hard drive(s) and preparing to install your Windows XP operating system, you may wonder which file system would be best - FAT32 or NTFS? Some users would say, obviously NTFS right? Well - actually it depends. A decision may not be that simple to take.

Though, Windows XP pushes you towards NTFS due to artificial limitations of its setup tools, and NT advocates nearly always say "use NTFS it's more secure". But you may want to think a bit further than that glib knee-jerk advice.

NTFS File System Advantages.

NTFS is the recommended file system for computers running the Microsoft Windows XP and Windows .NET Server operating systems. NTFS offers many

end-user benefits related to functionality, security, stability, availability, reliability, and performance**.** NTFS, which was originally introduced with Microsoft Windows NT® 3.1, has always provided advanced file system features such as security, transacted operations, large volumes, and better performance on large volumes. Such capabilities are not available on either FAT16 or FAT32.

I would use NTFS where:

- ✓ Users have professional-grade IT admin, including backup
- ✓ Users need to hide data more than they need to salvage it
- ✓ Applications require files over 4G in size
- ✓ Hard drive exceeds the 137G barrier

Due to terrible experiences I encountered with Windows-2000, I would avoid the use of NTFS in consumer PCs.

FAT32 File System Advantages.

FAT32 is a much simpler file system than NTFS. It is an enhanced version of the old FAT16 or FAT file system that was used in old MS-DOS operating systems. FAT32 was introduced at the time of Windows 95 as a significant enhancement of the FAT16 file system, one of the major improvements being the ability to use very large hard drives and partitions for example (partition size was limited to 2GB under FAT16). The FAT32 file system is still available in newer operating systems like Windows 2000, Windows XP, Windows Server 2003 and also in Windows Vista. We must note here that Windows Vista does no longer support the old FAT16 file system. Despite of what some users may think, we found the FAT32 file system to be robust and reliable, in about ten

years of use. That's one of the reasons FAT32 file system is still widely used today.

FAT32 is a bit faster, although the difference is not big. There is one exception though. If you are using NTFS and compressed files, and if your files are of types that compress well, you may get impressive read speeds when using NTFS and file compression. The reason is, since the document is compressed, the hard drive still transfers the same amount of data information per second, but then that data is expanded into system memory and the resulting data is much bigger than the data being physically read by the hard disk drive. This has the effect of significant speed increase in disk read operations, from the user standpoint. However, disk write operations are significantly slower when using compressed files, due to the fact that the operating system has to perform a lot of calculations when compressing data before saving it to disk.

Consider this scenario;

If you are a regular user, not really that much in love with your computer, just looking to do your job, then NTFS is right for you. This file system is secure, reliable, and will perform very well in most common home or office usage situations.

On the other hand - if you are a power user that wants to do a lot of things at once, like for example burning a DVD while listening to MP3 music while copying a lot of files from one partition to another while browsing the Internet at the same time, well in such extreme condition you may really like FAT32. The reason is that FAT32 has significantly less overhead and requires less CPU

and disk operations for such massive simultaneous data transfers, due to its simplicity in comparison with NTFS. Such multiple simultaneous heavy duty tasks did perform indeed better on FAT32 than NTFS during our tests and usage.

Advantages FAT32 File System over NTFS

1   We also found an advantage of using FAT32 over NTFS that fits us in a particular situation. When about to replace a hard disk drive that has the operating system on it (this kind of operation was used particularly with Windows 2000 operating systems) , migration of data from one disk to another can be much easier. When using NTFS, the operating system has to be reinstalled on the new drive. But when using FAT32, you can get away with a much simpler procedure and retain your existing installation. The trick is to pre-partition the new hard drive in a similar fashion as the old one was. If the size of the new partitions is different, no problem - just make sure data in each partition on the old disk, fits the data in the new partition. Then, use a disk clone tool like Norton Ghost for example, to copy all partitions from the old drive to the new drive. This operation may take 10 to 30 minutes in most cases, then you can put the new drive in and power your system and it will work and you retain all your applications installed (unless they are copy protected in such manner that you have to reactivate them when changing hard disk). You may receive a couple errors and need to reboot for a couple times, but this is by far less downtime than having to reinstall the whole operating system and applications from scratch - so it is a nice procedure if you have to keep machine downtime to the lowest possible.

2   FAT*32* is file system that is simple, well-documented, readable from a large number of Operating Systems and supported by a wide range of tools.

3   You are obliged to use FAT*32* if you need access from DOS mode or Win9*x*....

4   Better interactive file system checker (Scandisk) not available for NTFS

5   Better maintenance for Operating System (OS) not available for NTFS

6   Malware can drill right through NTFS protection, e.g. Witty, while Malware can be scanned for and cleaned in the FAT32 file system.

7   Transaction rollback does *not* preserve user data in NTFS, while Data can easily be recovered in FAT32.

8   Transaction rollback on NTFS does not help other causes of corruption.

9   More limited range of maintenance tools in NTFS

10 Automatically "fixes" failing clusters on the fly in NTFS is controversial, while File system structure can be manually checked and repaired in FAT32 file system.

Survey Conducted.

The success of a designed and implemented Decision Support System (DSS) is far beyond performance. Adequate provision should be in made to cater for data recovery. Most of the designer of DSS will consider all security measures against data piracy, confidentiality of data, access restriction, and system maintenance culture but, less emphasis is placed on the storage media to be used for the DSS.

Apart from considering high quality of Hard Drive to be used, the file system for partitioning should be our concern. This is the foundation in which our chosen operating system will be installed. Our choice of file system will be justified depending on the outlined situations.

In the Developed Countries.

The developed countries may not have the problem associated with the developing countries in the choice of file system to be used. The surveys conducted clearly explain the NTFS VS FAT32.

DEVELOPED COUNTRIES		
FEATURES	**NTFS** %	**FAT32** %
Constant Electricity	98	2
Hard Disc Capacity	90	10
Program and File Capacity	85	15
File Security	90	10
Processor Speed needs	85	15
Memory Requirment and Magt	90	10
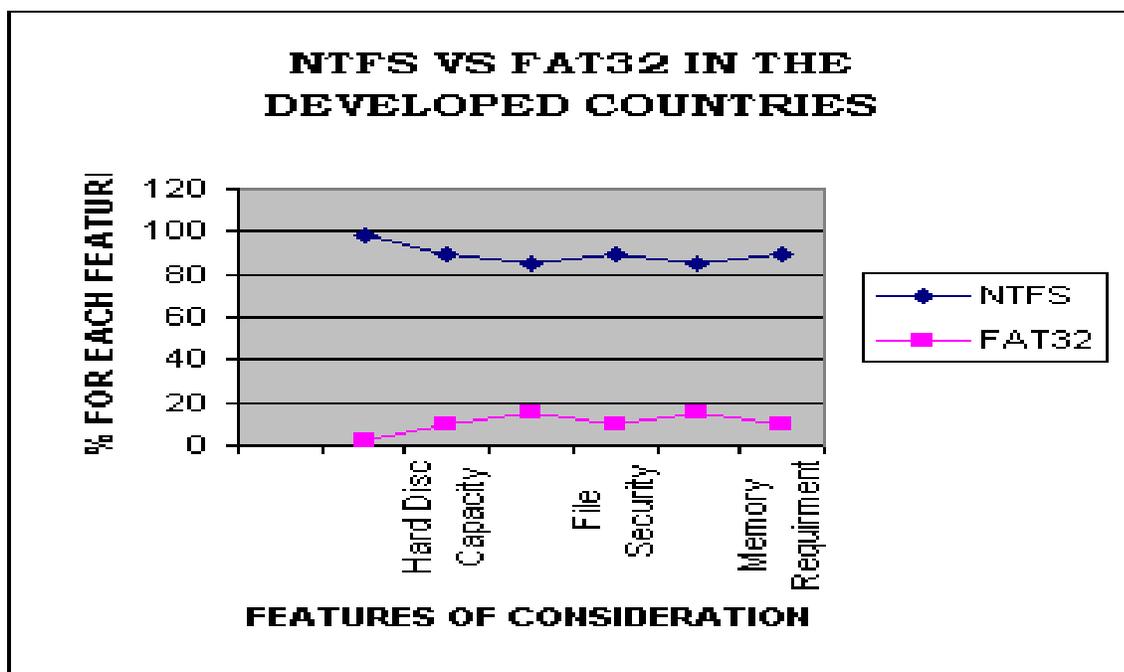
From the graph, it is clear that most designs and implementation of DSS will be done on NTFS in the developed countries. The recommended file system for today's PCs is NTFS in the developed countries where the above listed features.

In the Developing Countries.

In the developing countries, the use of computer system and Decision Support Systems are on the increase. In our survey, we discovered that most of the computer system configurations are actually, branded (Dell, Compaq, Gateway, Siemens, etc of Pentium, Pentium-II, Pentium-III) used systems from the developed countries imported for use. The government establishments and oil companies have the enabling financial capacity to acquire high capacity systems.

The afore mentioned imported used branded systems otherwise called (Tokunbo) has the Hard Drive limitation of 2GB – 10GB, Memory of 32MB – 128MB, VGA Color Monitor, 4X - 8X CDROM.

With all this limitations, some sort of installation has to be carried out on this system.

Our experiences have shown that, NTFS file system is not ideal for such computer systems.

Below is our graphical analysis of the survey.

DEVELOPING COUNTRIES		
FEATURES	NTFS	FAT32
Erratic Electricity	10	90
Low Hard Disc Capacity	30	70
Low Program and File Capacity	10	90
File Security not Considered	5	95
Low Processor Speed needs	25	75
Low Memory Requirements and Management	20	80
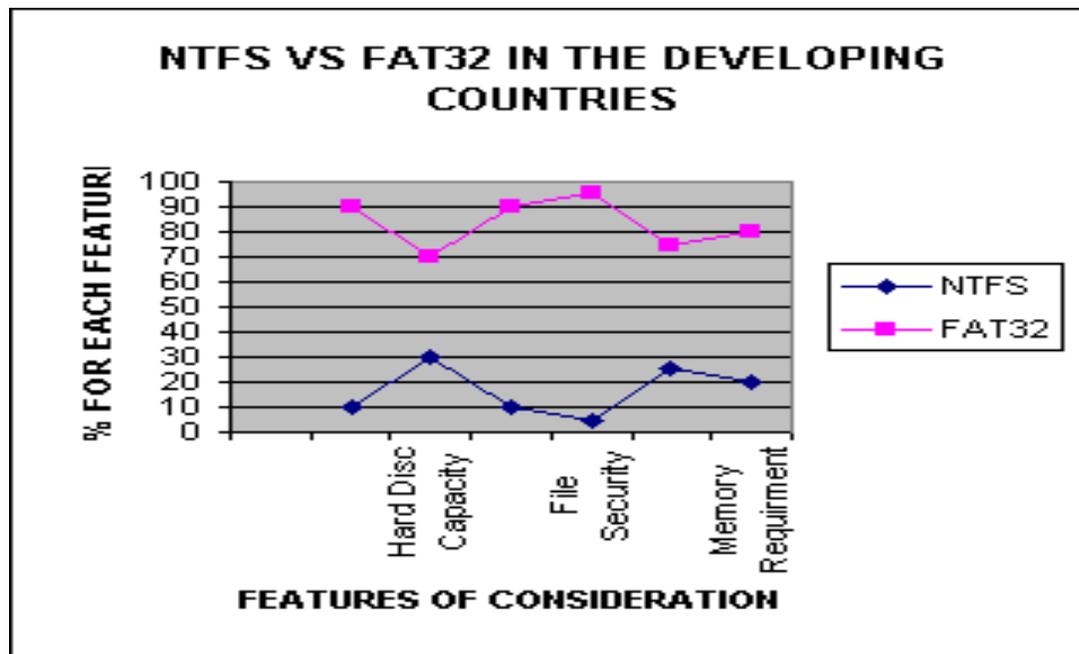
Recommendations and Action Plan

Form the analysis of our survey, it is highly recommended that, the FAT32 file system should be preferred in the developing countries. The factors are;

a.   FAT32 file system is better for 2GB – 20GB hard drive management

b.   FAT32 file system is better for Erratic Electricity Supply, which

characterize the developing countries

c. FAT32 file system is better for memory sizes of 32MB – 128MB

d. During Hard Drive boot error and associated failures, experiences have shown that, it is easier to recover data from FAT32 file system because of its compatibility.

How to choose FAT32 file system

There are to basic methods to partition your hard drive,

Procees-1

1. Boot from a CD-ROM or Diskette Drive

2. Type *fdisk*

3. If asked "Do want to enable LB" select *Y* for yes

4. Follow the instruction to create active DOS partition

5. After the partitioning, you reboot the system

6. At A:\> Type *format c:/s*

7. After the formatting, hard disc is ready for use as FAT32 file system storage medium.

8. The installation of the Operating System of your choice could be installed.

9. The subsequent programs would be installed

10. The DSS would be installed.

Process-2

1. This process involves the use of windows-xp installation CD that is bootable.

2. From the BIOS setup, you must make the 1st boot priority to be CD Drive

3. During the installation of windows-xp, you will be prompted to choose between NTFS and FAT32 file system.

4. Choose FAT32, and then the Hard Drive will be partitioned for you as FAT32.

5. Continue the installation and complete it.

6. Install all needed programs

7. Install your DSS.

Conclusions

We concludes that NTFS will be ideal in developed countries with the following features

- Have a volume of 20GB or more

- Have 128MB or more system memory

- Will have a large number of files and folders (greater than 100,000 total)

- Use files greater than 4GB in size

- Use dynamic disks/soft RAID

- Want faster file searches

- Want greater file security

- Want to control which files and directories users can see and use

- Want to control how much disk space users can utilize

- Want file compression

- Want to improve data integrity

- Want to use foreign/extended characters in file names

The FAT32 file system should be used in the developing countries where there is erratic electricity supply, because only FAT32 file system can with stand the stress of the interrupted power supply.

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