# DivX: The movie industry's mp3?

**Multimedia Systems Coursework, Department of Electronics and Computer Science, University of Southampton, SO17 1BJ.**

**Andrew Smithson.**
**ans199@ecs.soton.ac.uk**

## Abstract

In the last few years the use of mp3 to share music has grown to the extent that even the injunction against the sharing utility Napster has not really stemmed the flow of copyrighted material being shared. Current technology for movie encoding plus the restrictions on most home connections to the internet mean that the culture for sharing movies has not achieved the same levels. However the DivX;-) codec (compression/decompression) plus the increasing uptake of home broadband connections mean that it soon could become a reality. This paper will discuss how the codec works and how it could be used without causing a piracy problem with the latest blockbusters from Hollywood.

## Keywords

MPEG-4, MPEG-2, DVD, DivX;-), DeCSS.

## Introduction

The DivX;-) codec is a new way of providing movie content over the internet, providing high picture quality with small file size. As more and more people get high speed, broadband internet access the ability to download full movies that are of a comparable quality to those that can be purchased on DVD becomes more of a reality. The movie companies are obviously worried that this could lead to an increase in piracy in the same way that mp3 has apparently done with the music industry. To overcome this stigma the people behind DivX have got together with other developers to form DivXNetworks which plans to market the latest version of the codec along with the ability to stream movies reliably across the internet in a way that could be seen to be akin to going to your local video rental store and picking up a copy of the latest blockbuster. In fact with a high speed connection is should arrive in a matter of minutes and you should be always able to get the film you want provided it is available to rent on the server.

This paper discusses the current product availability, what will be available and how it should be used or improved. There is also a brief overview of the functionality specified in the MPEG-4 standard upon which DivX;-) as well as how it reacts with the current technology available from some of the other major companies in the field. The paper also discusses whether the way mp3 has affected the music industry and some of the lessons that have been learnt will affect how the codec will be used or accepted.

## The Origins of DivX;-)

The DivX codec started life when Jerome Rota, a French hacker who goes by the online name of Gej got hold of an early release of Microsoft's MPEG-4 codec which he altered slightly and released under the name DivX;-). This soon gained an underground following which started a culture of sharing movies on the internet, whether these were ones created themselves or some of the latest blockbusters which they had at their disposal.

## Why were the movie companies so interested?

The public's attention was drawn to DivX when the creator of DeCSS was sued by the MPAA (Motion Picture Association of America). DeCSS is a program that can break the encryption on a DVD and therefore allow them to be copied onto another disc and still be viewed as normal. Then by using the DivX codec pirates could compress the film into a file almost a tenth of the size without losing the quality of the DVD movie. This file then could be downloaded from the Internet using a fast connection in a little under an hour.

The author of DeCSS lost the case and the code was outlawed which slowed down the DVD copying craze but has not fully got rid of it. The DeCSS source code is still available and so there are still movies out there that can be downloaded and viewed by people with the right hardware and software.

However in a recent court ruling [CA 2001] is was deemed that the source code for DeCSS was protected in America under First Amendment rights and can be published on web sites for people to read and download. The First Amendment covers freedom of speech in America, which in this case allows someone to show the code necessary to perform a particular task. It does not allow for binaries that enable the decryption of a DVD to be published but I don't believe that this will stop those who wish to pirate DVDs doing so by downloading and compiling the source themselves.

This new ruling plus the work being done in producing newer versions of the codec and the growing availability of broadband internet access could see a new growth in the downloading of movies from the internet.

## What is currently available?

After the publicity of the DeCSS trial a young lawyer called Jordan Greenhall tracked down Jerome Rota and along with Joe Bezdek and Eldon Hylton they formed Project Mayo. Once enough financial backing had been secured they formed DivXNetworks, which is currently distributing a new codec called DivX;-) Deux which they claim has been developed from scratch and is available free of charge from www.divx.com. This new codec is supposedly free from all Microsoft code and have better performance with

smaller files than the original DivX codec, and producing files that 7-10 times smaller than if they had been encoded using MPEG-2.

The company plan to use the codec to market a video on demand service where you could select the film you want and then download it onto your computer ready to watch in a matter of minutes roughly equivalent to going to a local video rental shop hiring it there.

However the major film distributors are likely to want extra security features added to the files that are downloaded such as digital watermarks and ways to prevent a person who has legally paid for a movie then passing it on to all their friends or anyone else who can find where it has been posted.

To ensure that their copyright is not violated the movie companies are likely to want some kind of content watermarking so that playing software can tell whether the movie is genuine. Transaction watermarking should be use to ensure that only the individual who paid to watch the movie is watching the movie and not passing it on to all their friends. This works by putting some transparent information into the movie that uniquely identifies the person who has paid to watch the movie. Finally there must be assurance that any movie that is stored on a server is protected against anyone getting in via a backdoor and getting the content for free.

Any system would also have to be adaptable as there are individuals who actively try and break any and all encryption methods placed on copyrightable material. There are plenty of examples where companies have announced a brand new ‘unbreakable’ content encryption system, only to have it broken within a few weeks by some underground hacker or university researcher. One of the most recent examples was the encryption put forward by the Secure Digital Music Initiative (SDMI) who is trying to protect the rights of artists online. However Edward Felton, an university researcher in America has written a paper which explains how all of them have been broken [Felton 2001].

The codec could also be used in set-top boxes such as TiVo so that the information that is stored takes up less space than using the existing MPEG2 codec. This would limit the need to add more and more physical storage space but could be quite costly to replace all the hardware chips that contain the codec, which could make manufacturers such as TiVo design and build their own MPEG4 chips and fit them that way rather than getting the technology from an external supplier.

The latest pocket PC from Compaq now contains support for DivX movies, as will devices such as games consoles so with enough market saturation then people are more likely to use the available technology. This is important because it doesn’t matter how good or innovative the technology is, if no one uses it then it might as well not have been written. It is only through people using and learning to like to use a piece of technology that is can grow and take a market share.

## What does it provide?

As mentioned DivX;-) is based on the MPEG-4 specification from the Moving Pictures Expert Group which is the latest standard for encoding movies into computer readable files.

According to Oliver Lietz [Lietz 1997] there are certain pieces of functionality that should be provided. These are under the following categories:

- Content-Based Interactivity
    - Content-Based Manipulation and Bitstream Editing
    - Hybrid Natural and Synthetic Data Coding
    - Improved Temporal Random Access
- Compression
    - Improved Coding Efficiency
    - Coding of Multiple Concurrent Data Streams
- Universal Access
    - Robustness in Error-Prone Environments
    - Content-Based Scalability

The main selling points for the DivX codec is the improved coding efficiency with apparently the best compromise between film quality and file size. Usually one is improved at the expense of another. You can have a very small file but the picture quality is not always of an acceptable quality, or the picture quality is of a very good standard but the size of the file restricts how well it can be distributed. Even with a fast Internet connection people are not going to wait possibly days for a file to be downloaded. Within the image frames, each frame is broken up into separate images called Video Object Plains (VOP). The changes between each VOP can then be encoded so that rather than encode every frame you only need to encode the changes that each VOP undergoes which helps keep the file size down. There are also specifications for motion estimation and compensation that allow the use of '…temporal redundancies of the video content in the separate VOP layers' [Sikora]. This means that if something is moving in a straight line over a set of frames then it is not necessary to encode all the intermediate places in the VOP but instead when it is played back have the motion interpolated. However with all these things they need to be used in only to the extent that the file size is reduced without removing too much video quality. Over use will produce a very small file but at a quality that most people will not be prepared to watch for more than a few seconds or minutes.

The sound for a movie can be encoded using the new functionality specified with MPEG-4 or by using one of the other MPEG sound encoding methods, which could include mp3. This means that a company such as DivXNetworks could concentrate mainly on the video side and leave the sound to something that is already shown to work well.

Another feature of the MPEG-4 standard is the hybridisation of natural and synthetic objects within the movie. This means that as well as images that are recorded in a way that we are used to computer generated objects can be inserted that the user can interact

with. This may not seem a hugely important feature at first glance for a feature film until you look at some of the features being added to DVDs such as ‘White Rabbit’ interaction.

‘White Rabbit’ interaction was originally included in the DVD of the Matrix and is named after a point in the film when the lead character is told to follow the white rabbit which in turn is a reference to the book ‘Alice in Wonderland’. This feature inserts into the film links to relevant or interesting facts to do with that point of the film. One of the latest films to use this feature is Thirteen Days, which tells the story of the Cuban Missile Crisis and contains links to films clips and news stories from the time of the actual event. With some extra work an MPEG-4 movie could have this functionality but it is more likely to be used by film companies than people who just want to make a film available for free on the Internet. There are no downloadable movies that I am aware of that make use of this feature but it should be feasible within the specifications of MPEG-4.

DivX also has to fulfil all the other requirements in order to be MPEG-4 compliant, which helps make it more likely to be accepted as a way of viewing movies both by technically adept end users and big companies looking to get their films distributed as widely as possible.

## The future and how things could be

One of the main problems facing new moviemakers in today’s society is trying to get their work promoted or noticed by the necessary people in the big movie companies. By using something like the DivX codec they can place their movies on a web-server somewhere and hope that through word of mouth that the necessary people get to see and like the films. This could work along the lines of some of the mp3 sites that are currently available online promoting the work of unsigned artists, the main example of which can be seen at www.mp3.com.

There could be a more personal use as well, as more people put more aspects of their life online for everyone to see it could be quite feasible to have something like a wedding or a child’s baptism filmed and then put online somewhere where any one could view it, or by adding some kind of access restriction only allow members of the family to get hold of it, especially if they could not make to the service for whatever reason.

A major stumbling block for this kind of use would be the how easy it is for the average computer user to create/watch a movie made using the codec. Microsoft and Real Software have an almost monopoly in the streamed video market, and with every installation of Windows installing the latest version of Windows Media Player users are likely to be unwilling to install a new piece of software when they appear to have a perfectly good movie player installed on their system already. The current DivX codec can be installed into Window Media Player but only by user intervention rather than the program asking the Microsoft codec website what it should use to play the movie and downloading it as appropriate. Microsoft are unlikely to change this as they would rather people use their own implementation of MPEG4, rather than one from another company.

With this kind of problem the codec can only grow if it is able to be integrated almost seamlessly with technology that is on the majority of desktops around the moment not forgetting some of the less popular such as Linux and to a lesser extent these days BeOS. If everyone feels that they can use the software easily and can appreciate its benefits then the applications mentioned above could become very feasible.

## Conclusion

The DivX codec does provide a new way of distributing and viewing high quality movies in a small enough file that it can be distributed over the Internet and however it is used this fact is not going to go away. People always use technology the way they want, and it is never going to please everyone involved with the product and the products it affects. DivX has got the reputation it has because it was the first to offer the functionality required to successfully pirate films on the internet, had another company or hacker produced the tool most widely used then it would probably have the controversy and publicity that DivX currently enjoys.

The uptake of mp3 and proliferation of download sites and music sharing applications shows that people are willing to use the internet to get things they want, regardless of the legality of receiving and sharing the data. Before being shut down at the height of it's popularity Napster had '…over 40 million client downloads…'[Shirky 2001] most of which would be copyrighted mp3s. Even after the successful injunction against Napster's file sharing operations other programs and technologies are allowing people to continue to share music without having to pay the major music companies anything.

Movie companies and other organisations who are aware of this culture that now exists with online users of being able to get what they want for nothing or next to nothing needs to be addressed. As discussed by Hibbard [Hibbard 2001] DivXNetworks have come up with the concept of an online currency that could be used for downloading movies. These buku (pronounced *BOO-koo*) can be earned by clicking on links or purchased using a credit or debit card. This has the advantage that people can earn credit without having to pay any real money but after the Internet has been saturated with banner ads are they still effective in grabbing users attention when placed in the top of a web page? In his editorial on them Jason Calacanis calls them '…a complete, unmitigated failure…'[Calcanis 2001] which shows that this may not be the best way forward. However the opportunity is there to have some sort of charging mechanism and other actions could result in the accumulation of buku. For example an online DVD/Video shop could reward customers with buku for shopping with them in much the same way as most supermarkets and many other shops use loyalty cards to encourage regular shopping. This can then work to the stores advantage as some sort of e-mailing could be used to let someone who has downloaded a film to watch know that the film is now available to order or buy at this particular online shop, or just simply have some advertising for the site.

In the end the success of the DivX;-) codec, or more importantly the new DivX;-)Deux will depend on how many people accept it and make a valid attempt to use it. The work being done by DivXNetworks in providing a streaming video service that can be used by anyone could help promote its use but only if the take-up of the service is large enough. It could be that the system will grow in a similar way to the Linux operating system, starting with a small underground following who hail it as the best thing yet and in time being accepted by the major companies. The main problem would be if another company with more brand acceptance produces something that gains acceptance because it is the only way to see the majority of movies that the average user wishes to view. This is quite a testing time for DivXNetworks but if they manage to market their products successfully enough then the rewards could be seen for a long time to come and change the way people think about watching movies at home.

The culture created by the widespread of use mp3 to share and listen to music has instilled some fear into the companies who claim a major part of their income has been lost. With this in mind it is important that DivX;-) try and find a legitimate use so that the main ways in which it is used do not try and get shut down by companies and organizations with a lot of financial backing and high priced lawyers. There is no need to fear new technology such as this as long as it can be seen to add value to the market that these companies will try and embrace it rather than declare it a new way to encourage piracy. While DivX does appear to offer the same opportunities for piracy as mp3 the growth hasn't been as rapid because of the larger file size and the injunction against DVD unencryption software so the companies have time to implement systems that they and the end users will find acceptable.

## References


[CA 2001] Court of Appeals, California – DVD Copy Control Authority v. Andrew Bunner. http://www.courtinfo.ca.gov/opinions/documents/H021153.PDF. Last viewed November 16th 2001

[Felton 2001] Felton, Edward – Reading Between the Lines: Lessons from the SDMI Challenge. http://www.theregsiter.co.uk/extra/sdmi-attack.htm. Last viewed December 14th 2001

[Lietz 1997] Leitz, Oliver – Requirements for the MPEG-4 Video Standard. http://wwwam.hhi.de/mpeg-video/requ.htm. Last viewed November 18th 2001

[Shirky 2001] Shirky, Clay – Listening to Napster, In Peer-To-Peer Harnessing the Power of Disruptive Technologies. Edited by Andy Oram. Oreilly pp21-37

[Hibbard 2001] Hibbard, J – Are movies about to meet their Napster? http://www.redherring.com/index.asp?layout=story&channel=40000004&doc_id=11400 17714. Last viewed October 31st 2001

[Calcanis 2001] Calcanis, Jason McCabe - Our Biggest Mistake: The Banner Ad (Or, How Martin Nisenholtz Can Save Content). http://www.siliconalleydaily.com/issues/sar04182001.html#Headline8299. Last viewed November 16th 2001

[Koenen 2001] Overview of the MPEG-4 Standard. Edited by Rob Koenen. http://mpeg.telecomitalialab.com/standards/mpeg-4/mpeg-4.htm. Last viewed November 16th 2001

[Sikora] Sikora, Thomas – The Structure of the MPEG-4 Video Coding Algorithm. http://wwwam.hhi.de/mpeg-video/papers/sikora/fmpeg4vm.htm. Last viewed November 16th 2001

## Further Reading:

DivX homepage – http://www.divx.com

DivXNetworks homepage – http://www.divxnetworks.com