Fundamental of Digital Media Design

Introduction to Video

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Chapter Description

- **Aims**
  - To understand the concept of analog and digital video
  - To identify the various types of video compression
  - To learn the production process of video
  - Tostudy the new era of digital video
- **Expected Outcomes**
  - Understand the theory and concept of video
  - Able to record, edit and publish a digital video
- **References**

  - Tay Vaughan. Multimedia: Making It Work, Ninth Edition. Mc Graw Hill. 2014. ISBN-13: 978-0071832885
  - Savage, T.M., Vogel, K.E. An Introduction to Digital Multimedia 2nd ed.. 2013. Jones & Bartlett Learning ASIN: B00LZM6ESY.
  - Althos, Introduction to IP Video,2009
  - Terence Kawaja, LUMA's The State of Digital Video,2015.

Video in Multimedia

Video can be:

- Live
- Recorded

Image source:
https://c1.staticflickr.com/5/4033/4582276033_fc88298837_z.jpg
https://i.vimeocdn.com/video/653601329_1280x720.jpg

Video in Multimedia

- requires the highest performance demand
- playback a very large file size of video requires fast data transfer.

Introduction

- Video is visual multimedia source that combines a sequence of images to form a moving picture.
- The video transmits a signal to a screen and processes the order in which the screen captures should be shown.
- Videos usually have audio components that correspond with the pictures being shown on the screen.

Read more: http://www.businessdictionary.com/definition/video.html

What is video?

- The term VIDEO commonly refers to several storage formats for moving pictures
  - Digital video formats: Blue—ray, DVD, Quick Time and MPEG-4 and analog video tapes.
- Video can be recorded and transmitted in various physical media
  - In magnetic tape when recorded as PAL or NTSC electric signals by video camera, or in MPEG—4 digital media when recorded by digital camera.
- Quality of video essentially depends on capturing method and storage used.

What is video?

PAL

- Short form for Phase Alternate Line
- Is an analog television encoding system used in broadcast television systems in large parts of the world

NTSC

- Named for the National Television System Committee
- Is the analog television system used in most of North America, most countries in South America, Burma, South Korea, Taiwan, Japan, Philippines, and some Pacific island nations and territories.

What is video?

PAL vs NTSC

- The PAL standard automatically removes hue errors by utilising phase alternation of the color signal, so a tint control is unnecessary

- NTSC receivers have a tint control to perform color correction manually. If this is not adjust correctly, the colors may be faulty.

Digital video

- Digital video comprises of a series of orthogonal bitmap digital images displayed in rapid succession at a constant rate.
- **Digital video** is a **sequence of picture** signals (**frames**) that are represented by binary data (bits) that describe a finite **set of color and luminance levels**.
- Sending a digital video picture involves the conversion of an image into digital information that is transferred to a digital video receiver.
- The digital information contains characteristics of the video signal and the position of the image (bit location) that will be displayed.

Digital video

- The basic process of creating digital video is the image digitization process, compression analysis that produces key frames and difference frames, and formatting the data into files or streams (video formats).

Image Digitization

- Image digitization is the conversion of visual signals into digital form that represent them.
- Each image in a video sequence is digitized into component parts.
- Each image may be analyzed and converted to a representation (approximation) of its original.

Digital video

Key Frames

- A key frame is a **reference** video **frame image** that is part of a series or group of related frames that contains all the information needed to create its image.
- Because all of the image information must be contained in a key frame, the data size of a key frame can be relatively large.
- Key frames in an MPEG signal are called **I-frames**.

Digital video

Difference Frames

- Difference frames are images (pictures) within a sequence of images (such as in a video sequence) that are **created using information from other images** (such as from key frames (I-Frames).
- Because image components are often repeated within a sequence of images (temporal redundancy), the use of difference frames provides substantial reduction in the number of bits that are used to represent a digital video sequence (temporal data compression).
- Difference frames in an MPEG signal are called **p-frames** or **b-frames**.

Digital video

Video Formats

- Video formatting is the **method** that is **used** to contain or **assign digital media** objects or components within a file structure or media stream (data flow).
- Video formats are usually associated with industry standards like MPEG, Quicktime MOV format, or the Windows Media WMA format.

Video Digitization

- The basic process used to **digitize images** to create video sequences is the sampling of image elements (pixels) for intensity and color.
- For color video, each element contains intensity (brightness) and **color components** (red, green, and blue - RGB).
- These components are periodically sampled and converted into a digital format.

Video Digitization

- **Analog video digitization** involves analyzing each scan line of video, separating the color and intensity levels and digitizing each component.
- For **digital video capturing** from optical sensors (such as video recorders with CCD sensors), each pixel element is converted into a color type (red, green, and blue) which has an intensity level (brightness).

Video Digitization

- Converting video signals at 30 frames per second into digital streams of data results in large amounts of data.
- The **uncompressed data rate** for standard definition television (**SDTV**) is **270 Mbps** (SDI format).
- The uncompressed data rate for high definition television (**HDTV**) is **1.5 Gbps**.

Video Digitization

File size considerations

- Digitized video can be extremely large
  - A single second of high-quality color video can be as large as 1 MB
- Several elements determine the file size:
  1. Length of the video
  2. Frame rate
  3. Image size
  4. Color depth

Digital Video Workflow

HARDWARE SETTINGS (VIDEO CAMERA) = VIDEO SEQUENCE/LOG & CAPTURE/PROJECT SETTINGS = ? EXPORT SETTINGS

Image source: https://process.arts.ac.uk/sites/default/files/u141/digital_video_workflow.jpg

Video Compression

- **Video compression** is the process of **reducing** the amount of **data** that is needed to represent a video signal.
- Video compression is performed by analyzing the information contained within images sequences and removing
- redundancies. Video compression / decompression known as Codec have been developed because of the large sizes associated with video files

Video Compression

Spatial Compression (Image compression)

- Spatial compression is the removing of **redundant information within each image**.
- Spatial compression can use processes such as JPEG which use blocks of images to approximate portions of information.
- This can reduce the amount of data by a factor of 20:1 or more depending on the underlying complexity of the image (solid images compress much better)

Video Compression

Temporal Compression (Sequence compression

- Temporal compression is the removal of **redundant information between each image**.
- Temporal compression can use processes such as difference coding to identify objects that repeatedly appear in sequences of images.

Video Compression

Lossless Compression

- Preserves the extract image through out the compression and decompression process.

Lossy Compression

- Eliminates some of the data in the image and therefore provides greater compression ratios than lossless compression
- The greater the compression ratio, the poorer the decompressed image

Video Compression

Two widely used video compression software programs are:

1. Apples Quick Time
2. Microsoft Cideo for Windows

Video Production Process

A video production could be categorized into three phases:

1. Pre-production (Planning)
2. Production (Directing)
3. Post-production (Editing)

Video Production Process

Pre-production

- is the first of the three parts you need to consider when producing any type of video.
- During this stage, you're organizing everything so that the production phase goes smoothly.

Video Production Process

Pre-Production

- Make a production schedule
- Crew-Up
- Visualize your project's look
- Find and secure locations
- Casting
- Production design (Discuss among your team)
- Prepare costumes, props set dressing
- Question to ask when developing a shooting script
- Prepare a floor plan diagram / lighting plot for each location
- Breakdown shooting script
- Storyboard
- Shooting Schedule

Video Production Process

Production

- How-To Set-Up a Shoot
- Lighting
- Audio
- How-to Shoot A Video

Video Production Process

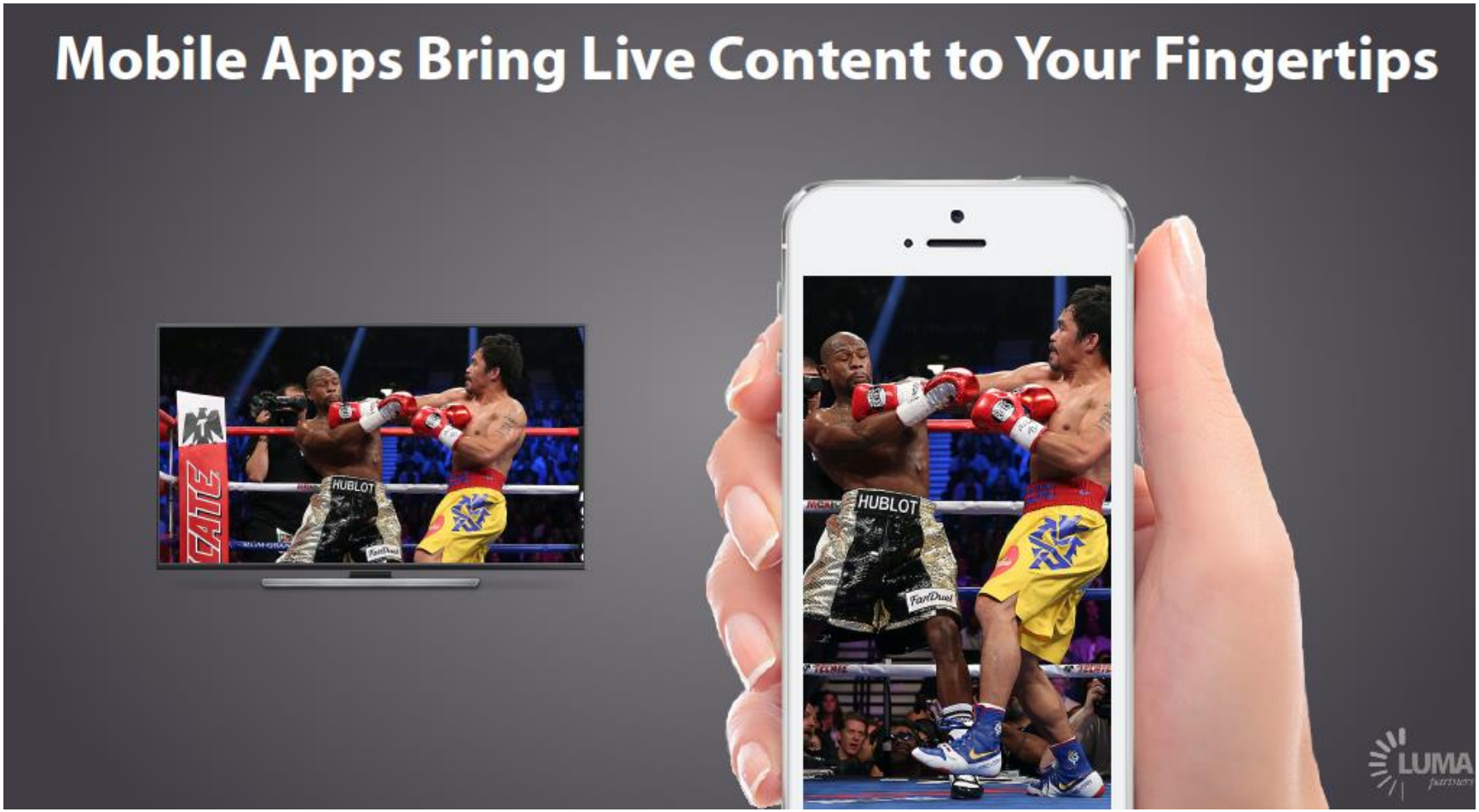
Post-Production

- Transfer your Footage
- Set-Up to Edit
- Editing
- Working with Audio, Music & Narration
- Save your Work
- Render & Export

The Rise of Digital Video

Image source: https://www.slideshare.net/tkawaja/lumas-the-state-of-digital-video/3-Hours29Source_eMarketer_comScoreUS_Digital_Video

The Rise of Digital Video



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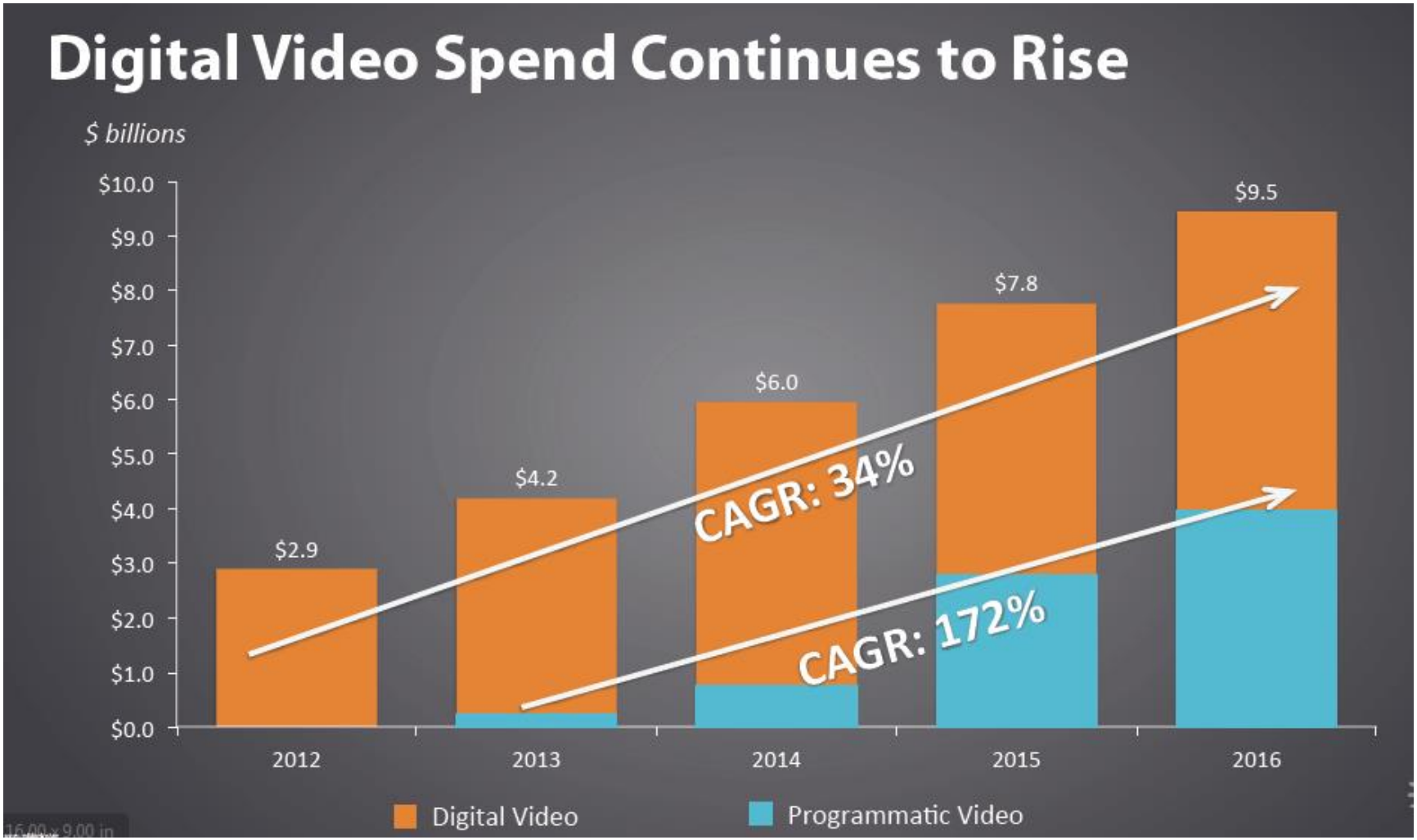

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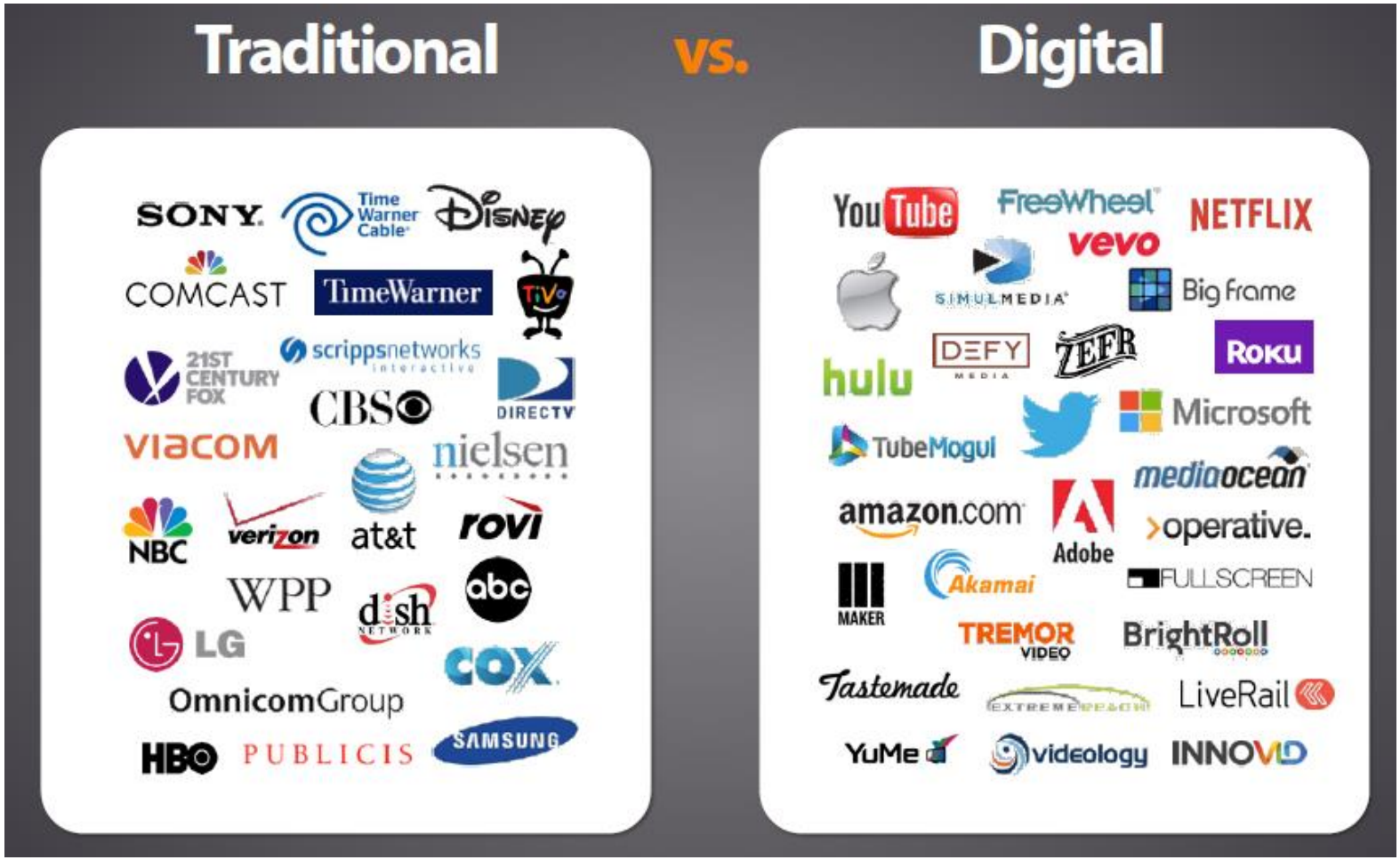

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The Rise of Digital Video

Digital video has a very bright future:

1. Preferred consumer media
2. Continued device proliferation
3. New content formats
4. Ad inventory shortage
5. TV demand shift

Conclusion of The Chapter

- Video is visual multimedia source that combines a sequence of images to form a moving picture.
- Quality of video essentially depends on capturing method and storage used.
- Digital video is a sequence of picture signals (frames) that are represented by binary data (bits) that describe a finite set of color and luminance levels.
- A video production could be categorized into 3 phases; planning, directing & editing.
- Digital video is raising up in this modern life.