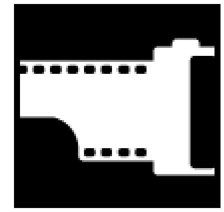
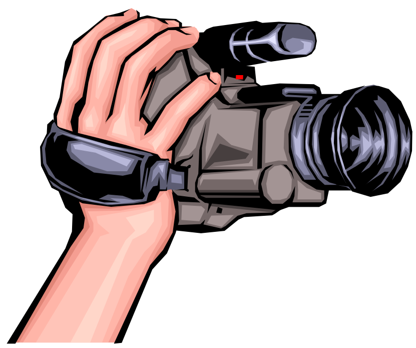
MPEG



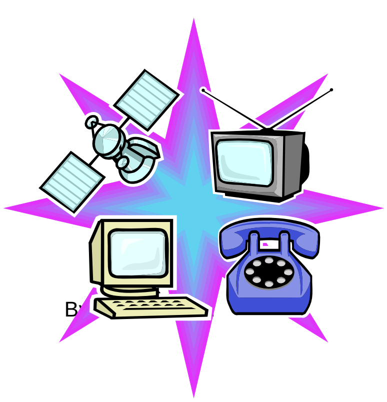
NTSC



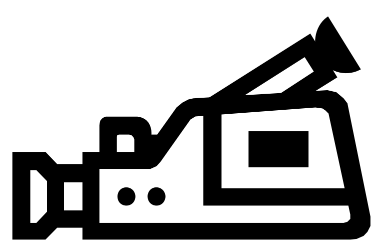
DV

DIGITAL VIDEO
WHAT IS IT?

ANALOG vs DIGITAL



By: Mike Durbin



Introduction

There's a lot to know about the technology of video. But there's no need to be intimidated by all this technology. As video has migrated to the desktop, it has gotten increasingly easier to produce high quality work with little technical know-how. This article isn't going to tell you everything, but it will give you a foundation in the basics.

VIDEO BASICS

Analog Versus Digital Video

One of the first things you should understand is the difference between analog and digital video. Your television (the video display with which we are all most familiar) is an analog device. The video it displays is transmitted to it as an analog signal, via the air or a cable. Analog signals are made up of continuously varying waveforms. In other words, the value of the signal, at any given time, can be anywhere in the range between the minimum and maximum allowed. Digital signals, by contrast, are transmitted only as precise points selected at intervals on the curve. The type of digital signal that can be used by your computer is binary, describing these points as a series of minimum or maximum values — the minimum value represents zero; the maximum value represents one. These series of zeroes and ones can then be interpreted at the receiving end as the numbers representing the original information. There are several benefits to digital signals. One of the most important is the very high quality of the transmission, as opposed to analog. With an analog signal, there is no way for the receiving end to distinguish between the original signal and any noise that may be introduced during transmission. And with each repeated transmission or duplication, there is inevitably more noise accumulated, resulting in the poor fidelity that is attributable to generation loss. With a digital signal, it is much easier to distinguish the original information from the noise. So a digital signal can be transmitted and duplicated as often as we wish with no loss in fidelity.

The world of video is in the middle transition from analog to digital. This transition is happening at every level of the industry. In broadcasting, standards have been set and stations are moving towards digital television (DTV). Many homes already receive digital cable or digital satellite signals. Video editing has moved from the world of analog tape-to-tape editing and into the world of digital non-linear editing (NLE). Home viewers watch crystal clear video on digital versatile disk (DVD) players. In consumer electronics, digital video cameras (DV) have introduced impressive quality at an affordable price. The advantages of using a computer for video production activities such as non-linear editing are enormous. Traditional tape-to-tape editing was like writing a letter with a type-writer. If you wanted to insert video at the beginning of a project, you had to start from scratch. Desktop video, however, enables you to work with moving images in much the same way you write with a word processor. Your movie "document " can quickly and easily be edited and re-edited to your heart 's content, including adding music, titles, and special effects.

Frame Rates and Resolution

When a series of sequential pictures is shown to the human eye, an amazing thing happens. If the pictures are being shown rapidly enough, instead of seeing each separate image, we perceive a smoothly moving animation. This is the basis for film and video. The number of pictures being shown per second is called the frame rate .It takes a frame rate of about 10 frames per second for us to perceive smooth motion. Below that speed, we notice jerkiness. Higher frame rates make for smoother playback. The movies you see in a theatre are filmed and projected at a rate of 24 frames per second. The movies you see on television are projected at about 30 frames per second, depending on the country in which you live and the video standard in use there.

The quality of the movies you watch is not only dependent upon frame rate. The amount of information in each frame is also a factor. This is known as the resolution of the image. Resolution is normally represented by the number of individual picture elements (pixels) that are on the screen, and is expressed as a number of horizontal pixels times the number of vertical pixels (e.g.640x480 or 720x480). All other things being equal, a higher resolution will result in a better quality image.

You may find yourself working with a wide variety of frame rates and resolutions. For example, if you are producing a video that is going to be shown on VHS tape, CD-ROM, and the Web, then you are going to be producing videos in three different resolutions and at three different frame rates. The frame rate and the resolution are very important in digital video, because they determine how much data needs to be transmitted and stored in order to view your video. There will often be trade-offs between the desire for great quality video and the requirements imposed by storage and bandwidth limitations.

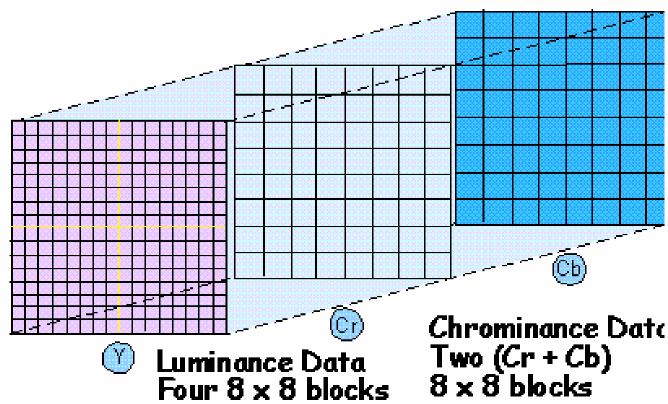
Interlaced and Non-interlaced Video

There is one more thing you should know about video frame rates. Standard (non-digital) televisions display interlaced video. An electron beam scans across the inside of the screen, striking a phosphor coating. The phosphors then give off light we can see. The intensity of the beam controls the intensity of the released light. It takes a certain amount of time for the electron beam to scan across each line of the television set before it reaches the bottom and returns to begin again. When televisions were first invented, the phosphors available had a very short persistence (i.e, the amount of time they would remain illuminated). Consequently, in the time it took the electron beam to scan to the bottom of the screen, the phosphors at the top were already going dark. To combat this, the early television engineers designed an interlaced system. This meant that the electron beam would only scan every other line the first time, and then return to the top and scan the intermediate lines. These two alternating sets of lines are known as the “upper ” (or “odd”) and “lower” (or “even”) fields in the television signal. Therefore a television that is displaying 30 frames per second is really displaying 60 fields per second. Why is the frame/field issue of importance? Imagine that you are watching a video of a ball flying across the screen. In the first 1/60th of a second, the TV paints all of the even lines in the screen and shows the ball in its position at that instant. Because the ball continues to move, the odd lines in the TV that are painted in the next 1/60th of a second will show the ball in a slightly different position. If you are using a computer to create animations or moving text, then your software must calculate images for the two sets of fields, for each frame of video, in order to achieve the smoothest motion. The frames/fields issue is generally only of concern for video which will be displayed on televisions. If your video is going to be displayed only on computers, there is no issue, since computer monitors use non-interlaced video signals.

Video Color Systems

Most of us are familiar with the concept of RGB color. What this stands for is the Red, Green, and Blue components of a color. Our computer monitors display RGB color. Each pixel we see is actually the product of the light coming from a red, a green, and a blue phosphor placed very close together. Because these phosphors are so close together, our eyes blend the primary light colors so that we perceive a single colored dot. The three different color components — Red, Green, and Blue — are often referred to as the channels of a computer image. Computers typically store and transmit color with 8 bits of information for each of the Red, Green, and Blue components. With these 24 bits of

information, over a million different variations of color can be represented for each pixel (that is 2 raised to the 24th power).This type of representation is known as 24-bit color.
Televisions also display video using the red, green, and blue phosphors described above. However, television signals are not transmitted or stored in RGB.   Why not?
When television was first invented, it worked only in black and white. The term “black and white ” is actually something of a misnomer, because what you really see are the shades of gray between black and white. That means that the only piece of information being sent is the brightness (known as the luminance) for each dot. When color television was being developed, it was imperative that color



broadcasts could be viewed on black and white televisions, so that millions of people didn’t have to throw out the sets they already owned. Rather, there could be a gradual transition to the new technology. So, instead of transmitting the new color broadcasts in RGB, they were (and still are) transmitted in something called YCC .The “Y” was the same old luminance signal that was used by black and white televisions, while the “C ’s” stood for the color components. The two color components would determine the hue of a pixel, while the luminance signal would determine its brightness. Thus, color transmission was facilitated while black and white compatibility was maintained.

Should you care about the differences between RGB and YCC color? For most applications, you probably won’t ever need to think about it. It is good to understand the differences, however. If you are concerned with the highest quality output, you’ll want to work in 16-bit-per-channel color, (64-bit color), rather than the typical 8-bit-per-channel color described above (commonly known as 24-bit color). When you work with high-resolution images that use a narrow range of colors, such as when you ’re creating film effects or output for HDTV, the difference is easily visible: transitions between colors are smoother with less visible banding, and more detail is preserved.

Analog Video Formats

At some point almost all video will be digital, in the same way that most music today is mastered, edited and distributed (via CD or the Web) in a digital form. These changes are happening, but it doesn't mean that you can ignore the analog video world. Many professional video devices are still analog, as well as tens of millions of consumer cameras and tape machines. You should understand the basics of analog video. Because of the noise concerns mentioned earlier, in analog video the type of connection between devices is extremely important. There are three basic types of analog video connections.

Composite: The simplest type of analog connection is the composite cable. This cable uses a single wire to transmit the video signal. The luminance and color signal are composited together and transmitted simultaneously. This is the lowest quality connection because of the merging of the two signals. At some point almost all video will be digital...but it doesn't mean that you can ignore the analog video world.

S-Video: The next higher quality analog connection is called S-Video. This cable separates the luminance signal onto one wire and the combined color signals onto another wire. The separate wires are encased in a single cable.

Component: The best type of analog connection is the component video system, where each of the YCC signals is given its own cable.

How do you know which type of connection to use? Typically, the higher the quality of the recording format, the higher the quality of the connection type.

Broadcast Standards

There are three television standards in use around the world. These are known by the acronyms NTSC, PAL, and SECAM. Most of us never have to worry about these different standards. The cameras, televisions, and video peripherals that you buy in your own country will conform to the standards of that country. It will become a concern for you, however, if you begin producing content for international consumption, or if you wish to incorporate foreign content into your production. You can translate between the various standards, but quality can be an issue because of differences in frame rate and resolution. The multiple video standards exist for both technical and political reasons. Remember that the video standard is different from the videotape format. For example, a VHS format video can have either NTSC or PAL video recorded on it.

Getting Video Into Your Computer

Since your computer only "understands" digital (binary) information, any video with which you would like to work will have to be in, or be converted to, a digital format.
Analog: Traditional (analog) video camcorders record what they "see and hear" in the real world, in analog format. So, if you are working with an analog video camera or other analog source material (such as videotape),then you will need a video capture device that can "digitize" the analog video. This will usually be a video capture card that you install in your computer. A wide variety of analog video capture cards are available. The differences between them include the type of video signal that can be digitized (e.g. composite or component), as well as the quality of the digitized video.
After you are done editing, you can then output your video for distribution. This output might be in a digital format for the Web, or you might output back to an analog format like VHS or Beta-SP.
Digital: Digital video camcorders have become widely available and affordable. Digital camcorders translate what they record into digital format right inside the camera .So your computer can work with

this digital information as it is fed straight from the camera. The most popular digital video camcorders use a format called DV.To get DV from the camera into the computer is a simpler process than for analog video because the video has already been digitized. Therefore the camera just needs a way to communicate with your computer (and vice versa).The most common form of connection is known as IEEE 1394.

Video Compression

Whether you use a capture card or a digital camcorder, in most cases when your video is digitized it will also be compressed. Compression is necessary because of the enormous amount of data that comprises uncompressed video.

A single frame of uncompressed video takes about 1 megabyte (MB)of space to store.

You can calculate this by multiplying the horizontal resolution (720 pixels) by the vertical resolution (486 pixels), and then multiplying by 3 bytes for the RGB color information.

At the standard video rate of 29.97 frames per second, this would result in around 30 MB of storage required for each and every second of uncompressed video! It would take over 1.5 gigabytes (GB)to hold a minute of uncompressed video!

In order to view and work with uncompressed video, you would need an extremely fast and expensive disk array, capable of delivering that much data to your computer processor rapidly enough.
The goal of compression is to reduce the data rate while still keeping the image quality high. The amount of compression used depends on how the video will be used. The DV format compresses at a 5:1 ratio (i.e. the video is compressed to one-fifth of its original size).Video you access on the Web might be compressed at 50:1 or even more.

Types of Compression

There are many different ways of compressing video. One method is to simply reduce the size of each video frame. A 320x240 image has only one-fourth the number of pixels as a 640x480 image.
Or we could reduce the frame rate of the video. A 15 frame-per-second video has only half the data of a 30 frame-per-second video. These simple compression schemes won ’t work, however, if we want our video to be displayed on a television monitor at full resolution and frame-rate. What we need is another way of approaching the compression problem …
It turns out that the human eye is much more sensitive to changes in the luminance of an image than to changes in the color .Almost all video compression schemes take advantage of this characteristic of human perception. These schemes work by discarding much of the color information in the picture. As long as this type of compression is not too severe, it is generally unnoticeable. In fact, in even the highest quality “uncompressed” video used by broadcasters, some of the original color information has been discarded. When each frame of video is compressed separately, the type of compression is known as “intra -frame” or “spatial ” compression. But some video compression systems utilize what is known as “inter -frame” or “temporal” compression. Inter-frame compression takes advantage of the fact that any given frame video is probably very similar to the frames around it. So, instead of storing entire frames, we can store just the differences between certain frames.
The compression and decompression of video is handled by something called a codec. Codecs may be found in hardware —for example, in DV camcorders or capture cards —or in software. Some

codecs have a fixed compression ratio and therefore a fixed data rate. Others can compress each frame a different amount depending on its content, resulting in a data rate that can vary over time. Some codecs allow you to choose a quality setting that controls the data rate. Such adjustable settings can be useful in editing. For example, you may wish to capture a large quantity of video at a low quality setting in order to generate a rough edit of your program, and then recapture just the bits you want to use at a high quality setting. This allows you to edit large quantities of video without needing a drive large enough to hold the entire set at high-quality.

What is DV?

One of the most exciting changes in the world of video has been the arrival of the DV camcorder. What is DV and why is it so important? The term "DV " is commonly applied to a variety of different things.

DV Tape: First, the DV designation is used for a special type of tape cartridge used in DV camcorders and DV tape decks .A DV tape is about the size of a typical audio cassette. Most of us are actually more familiar with the mini -DV tape, which is smaller than the basic DV tape --about half the size of an audio cassette.

DV Compression: DV also connotes the type of compression used by DV systems . Video that has been compressed into the DV format can actually be stored on any digital storage device, such as a hard drive or a CD-ROM. The most common form of DV compression uses a fixed data rate of 25 megabits/sec for video. This compression is called "DV25."

DV Camcorders (Cameras): Finally, DV is applied to camcorders that employ the DV format. When someone refers to a "standard " DV camcorder, they are talking about a video camcorder that uses mini-DV tape, compresses the video using the DV25 standard, and has a port for connecting to a desktop computer. Today, such DV camcorders are in use by both consumers and professionals. Note: Some DV cameras actually use full size cassettes as you would see in an Analog camera. The digital format is the same as mini-DV put with longer record times.

Benefits of DV: There are many benefits to DV, particularly when compared to analog devices like VHS decks or Hi-8 cameras.

Superior images and sound: A DV camcorder can capture much higher quality video than other consumer video devices. DV video provides 500 lines of vertical resolution (compared to about 250 for VHS), resulting in a much crisper and more attractive image. Not only is the video resolution better, but so is the color accuracy of the DV image. DV sound, too, is of much higher quality. Instead of analog audio, DV provides CD-quality sound recorded at 48Khz with a resolution of 16 bits.

No generation loss: Since the connection to your computer is digital, there is no generation loss when transferring DV. You can make a copy of a copy of a copy of a DV tape and it will still be as good as the original. No need for a video capture card: Because digitization occurs in the camera, there is no need for an analog-to-digital video capture card in your computer.

Better engineering: The quality of the DV videotape is better than for analog devices. Plus, the smaller size and smoother transport mechanism of the tape means DV cameras can be smaller and have more battery life than their analog counterparts.

IEEE 1394You can directly transfer digital information back and forth between a DV camcorder and your computer. The ports and cables that enable this direct transfer use the IEEE 1394 standard. Originally developed by Apple Computer, this standard is also known by the trade names FireWire ® (Apple Computer)and i.LINK (Sony Corporation).This high-speed serial interface currently allows up to 400 million bits per second to be transferred (and higher speeds are coming soon).If your computer does not come with this interface built in, then you will need to purchase an inexpensive card that provides the correct port.

The single IEEE 1394 cable transmits all of the information including video, audio, time code, and device control (allowing you to control the camera from the computer).IEEE 1394 is not exclusively used for video transfer; it is a general purpose digital interface that can also be used for other connections, such as to hard drives or networks.

DV25 Compression

As previously mentioned, the DV25 codec provides 25 million bits per second of video data.DV25 is compressed at a fixed rate of 5:1.There is also audio and control information being transmitted, so that the total data rate is about 3.6 million bytes (MB) per second.

This means that one hour of DV compressed footage will require about 13 billion bytes (gigabytes =GB)of storage. It is impressive to realize that each 60-minute mini-DV cassette is actually 13 GB of offline storage!

DV25 compression uses a reduced color sampling method known as 4:1:1 color, which is explained in the next section. The audio is uncompressed, and there are two stereo audio pairs. The audio can be digitized at either 12 bits at a sampling rate of 32kHz or 16 bits at a sampling rate of 44kHz or 48kHz. You should generally use the highest quality (16 bit,48kHz)setting.

4:1:1 Color Sampling When working with RGB images, we use exactly the same number of bits to store the three color components. When working with YCC video, however, we take advantage of the peculiarity of human perception previously mentioned —the eye is much more sensitive to changes in the luminance of an image than to the color (known as chrominance). So, instead of storing the same amount of information for each of the YCC components, professional video only needs to store half as much color information as it does luminance information. This is also known as 4:2:2 color, which means that for every four samples of luminance values, there are only 2 samples of each color signal. This helps save bandwidth during analog transmission, as well as storage space in the digital realm. YCC can be reduced even further to what is known as 4:1:1 color .DV cameras save video in the 4:1:1 space in order to reduce storage needs. This is not a problem for most applications, but it can cause issues during sophisticated operations such as compositing a person shot against a blue background into a new scene. The reduced color information may cause some visual artifacts around the composited image.

DV Variations There are a number of variations to the DV format: Digital8: A prosumer-targeted variation on the DV25 theme is called Digital8. It offers the same data rate and color sampling as DV25, but a slightly lower resolution. The Digital8 camcorder is designed to accommodate those customers who want to move up to digital video, but who might have a significant investment in analog Hi-8 movies. The Digital8 camcorder records digitally, but it can also play back analog Hi-8 tapes.

DVCAM and DVPRO: The basic DV format was designed for the consumer marketplace. Sony has introduced a professional variant known as DVCAM, which uses the same compression and tape as DV, but records less video on each tape. Recording is accomplished by magnetizing very small sections of videotape with differing polarities. The closer these small areas are to each other, the more likely there can be some interference. Remember, even though the data being recorded is digital, the medium itself is analog and subject to noise. Putting less data on the tape makes the recording more durable and facilitates better interchange between devices. Both the DVCAM and DVCPRO systems are designed with the professional in mind and each offers distinct benefits for a particular customer type.

DV50 and DV100: In addition to the DV25 standard, there are also emerging standards known as DV50 and DV100.Since DV25 indicates 25 Mbits/sec of video, DV50 indicates 50 Mbits/sec and DV100 represents 100 Mbits/sec. The DV50 standard uses 4:2:2 color sampling and a lower compression of 3:3:1.The video quality of this standard is extremely high, and is suitable for the most demanding professional broadcast purposes. The DV100 format will be used for HDTV (high definition television) recording.

Digital Betacam: Also known as DigiBeta, Digital Betacam is the high-end broadcast professional's choice. It provides superior image quality, and the high-end equipment required to work in this format is commensurately costly. Analog Betacam SP tapes can also be played back in DigiBeta decks.

Digital video formats

MPEG-2

MPEG stands for the Motion Pictures Expert Group, an organization of film and video professionals involved in establishing industry standards;-2 refers to “compression standard version 2.”This standard has gained wide acceptance in the marketplace. It is the format recorded onto DVD disks, and the format currently received by home satellite dishes. The principal feature of the MPEG-2 format is that it can provide extremely high-quality video with a data rate of around 1 MB/sec. That’s almost one quarter of the data rate needed for DV video.

So why isn’t everything in MPEG-2?

While MPEG-2 is an excellent distribution format, it is less useful for direct recording and editing of video because, from a video editing standpoint, it can be difficult to work with MPEG-2. The MPEG-2 compression scheme performs both intra-frame (spatial) and inter-frame (temporal) compression. The type of inter-frame compression that MPEG-2 employs involves estimating the motion of different parts of the image and then recording that motion rather than the actual pixels. This is both sophisticated and time-consuming. Most MPEG-2 schemes take much longer to compress video than they do to decompress it. Additionally, an MPEG-2 codec must have many frames of video to work with at once in order to perform the calculations. So, For example, say that you wanted to edit frame number 128 of your video. Instead of just reading frame 128 from a disk, the editing system might have to read frames 124,125,126,and 127 in order to compute what frame 128 actually looks like. There are three different frame types in MPEG-2. These are known as the I, P, and B frames. I stands for “intra-frame ” encoding and works just like a DV frame of video. The P frame is a “predicted ” frame. It is computed from the frames previous to it. B is for “bi-directional ” frame. This means that not only is the B frame computed from previous frames, it can also use frames that come after it. More data must be preserved to describe I frames, making them the “largest,” whereas P frames can be less than a tenth of that size. B frames are the smallest. Because the P and B frames are calculated from the I frames, you can’t just have one I frame and the rest P ’s and B ’s. There must be I frames interspersed or else the accumulated error becomes too great and the image quality suffers. A typical MPEG-2 sequence might look something like:

I -P-P-P-P-B-B-B-B-P-B-B-B-P-I -P-P-P-P-B-B-B-B-P-I -P-P-P-B-B

MPEG-2 is a very flexible format, making it possible to capture and edit video using only I frame encoding. Once editing is completed, the video can be recompressed to IPB format in order to reduce the overall size for distribution.

Other Forms of MPEG

MPEG-1, limited to a frame size of 352x240 pixels, was the first MPEG standard established and is still used for CD-ROMs, video CD (VCD), and some Web video.

The specifications for MPEG-3 were abandoned, as the industry moved on to complete MPEG-4.(Note that MP3 —which stands for MPEG-1, Layer 3 —is an audio-only compression format and should not be confused with MPEG video formats).Currently in use in the latest releases of the QuickTime and Windows Media architectures.

MPEG-4 facilitates streaming video on the Web and over wireless networks, as well as providing mechanisms for multimedia interactivity. The names MPEG-5 and MPEG-6 will not be used; the next release is expected to be MPEG-7, which will not advance compression but will focus on the incorporation of "metadata," enabling sophisticated indexing and retrieval of multimedia content.MPEG-21, also in the planning stages, is an iteration that is expected to create a complete structure for the management and use of digital assets, incorporating e-commerce capabilities that will make sharing creative products more commercially viable.

Is DV Perfect?

The image quality of the DV format has been tested by both human and mechanical means. This testing ranks DV quality on par with Beta-SP, which has been the mainstay for professional video production for decades. But DV is not perfect. Because the video is compressed, it is possible for there to be visible degradations — known as compression artifacts .These artifacts result from the color compression, and will be most noticeable around sharp color boundaries like white text on a black background. The 4:1:1 reduced color sampling in DV compression can also cause issues when performing professional compositing. Additionally, compression does add noise to the picture. If DV is repeatedly decompressed and then recompressed, it will begin to degrade. This is different from just transmitting DV from generation to generation, which is lossless. Technology is advancing rapidly, and even now there are video boards available that make it possible to edit and composite uncompressed

video on the desktop. But, for most editing uses, you won ’t do many compression/decompression cycles and so any degradation that may result from DV compression will be unnoticeable. While DV isn’t perfect, it is certainly the highest-quality, most cost-effective video format ever made available to the average consumer and to many professionals.
The entire video industry is being transformed by the low cost and high quality of the DV solution.

MPEG 2 Satellite Transmission Rates

I have been asked many times about the data rate of the video signals being transmitted over most digital satellites. The following is a sample but by no means the definition. The suppliers can change rates as desired to allow more content or more quality. In most cases the bandwidth is adjusted automatically (limited of course by available bandwidth) by the encoders base on the content of the video.
TRUE BANDWIDTH ON DEMAND.
The transmission speed required for any MPEG 2 broadcast varies according to the nature of the video material. The MPEG 2 encoder located at the satellite uplink has a finite time to make encoding decisions. Pre-recorded movies and other taped material do not push the time constraints of the encoder to the limit; the encoder can select at its leisure the most efficient method for encoding at the lowest possible data rate. Live sports and other live action materials require a higher data rate because the encoder is forced to make immediate coding decisions and must also transmit complex, rapid motion changes without introducing high levels of distortion.

Representative MPEG-2 Transmission Rates
Type of Video Service Data Rate

- Movies (VHS quality) 1.152 Mb/s
- News/Entertainment 3.456 Mb/s
- Live Sports Event 4.608 Mb/s
- 16:9 Wide Screen TV 5.760 Mb/s
- Studio Quality Broadcast TV 8.064 Mb/s
- High Definition Television 14.00 Mb/s
- Audio or Data Services Data Rate
- Monaural sound 0.128 Mb/s
- Stereo sound (L + R) 0.512 Mb/s
- Digital Data 9.6 kb/s

MPEG DTH Transmissions

DTH satellite TV programmers use a transmission format called Multiple Channel Per Carrier (MCPC) to multiplex two or more program services into a single unified digital bit stream. With MCPC, a package of program services can use the same conditional access and forward error correction systems, thereby economizing on the overall bandwidth and transmission speed requirements. What's more, programmers can dynamically assign capacity within the digital bit stream of any multiplexed transmission, so that more bits are available to a live sport broadcast and fewer bits to a news report or interview program consisting of 'talking heads.' At the conclusion of a live basketball game, for example, the digital capacity previously used to relay a single sport event even could be used to transmit four separate movies.

The ABCS of Digital Receiver/Decoders

Coping in the new digital age will require a basic understanding of a few new terms that have grown up surrounding this new technology. The following is a brief explanation of some of the new digital jargon that you may come across.

Bit Rate. This is the amount of data information being transmitted in one second of time. The total bit stream passing through a single satellite transponder consists of as many as eight TV services with associated audio, auxiliary audio services, conditional access data, and auxiliary data services such as teletext. The informational bit rate for this transmission may be as high as 49 Mega (million) bits per second (Mb/s) over a 36-MHz-wide satellite transponder. A single video signal within this bit stream will have a lower bit rate. For example, a VHS quality movie can be transmitted at a bit rate of 1.152 Mb/s; a news or general entertainment TV program at 3.456 Mb/s; live sports at 4.608 Mb/s or studio-quality broadcasts at a rate of more than 8 Mb/s.

Bit Error Rate (BER). Measured in exponential notation, the Bit Error Rate (BER) expresses the performance level of the digital receiver. For example, a higher BER of 5.0 x 10-5 is superior to a lower BER of 9.0 x 10-4. The higher the BER, the greater the receiver/decoder's ability to perform well during marginal reception conditions, such as when there is heavy rainfall, snow or wind gusts.

Digital Receiver/Decoder Threshold. Unlike traditional analogue Receiver/decoders, where the unit continues to deliver a picture even when it is operating below the receiver/decoder's threshold rating, digital receiver/decoders stop dead in their tracks when the signal level falls below the digital threshold level of the unit. It's like a light switch: either on or off. Manufacturers define the threshold as a BER such as 3.0 x 10-3. Reception stops whenever the BER falls below receiver threshold.

Digital Video Broadcasting (DVB). A 'broadcast specific' version of MPEG 2 developed in Europe for DTH, cable and terrestrial TV applications which numerous satellite programmers world-wide have since adopted for their systems. However, just because a satellite receiver/decoder is MPEG 2 DVB compliant doesn't mean that it can pick up any MPEG 2 DVB compliant satellite TV signal. Major differences in encryption and conditional access methods, use or non-use of 'B' frames, and other technical parameters have prevented MPEG 2 from becoming a truly world-wide video standard. A few programmers have formed alliances so that their DTH subscribers will have access to the maximum number of services available from a given satellite. Other programmers, however, have elected to use unique systems that can only access a single DTH program package. DVA refers to the use of NTSC USA standards.

Forward Error Correction (FEC). The digital bit stream contains special codes that the receiver/decoder can use to check to ensure that all bits of information sent have been received. If bit errors due to thermal noise, for example, are detected, the receiver/decoder can use the convolutional encoding information that has been forwarded to it by the transmitting station to either correct each detected error or conceal it.

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