STAR Watch

Statewide Technology Assistance Resources Project

A publication of the Western New York Law Center, Inc.

Volume 6 Issue 2 July 2002

Megahertz Madness

With clock speeds reaching 2.53 GHz for Intel Pentium 4 processors, this might be an ideal time to ask a very serious question about computer performance: So what?

First, let's take a test. True or false: A computer with a 2.0 GHz CPU has twice the performance of a computer with a 1.0 GHz CPU. The answer is "False". The truth is clock speed isn't everything. It is possible for a 1.2GHz processor to outrun a 2GHz processor in real-world performance. Many things help determine a system's overall performance, and the Intel Pentium 4 processor's ability to run at phenomenal clock speeds creates a confusing situation for consumers.

Several years ago when Intel virtually controlled the market for processors, clock speed was a fairly reliable indicator of relative performance. That all changed when AMD was ready to market a processor that was a serious threat to Intel's dominance of the processor marketplace. Intel gambled that they could continue to dominate as long as they maintained the lead in raw megahertz (MHz) or gigahertz (GHz). If they could dominate the competition in this one area, all else wouldn't much matter. They wanted the Mhz or GHz lead so badly that they were willing to make some pretty serious trade offs to get it. The P4 is now running at better than 2.4 gigahertz (Ghz), but at what price?

Intel spent several years developing the Pentium 4 processor, only to cut corners and rush it into production to counter the threat from AMD's Athlon processor. They sacrificed processor efficiency for a high clock rate. Initially, the strategy worked and Intel was able to charge premium prices for processors that operated at clock speeds that no competitor could approach. Unfortunately for Intel, when the independent performance reviews came in, it became clear that a P4 1.4 Ghz

didn't perform much better than a 1Ghz Pentium III. Pure clock speed is no indicator of performance.

The question of how clock speed translates into performance is complex, but not impossible to understand. Instructions per Clock (IPC) describes the amount of work a processor does per clock cycle. Modern processors play all sorts of tricks that make the concept of IPC a little bit slippery. With multiple instructions "in flight" at once, and with different types of instructions that take different amounts of time to execute, arriving at an exact number of instructions per clock on modern CPUs is virtually impossible because it changes in response to varying conditions. But the concept of IPC has survived because it's a good generalization, a useful conceptual term. It's safe to say that the Pentium 4's IPC is usually lower than the PIII's or AMD Athlon's, even though that's not always the case.

Processor performance is determined by combining the IPC with the clock speed. It has been demonstrated that the P4 1.7GHz performs roughly the same as a 1.2GHz Athlon. When matched up, the respective IPC/clock speeds of these two processors are approximately equal. When comparing a P4 processor to its predecessor the Pentium III, the results are even more troubling to consumers. In many situations, the 1 GHz Pentium III outperforms the Pentium 4.

But why are there any differences among P III, P4, and AMD processors? Don't all processors do exactly the same things? In most situations, the instructions that the processors can handle and the results of executing those instructions are identical. But internally, each of the processors does things very differently. These internal differences significantly affect the overall performance. Confused? Consider this analogy: Two secretaries are given the same letter to type. As long as the resulting letters are properly formatted and error-free, there is no concern about how the secretaries accomplished the typing task. But the time required to type the letters would not be exactly the same, and the subtasks that each secretary performed in order to type the letters would not always be done in the same order. It is possible that the faster typist might require more time to complete the task than the slower typist because the slower typist uses the word processor more effectively. Raw clock speed does not necessarily guarantee high performance.

Is there any hope?

Will Intel's Pentium 4 ever live up to its promises? The processor efficiency will probably never substantially improve, but raw clock speed increases will eventually reach a level that nets a performance increase.

The greatest hope for improvement will come from software. Computer hardware has gotten ahead of the software that runs on it. As application programs and new operating systems are optimized to account for the operating characteristics of the new processors, users will begin to notice improvement. Additionally, the Pentium 4 has new audiovisual instructions. These instructions won't do much for spreadsheets and word processing, but they will speed up such things as graphics, video compression, and 3-D games, once, that is, the programmers include the new instructions in their software code.

Demystifying the DVD Alphabet

The DVD (short for Digital Versatile Disk) has finally come of age. The enormous capacity of DVDs--enough to hold an entire feature-length movie or multiple gigabytes of data files--combined with their compact size and affordable price have made them an item that most offices should consider purchasing. Many users want to put their own content on them, whether it's to distribute instructional videos or archive important files from their hard disks. But the alphabet soup of rewritable DVD standards (DVD-R, DVD+R, DVD-RAM, DVD-RW, and DVD+RW) are causing tremendous confusion among potential users. Often, the various rewritable discs are incompatible with each other, and offer varying compatibility with other devices such as home DVD players or computer DVD-ROM drives.

Currently, there's no single best choice among the standards, but there are some very good choices if the reason(s) for purchasing a DVD can be defined.

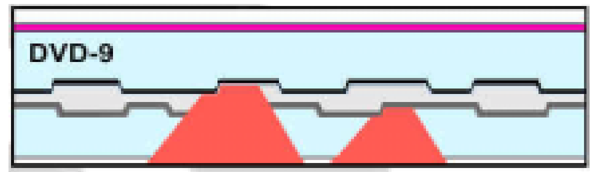
DVD FORMATS – Physical Structure

DVD discs have the same physical dimensions as CDs, but each DVD can have data on one or two sides and up to two layers on each side offering four possible read-only formats plus recordable and rewritable formats:

Single Sided/Single Layer (4.7GB)

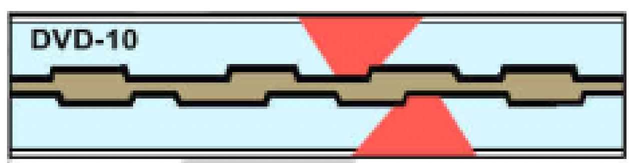
This is the simplest type of DVD, comprising a single layer with a capacity of 4.7GB. Only one of the two 0.6mm substrates contains data, the other being a blank disc. The two substrates are bonded together to form a 1.2mm thick disc. Single sided discs can be printed on by any conventional method eg screen printing. Alternatively, the blank substrate can be molded with an image in its surface and then “metallized” to make it visible.

Single Sided/Dual Layer (8.5GB)



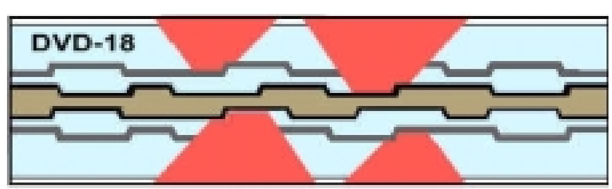
This dual-layer, single sided version has a capacity of 8.5GB which is slightly less than twice the single layer version. To make it easier for the second layer to be read, the pits on both layers are 10 per cent longer than on a Single Sided/Single Layer DVD. Each layer is molded in a single substrate, the two substrates are joined with an optically transparent bonding layer. These discs can be labeled after bonding in the conventional way. Because of the complex manufacturing process, dual layer DVDs cannot be produced on any computer DVD burners.

Double Sided/Single Layer (9.4GB)



This disc comprises two sides each single layer. It differs from the Single Sided/Single Layer version in that both substrates contain data. To read both sides the disc will need to be turned over for most DVD players/readers. The capacity is 9.4GB, twice the single side/single layer version. Double sided discs cannot be labeled except on the hub inside the lead-in area. Labeling is therefore a potential problem with double sided discs. Very few computer DVD burners can read/record both sides of a DVD.

Double Sided/Dual Layer (17.1GB)

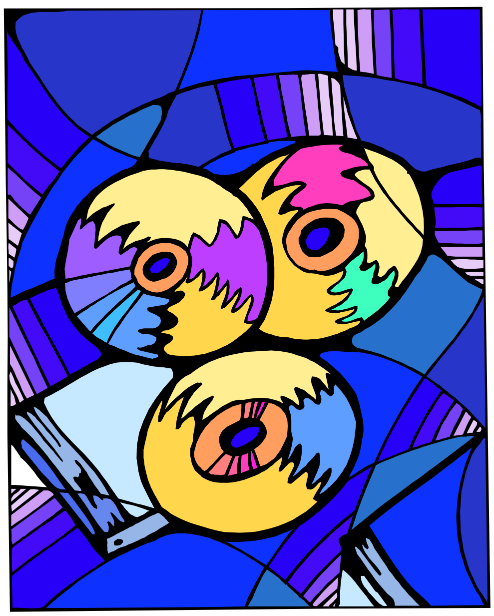


This version comprises two sides each with a dual layer format. Both layers of each side must be manufactured on a single polycarbonate substrate. It has the largest capacity of the family but is the most difficult and complex to manufacture.

DVD FORMATS – Data Structure

Aside from how the data is physically stored, there are multiple ways to store the data on the DVD. Here are the most common formats:

DVD Video: For viewing movies and other visual entertainment. The total capacity can be up to 17 gigabytes if two layers on both sides of the disk are utilized. Normally, because of labeling and manufacturing issues, most DVD Video format disks are Single Sided.



DVD-ROM: Its basic technology is the same as DVD Video, but it also includes computer-friendly file formats. It is used to store data. This product should replace conventional CD-ROMs in the near future. These discs can be read, but not written to by the user.

DVD-R: Its capacity is 4.7 gigabytes. DVD-R is non-rewriteable format and is compatible with many existing DVD-ROM drives and many DVD-Video players (about 90% of all players)

DVD-RAM: This makes DVD a virtual hard disk, with a random read-write access. Originally a 2.6-gigabyte drive, its capacity has increased to 4.7-gigabyte-per-side, for a total of 9.4 gigabytes. The information on this type of DVD is organized and recorded differently more like a hard drive than a DVD. You can drag and drop files to a DVD-RAM drive as if it were a standard hard drive. Unlike other rewritable DVD formats, DVD-RAMs do not have to be reformatted to be reused. This makes it ideal for storing computer data files for backup/recovery purposes. It is claimed that DVD-RAMs can be rewritten up to 100,000 times.

Unlike other types of DVDs, DVD-RAMs are enclosed in a cartridge which made them incompatible with other types of DVDs. However, Panasonic is currently marketing what it describes as a DVD-RAM/R drive (LF-D321U) that uses cartridges that open to allow removal of the DVD media and also allow the DVD media to be recorded as a DVD-R. This allows the creation of DVDs that can be read in a standard computer DVD drive.

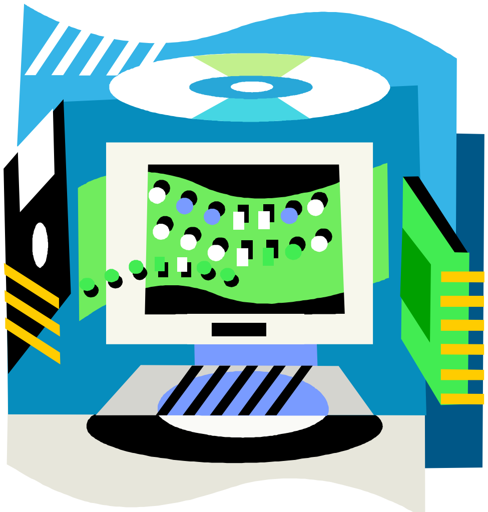
DVD-RW: Similar to DVD-RAM except that its technology features a sequential read-write access more like a phonograph than a hard disk. Its read-write capacity is 4.7 gigabytes per side. It can be re-written up to about 1,000 times. DVD-RW is compatible with many newer DVD-ROM drives and DVD-Video players.

DVD+RW: DVD+RW has some better features than DVD-RW/DVD-R. DVD+RW is a rewritable format and the DVD+R is just a non-rewritable format. DVD+RW is compatible with most newer DVD-ROM drives and DVD-Video players(about 70% off all players).

DVD+R: This format is simply a non-rewriteable version of DVD+RW that claims to have even greater compatibility with existing DVD players than DVD+RW. These discs can only be written to once by the user.

DVD Audio: The latest audio format more than doubles the fidelity of a standard CD. It is expected to become the most popular audio disk. This format cannot be used to store computer data files.

DVD Multi: DVD Multi is not a new format, but a new set of specifications that will define which drives will read and write which disks for the various DVD consumer and computer applications. DVD Multi is targeted at providing broader compatibility across DVD disks, and will use all existing format versions.



So Which Format is Better?

Depending on your needs, our suggestion would be DVD+R, DVD+RW or DVD-RAM/R.

DVD-RAM/R drive…

- Can hold a large amount of data (9.4 gigabytes) on a double-sided DVD
- Has a file system that allows rapid access to specific files
- Can be used like another hard drive
- Can transfer data to/from the DVD at 33.3 megabytes/sec.
- Can also create DVD-R formatted DVDs that have the greatest compatibility with other DVD devices.

DVD+R and DVD+RW drives…

- Are compatible with most existing DVD-Video and DVD-ROM drives.
- Can create DVDs at 2.4x DVD speed. To date, a DVD-RW drive supports 2x DVD speed for writing DVD-R discs, but only 1x DVD speed (about 10 Mbits/sec) for the writing of DVD-RW discs.
- DVD+RW (and DVD+R) recordings allow a choice of 4 image quality settings which translates into a recording time of 1 to 4 hours per side.
- Sections of DVD+RW can be re-recorded without reformatting the entire DVD. Due to DVD+RW's unique lossless linking principle, you can replace parts of a recording directly on the disc, without the need to erase it first, or re-write the full disk. With suitable software, you could overwrite a part of a video on a DVD+RW disc with a new recording, just as with a DVD+RW video recorder. With DVD-RW, you must rewrite the entire disk if you want to make any change to it.
- DVD-R and DVD-RW must be "finalized" before they can be read on another DVD device. DVD+R and DVD+RW do not.
- DVD+RW incorporates a defect management system by default which was designed to be 100% invisible to existing drives and players, so that the discs can be read as if they were normal DVD-ROM or DVD-Video discs. DVD-RW does not allow address information to be read during the recording process, hence it's impossible to locate where the writing process is taking place. When the writing process is being interrupted for any reason, it's nearly impossible to return to the previous writing location. DVD+RW allows the address information to be read during recording, so that in case of a writing problem, the writing can be continued at the previous location.

- And finally, for those who care, Microsoft has decided to support DVD+RW. Microsoft plans to demonstrate software and to provide technical documentation for incorporating the DVD+RW format into its Windows operating system. This endorsement could prove important in determining a winner in a long-running standards battle for DVD burners.

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