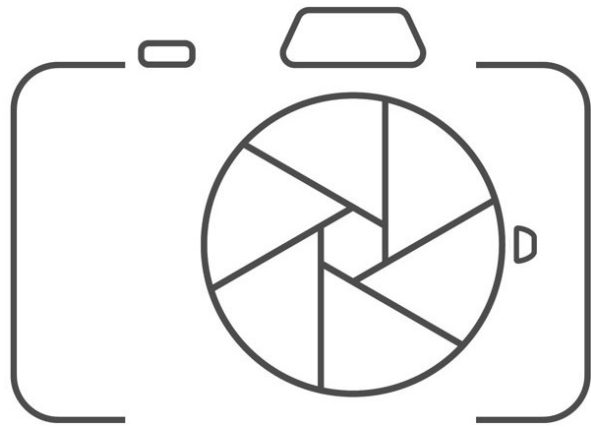


Video Production

VIDEO PRODUCTION—the process of converting an idea into a video—is available to all of us today due to the abundance of production equipment and software. Virtually all smartphones are video capable and will record sound. Streaming video and one-minute videos are within reach of anyone who wishes to produce and post a short film. This E-Unit introduces you to the video production storyboard process and the tools, terms, and technical details that you need to know in order to create a short video.



Objective:



Summarize the video production storyboard process and the tools, terms, and technical details that you need to know in order to create a short video.

Key Terms:



Apple QuickTime Movie (QT)	display resolution	MP4 (or MPEG-4)
Advanced Systems Format (ASF)	DivX encoded Movie (DivX)	MPG
advanced video coding, high definition (AVCHD)	dots per inch (DPI)	one-minute video
Audio Video Interleave (AVI)	DSLR camera	pixel
bit rate (data rate)	file extension	pixels per inch (PPI)
chronological	file format	storyboard
codec	flash video	storyboard panel
container	frame	streaming video
D1 resolution	frame rate	tripod
digital camera	frames per second (FPS)	video
digital rights management (DRM)	H.264	video file format
	Hertz (Hz)	videographer
	metadata	videography
	microphone (mic or mike)	video production
	MOV	Windows Media Video (WMV)

Videography

A **video** is a digital recording of an image (or a set of images). It is an electronic medium to record, copy, playback, broadcast, or display moving visual images.

Video production is the process of converting an idea into a video. A producer creates video by first capturing moving images (videography), and then creating combinations and post-production edits of parts of the video (video editing). **Streaming video** is content that is sent in compressed form over the Internet and played by the viewer in real time. A **one-minute video** is a video that is exactly 60 seconds in length. It contains no camera movements (panning, tilting, etc.), no editing, and limited additions to sound (utilizes most of the original sound).

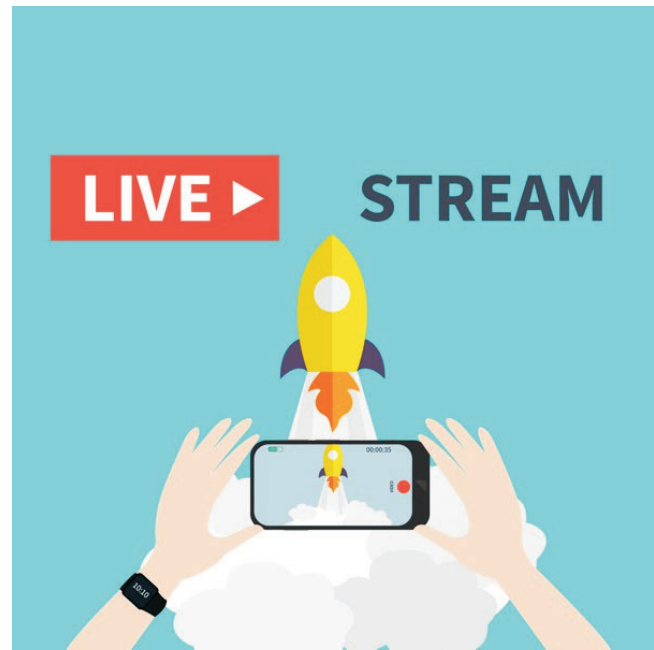


FIGURE 1. A live-stream is the real-time transmission of an event over the Internet. The term refers to the delivery method, not the medium (video), and is an alternative to file downloading.

STORYBOARD A VIDEO

Videography

Videography is the process of capturing moving images with a video camera. In contrast, cinematography uses mechanical film cameras. From conception to final product, videography involves the art and method of shooting video in a way that elicits a desired effect on the viewer.

A **videographer** is a person who records images and sounds using a video format. A videographer shoots the event, and is in charge of the video's editing and production.

Storyboard

A **storyboard** is a sequence of drawings (typically with brief directions and dialogue) that represent camera shots planned for a video or film production. It serves as a creative starting point to develop the storyline and to illustrate key scenes. Because storyboards show a film's key moments, the camera shots are easier to review and present to others. A storyboard allows the videographer to arrange and edit scene flow before production. To create a storyboard:

Step One

Develop a timeline in outline or list form. Timelines tell where and when the story begins and, in chronological order, how the story unfolds. **Chronological** refers to an arrangement

of events by order of occurrence. Timelines include all the main events in the order that they will appear in the video.

Step Two

Identify key moments and important scenes, including the opening scene, the closing scene, and any location changes. Clearly depict any major change in time, location, or story segments.

Step Three

Develop the level of detail necessary to represent the event or scene. Each video storyboard will range in the time and depth of information and background needed for the story. Although there should be enough detail to explain the story, the storyboard should be simple. Video should have short, clear descriptions and illustrations.

Step Four

Create a box (or cell) in the storyboard for each scene. A **storyboard panel** is a drawing of a three-to-four-inch rectangle that illustrates and describes an individual video scene. Storyboard panels help to set up the scenes and provide key information. Write a scene description in each box in the storyboard.

Step Five

Create a full layout of the storyboard. This step can be accomplished on a series of flash cards. They are used as rectangles to represent the video screen. Then, they are aligned in a grid pattern on a large board, or a series of boards. Starting in the first box, write a description of the scene to be filmed. Continue the process for each flash card scene.



FIGURE 2. A storyboard is a sequence of drawings, typically with brief directions and dialogue, representing camera shots planned for a video or film production. It serves as a creative starting point to develop the storyline and to illustrate key scenes. Because storyboards physically visualize a video or film, the camera shots are easier to review and present to others.

Step Six

Sketch scenes in the storyboard boxes. Illustrate each major scene with the appropriate details. It is not necessary or important to create a realistic illustration. The drawing should represent the overall appearance of the scene and show the important elements of the scene. Elements of the sketch may include perspective, items for the foreground or background, and people that appear in the scene. These drawings are usually illustrated in black and white, but color may be added.

Step Seven

Finalize the storyboard by reviewing the story line and the illustrations. This ensures that the story has a smooth flow and that important details are visible and well described. The following elements can be added during this step:

- ◆ Important scene information or lead-in elements
- ◆ Notes about music, specific songs, or sounds
- ◆ Critical dialogue for the scene

DIGITAL VIDEO FILE FORMATS

All video files contain four parts: video stream, audio stream, metadata (stored information about the video, navigation, and subtitles), and a container. A **file format** is a standard way to encode and store information in a computer file. All file formats are structures for bundling data. A file format is more than a file extension.

File Extension

A **file extension** is one or more letters at the end of a filename that usually follow a period (dot) and indicates the type of information stored in the file. An extension can be a codec, a container, or both a codec and a container. Most computer files have more than one type of data inside. For example, video files are collections of images, audio, and other data. Video is typically stored in a compressed form to reduce the file size and occupy less computer memory.

Video File Format

A **video file format** is an arrangement of digital video data on a computer system. The file format provides an indication of how much storage space is needed. Most video files are compressed for storage and then uncompressed for viewing. Some formats are best for video capture, and others are best for editing. The file format explains how the file is interpreted and played. These files generally come in the form of codecs and containers.

Containers

A **container** is a wrapper—a shell file—that holds a variety of media. Typically, audio and video data are held together in a single file. A container usually consists of a video and an audio codec, but may also contain information such as subtitles. A container allows the video production personnel to choose one codec for video and one for audio. A video's file extension typically refers to the container. Containers also hold metadata. **Metadata** is data that gives information about other data. For example, descriptions of media content in the file can include frame rates, camera settings, locations, and other production information. Container file extensions include .mov, .avi, .mp3.

AVI

Audio Video Interleave (AVI) is a multimedia, container file format that is used for watching standard-definition video on personal computers. Container files with the .avi extension often contain both video and audio data that allow for synchronous audio-with-video playback. Microsoft introduced AVI as part of its “Video for Windows” software and subsequently replaced it with a Windows Media Video (WMV). AVI files offer less compression than comparable formats (such as MPEG and MOV). AVI files also have a 2GB size limit that restricts their use. AVI formats are used with Apple QuickTime Player, Windows Media Player, and VideoLAN Client (VLC) media players.

ASF

Advanced Systems Format (ASF) is a proprietary Microsoft container that uses files compressed with Windows Media Audio (WMA) and WMV codecs. The container allows for a form of copy protection through digital rights management. **Digital rights management (DRM)** is a systematic approach to copyright protection for digital media. The purpose of DRM is to prevent online piracy by hindering the unauthorized redistribution of digital media and by restricting the ways that consumers can copy content that they purchased. ASF formats can be used with Windows Media Player and VLC. ASF video files come with different extensions, such as .wma, .wmv, or .asf.

MOV

An **MOV** is a file format used to save movie files and video clips to a computer hard drive or other media device. MOV and QT file formats support a wide range of codecs. **Apple QuickTime Movie (QT)** is a proprietary container format developed by Apple that supports a variety of codecs. QT is the player and the extension for QuickTime. The QT format is cross-platform. It supports both Mac and Windows systems. MOV and QT extensions can be opened with QT (usually displayed as .mov or .qt).

AVCHD

Advanced Video Coding, High Definition (AVCHD) is a video format that was jointly developed by Panasonic and Sony for use in consumer camcorders. AVCHD is a form of video compression. This codec allows the large data files created by high-definition video recording to be captured and saved on random-access media—DVDs, hard disk drives, memory cards, and flash drives. AVCHD is used with QT and with VLC.

Flash video

A **flash video** is a container that uses Flash Player or a Flash Plugin (within an Internet browser) to play videos. Older Flash videos often used the Sorenson codec, but the new Flash uses H.264. It uses several different codecs and is the most common format used for video streaming over the Internet. However, it is not supported on iOS devices (iPhones and iPads). Flash video uses the file extensions .flv and .swf.

Codecs

A **codec** is a program that decodes video and audio data in a video file to determine the amount of change between frames. It is said to be a combination of the words “compress and decompress” or “coder and decoder.” A codec compresses and decompresses the file data, interprets the video file, and decides how to play it on the computer screen. The compressed data format typically conforms to a standard video compression specification. All computers require a proper codec to play a video file.

Some popular codecs for computer video are MPEG, Indeo, and Cinepak. Video codecs are often proprietary. They are branded and protected. Payment of fees may be required in order for the user to utilize video codecs. Video editing software typically includes a few built-in codecs.

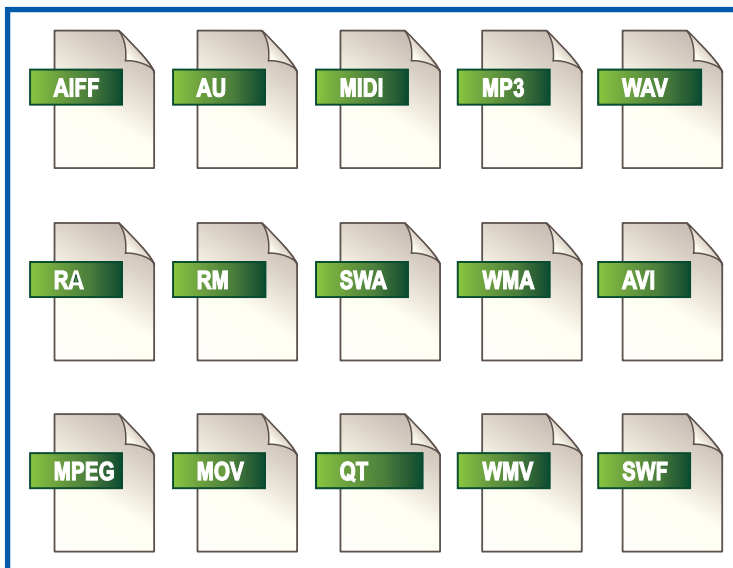


FIGURE 3. Based on the definitions and descriptions of containers and codecs, which of these sound and video file format icons are containers? Which are codecs?

WMV

Windows Media Video (WMV) is a codec used to stream video or audio over the Internet. While a small portion of a video or audio file downloads and begins to play, the rest of the download continues streaming in the background. Created as part of the Windows Media framework, WMV was designed as a video compressing format for Internet streaming applications. Microsoft also developed Advanced Systems Format (ASF) to store video encoded by WMV. Currently, WMV can support a range of resolutions, including high definition from 720p to 1080p. WMV files can be opened with Windows Media Player or a Windows Media Player plugin. The video can be saved under the extensions .wmv and .asf.

DivX

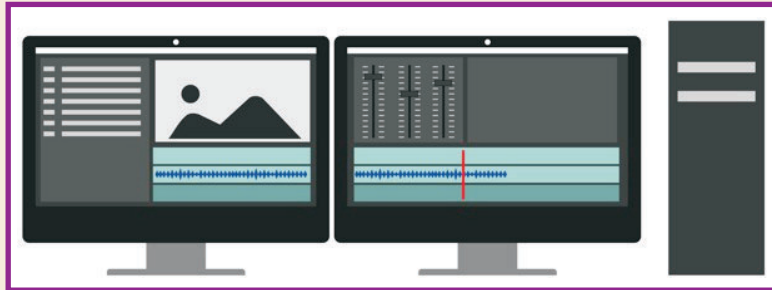
DivX encoded Movie(DivX) is the brand name of a video file format that effectively compresses videos with minimal quality loss while concurrently supporting resolutions of up to 1080p HD. The DivX codec allows for video and audio files to be compressed and decompressed in unison on multiple storage devices and formats. DivX is notable for its ability to compress lengthy video segments into small sizes while maintaining excellent visual quality. It is recognized by DVD players and can be used with DivX Player, The Core Media Player, QT (that has a DivX codec installed), and VLC.



FURTHER EXPLORATION...

ONLINE CONNECTION: What is DivX?

As an advanced codec, DivX has revolutionized video and film compression. It allows for high compression with limited loss in quality of the original file. The DivX codec can be installed within most common video editing software and allows for easy storage compression and playback. To learn more about DivX, visit the G4 Media website at <http://www.g4tv.com/videos/25188/what-is-divx/>.



The DivX codec can be installed within most common video editing software.

DivX can be played in a range of systems and devices. There is DivX software that can be used for both MAC and Windows. The DivX codec can be embedded within other file formats, such as AVI, and it can be its own file format (or container).

Codecs That Are Also Containers

Codecs differ from containers in a few ways. The file format container (such as .mov or .avi) is a way to “pack up” data for storage, whereas the codec is a way to encode or decode that data. However, there are exceptions. Sometimes the file is encoded, decoded, and packed with the same formatting software.

MPG

An **MPG** is a video file format for encoding and compressing video images. It was standardized by the MPEG (Moving Picture Experts Group). The most popular MPG files are MPEG-1 and MPEG-2. Both types of MPG files serve as container files for audio and video data to ensure that the audio and video stay in sync. MPG files incorporate MPEG-1 and MPEG-2 video and audio compression, and they are often used to create movies that are distributed over the Internet. MPEG-1 is used almost exclusively for VCDs (video compact disks), and MPEG-2 (H.262) is used for DVDs or broadcast HDTV. MPG files open with Microsoft Windows Media Player and QT.

MP4/MPEG-4

An **MP4 (or MPEG-4)** is a digital, multimedia container most commonly used to store video and audio or to share files on the Web. However, it can also be used to store other data, such as subtitles and still images. MP4 compresses audio and video separately. The video is compressed with MPEG-4 encoding and the audio is compressed with AAC (Advanced Audio Compression). The files can be opened with QT or MP4 players.

H.264

The **H.264** codec is the common standard for high definition digital video. This codec is versatile and works with very high and very low bit rates. For a video file, the **bit rate (data rate)** is the size of the data stream when the video is playing. The bit rate is measured in kilobits per second (Kbps) or megabits per second (Mbps). Bit rate is critical because it specifies the minimum capabilities (of the hard-drive transfer rate or the Internet connection) needed to play a video without interruption. H.264 can send low-resolution, highly compressed videos across the Internet. It can easily encode high-definition movies at high bit rates to play on an HD (high definition) television. H.264 codec is used with digital video cameras and camcorders and uses the AVCHD container. It is also used by web-streaming services such as Vimeo and can support 3D video. It opens with VLC and QT.

DISPLAY RESOLUTION AND FRAME RATES

Display resolution is a measure of the sharpness of an image, usually expressed as the total number of pixels in the image. Resolution is typically reported as width $\times$ height (with units in pixels). For example, 1024×768 is a width of 1024 pixels and a height of 768 pixels.

Resolution

A **pixel** is a single point in a graphic image; short for picture element. Video images are made up of thousands of little squares called pixels. The width of each pixel (relative to its height) is known as the pixel aspect ratio (PAR). For uploading to Vimeo, the PAR is set to 1:1 or 1.00. **Dots per inch (DPI)** is the number of dots that make up one inch of a picture, and indicates the resolution of an image. The more dots per inch, the higher the resolution of an image. **Pixels per inch (PPI)** is the number of pixels per an inch of a digital image, and relates to digital resolution. **D1 resolution** is a standard for TV and DVD-Video: full D1 represents 720×480 pixels—the standard PPI.

The resolution number represents the total number of horizontal lines the video has from top to bottom. For example, the resolution of a 480-pixel (or 480p) video is made up of 480 lines stacked on top of each other. Each line may contain 720 pixels across (on monitors) or 640 pixels across (on standard TVs). Resolution can be stated as 720 (or 640) $\times$ 480 . There are a range of resolutions depending upon the video source, the editing software, and the screen display.

Video resolutions range from current standard definition (480p) to high definition (such as 1080p). The traditional or standard ratio of $640p \times 480p$ has an aspect ratio of 4:3. This is an older, typical video image that has a ratio of 4 parts in length to 3 parts in height that displays the image closer to a square view. Newer, high-definition ratios typically begin at 720p (or a $1280 \times 720p$ ratio). This is an aspect ratio of 16:9 that results in an image being longer than it is wide (e.g., a PPI of 1280 wide and 720 high). There is also 1080p that consists of even more pixels per inch in width. This allows for greater clarity and definition of the image.

Frame Rates

A **frame** is a single image, the smallest unit of a film or video's structure. Many frames or "still" images are played consecutively to comprise a film or video. The **frame rate** is the frequency (per second) at which individual frames in a film or video are displayed to the viewer. Human beings process 10 to 12 images per second, perceiving each frame individually. Higher frame rates are perceived as motion.

- ◆ Frame rate is marked as **frames per second (FPS)**, the number of frames (or still images) displayed each second. It will follow a number in the lower case, as "fps." Higher frame rates result in more fluid, seamless video images.
- ◆ Traditional films are shot at a rate of 24fps. Modern TV is broadcast from 30fps to 60fps. Lower-end or standard video cameras can record at 30fps. The suffix "p" may also be used instead of the traditional "fps." For example, 24fps may also be shown as 24p.
- ◆ Recent, high-end commercial films allocate a frame rate of 48fps. Rates of 48fps or 60fps are more suitable for high-action films and fast-paced sports.
- ◆ Display screens, TVs, and monitors also have a refresh rate measured in hertz. **Hertz (Hz)** is a unit of frequency of electrical vibrations equal to one cycle per second. For film or video recorded at 60fps, the optimal display setting would be 60hz, or 60 cycles (frames) per second.

BASIC VIDEO EQUIPMENT AND PRODUCTION

There are many terms and areas of production that you need to understand in videography. Cameras, lighting, sound, crew members, and editing options are all involved with this process.

Cameras

A **digital camera** is an optical instrument that stores digital images rather than recording them on film. A high-quality, moderately expensive digital, single-lens reflex (DSLR) video camera is a good option for creating a short video. A **DSLR camera** is a digital camera that uses a reflex-mirror mechanism. When a picture is taken, the reflex mirror moves, allowing light to reach a digital image sensor. The image sensor records the image. The camera processor takes the information from the image sensor, converts it to an appropriate format, then writes it onto a memory card. A digital image can be downloaded to a computer system, edited, and printed. The specifications of any video camera should be reviewed to ensure that the camera is able to record and save video in the format required. A videographer should do the following:

- ◆ Take a lens that can zoom in and out, or multiple lenses that have this capacity—most video cameras have a built-in lens that is able to zoom in and out for a range of shots.

- ◆ Review the storyboard to ensure the camera lenses are able to take the required video shots.
- ◆ Evaluate the storyboard to determine the necessity of “secure-steady” footage. To keep the camera from moving while filming, a tripod may be used. A **tripod** is a portable, three-legged frame used as a platform for supporting the weight of and maintaining the stability of an object, such as a camera.

A tripod is handy when zooming in on a shot. Even slight movement is exaggerated on film. When filming low-light scenes, the recording speed is usually slower and movement is more noticeable. A tripod will counteract these issues.

Lighting

A lighting source is essential to suitably illuminate the subject. A collection of light sources directed on the subject may be more appropriate than a single source of light. Lighting can highlight the main subject or highlight other areas within the frame.

Sound

Audio equipment includes a microphone. A **microphone (mic or mike)** is an instrument that converts sound energy into electrical signals. A directional microphone picks up sound from a certain direction (or directions). A directional microphone has a greater sensitivity to sounds coming from an area directly in front of it. Directional mikes can be used to minimize unwanted sounds. In contrast, an omnidirectional microphone, a mike that picks up sound equally from all directions, can be used when all sound is trying to be captured. A remote mike may also be helpful as it allows sound to be recorded at specific locations. The audio portions of the video can be recorded independent of the video equipment. Audio can be captured with a digital recording device and then downloaded to a computer, along with the video footage.

Crew

A film-production crew works in setup, recording, and editing video. A film crew may include the following managers and their team:

- ◆ A producer (to oversee all the work)
- ◆ A sound engineer
- ◆ A lighting engineer
- ◆ A props manager

Editing

Once the storyboard is finalized and all equipment is in place, the video can be shot. It is wise to film several “takes” of important scenes to ensure the best results are achieved during editing. During editing, the video footage is cut, pasted, and scenes are cropped using editing software. Editing software makes the process relatively easy. It is not necessary to film the

storyboard in sequence. Scenes may be filmed out of order and edited into the correct order. In general, you should do the following:

- ◆ Download the video file to the proper software and file formats.
- ◆ Use video editing software to crop, reorganize, and alter footage.
- ◆ Save each file with the proper codec or file extension most useful for video editing and playback.
- ◆ Add sound to the video track. Most video editing software allows the editor to “drop-and-drag” the sound files (a song or any recorded audio). The process is similar to video-image editing, as an editor is able to crop the audio track, cut and paste portions of the track, and adjust the volume of the audio track.

Summary:



Video production—the process of converting an idea into a video—is available to all of us today, due to the abundance of production equipment and software. Virtually, all smartphones are video capable and will record sound. Streaming video and one-minute videos are within reach of anyone who wishes to produce and post a short film. This E-Unit introduces you to the storyboard process and the tools, terms, and technical details that you need to know in order to create a short video.

Checking Your Knowledge:



1. Describe video and video production.
2. What is a file format?
3. Differentiate between a container and a codec.
4. How does video resolution affect the finished video? How does the frame rate affect the finished video?
5. What is the role of a storyboard in video production?

Expanding Your Knowledge:



Creating, shooting, and editing video has become relatively quick and easy with the availability of video editing software and video cameras. There are many online “DIY” instructional videos that demonstrate a range of free software and apps to aid video projects. Do a quick search about how to create a short film using basic apps and software. Review some of the instructional videos, and create a one-minute, or short, video. Post your video.

Web Links:



Animated Horse

<https://commons.wikimedia.org/wiki/File:Animhorse.gif>

SLR Cross Section

https://commons.wikimedia.org/wiki/File:SLR_cross_section.svg

Storyboarding Your Film

<http://www.dummies.com/art-center/performing-arts/filmmaking/storyboarding-your-film/>

Storyboard Template

<https://www.tes.com/us/teacher-lessons/storyboard-template-6-boxes-7072824>

Video Resolutions

<http://www.mediacollege.com/video/resolution/>

What Determines Resolution and FPS?

<https://www.quora.com/What-determines-the-relationship-between-resolution-and-fps-in-cameras>