

## **CODECS**

### **Shooting, Editing, Delivery**

**SD Video is big,**

**HD is bigger,**

**UHD is just  
silly...**

## **What *is* High Definition (HD)?**

Any image larger than Standard Definition (SD) **720x486**

- **HD analog** developed early 80's, first broadcast in Japan in **1986**.
- **HD digital** first broadcast in U.S. in **1996**.
- **HDV** created by JVC, Sony, Canon and Sharp in **2003**.
- **4K camera** released by DALSA in **2006**.
- **DSLR HD** released by Nikon in **2009**.

## **What is *Ultra* High Definition (UHD)?**

- Consumer Display Standard, 2x the size of HD: **3840x2160**

## **And 4K?**

- Broadcast & Cinema Standard, 2x the size of 2K: **4096x2160**  
JPEG2000, 250mbps, 12bit 4:4:4 color sampling

## **Storage Rates Compared**

(4-100 times more data than DSLR & HDV)

## So how do we get this down to a manageable size?

### Compression

#### Codecs vs. Formats (Containers)

Formats take care of packaging, transport & presentation

<b>MOV</b>	QuickTime
<b>MP4</b>	MPEG-4 Part 14
<b>AVCHD</b>	Advanced Video Coding High Definition
<b>AVI</b>	Audio Video Interleave (doesn't support aspect ratios)
<b>WMV</b>	Windows Media Video
<b>ASF</b>	Advanced Systems Format
<b>R3D</b>	Redcode Raw
<b>MPEG</b>	Moving Pictures Experts Group
<b>FLV</b>	Flash Video

## Codecs

Encoding/Decoding, Compression/Decompression

- **Lossless**
- **Lossy**
  
- **Intra-frame** – Large file sizes
  - All compression **within** an individual frame
  - **Good for editing**
  
- **Inter-frame** – Small file sizes, Processor Intensive
  - Compresses information based on **surrounding** frames
  - **Bad for editing**

### Most Common Codecs

- |  |
|--|
| <ul style="list-style-type: none"><li>▪ <b>Apple ProRes</b></li><li>▪ <b>H.264</b></li></ul>   |
| <ul style="list-style-type: none"><li>▪ <b>Avid DNxHD</b></li><li>▪ <b>Cineform</b></li><li>▪ <b>Panasonic DVCProHD</b></li><li>▪ <b>Redcode Raw</b></li><li>▪ <b>Sony HDCAM/XDCAM</b></li></ul> |

## Why are Inter-frame Codecs bad for Editing? Long-GOP (Group of Pictures)

### Group of Pictures (GOP)

**I – Intra-frames:** self-contained frames, with *intra*-frame compression called Key Frames

**P – Predictive frames:** what has changed from I frames

**B – Bidirectional frames:** compress only changed info from I & P frames

#### GOP-15:

<i>I</i>	<i>b</i>	<i>b</i>	<i>p</i>	<i>b</i>	<i>b</i>	<i>p</i>	<i>b</i>	<i>b</i>	<i>p</i>	<i>b</i>	<i>b</i>	<i>p</i>	<i>b</i>	<i>p</i>
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

v

#### To do a simple edit:

<i>I</i>	<i>b</i>	<i>b</i>	<i>p</i>	<i>b</i>	<i>b</i>	<i>p</i>	<i>b</i>	<i>b</i>	<i>p</i>	<i>b</i>	<i>b</i>	<i>p</i>	<i>b</i>	<i>p</i>
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

cut

#### These frames now recompressed →

<i>I</i>	<i>b</i>	<i>b</i>	<i>p</i>	<i>b</i>	<i>b</i>	<i>p</i>	<i>b</i>	<div style="background-color: #000080; color: white; padding: 2px;"><i>I</i></div>	<i>b</i>	<i>b</i>	<i>p</i>	<i>b</i>	<i>p</i>
1	2	3	4	5	6	7	8	9	10	11	12	13	14

- Frame retrieval is an issue - landing on “*b*” frame requires 3 other frames to be decoded
- Any dissolves, effects, etc. require rendering [i.e. recompression]
- Early Long-GOP only allowed cuts on “*I*” frames

**Most camcorders record inter-frame codecs (long-GOP)**  
**All internet video codecs are long-GOP**

**SOLUTION?**

**1. NLE's that cut "natively"**

**2. Transcoding (re-wrapping)**

**Native editing**

- System performance may get slower with longer timelines.
- Rendering long-GOP codecs is slower than i-frame codecs.
- Audio Sync issues with drifting.
- Some codecs/NLE's don't support higher bit depth for color correction.

**Transcoding**

Transcoding to an **intra-frame codec**: ProRes, etc...

- Also called "intermediate" or "mezzanine" codecs.
- Transcoding means slight image quality loss due to re-compression.
- Transcoding means larger file sizes [~10x] and duplicated media.
  - Clip management/naming conventions even more important.

## **Ripping/Converting DVD & YouTube Source**

DVD's use mpeg-2 compression, YouTube is usually H.264  
(both inter-frame codecs)

### **Ripping Software**

<b>Mac &amp; Windows</b>
<ul style="list-style-type: none"><li>▪ <b>Handbrake</b></li><li>▪ <b>MakeMKV</b></li><li>▪ <b>DVDFab HD</b></li></ul>
<b>Others</b>
<ul style="list-style-type: none"><li>▪ <b>AnyDVD – PC only</b></li><li>▪ <b>DVDShrink – PC only</b></li></ul>

### **Transcoding Software**

<b>Mac &amp; Windows</b>
<ul style="list-style-type: none"><li>▪ <b>MPEG Streamclip</b></li><li>▪ <b>Handbrake</b></li><li>▪ <b>Media Coder</b></li><li>▪ <b>Adobe Media Encoder</b></li><li>▪ <b>Any Video Converter</b></li></ul>
<b>Others</b>
<ul style="list-style-type: none"><li>▪ <b>Compressor – Mac only</b></li><li>▪ <b>Format Factory – PC only</b></li><li>▪ <b>NLE Log &amp; Transfer/Manager</b></li></ul>

### **Testing Workflows...**

## **Other Issues for Editing Large Source**

### **Processors**

2GHz Four-core or Six-core

### **Graphics Cards**

NVIDIA GeForce

### **Video/Capture Cards**

Blackmagic DeckLink

### **RAM**

12GB-32GB

### **Storage**

7,200rpms minimum

RAID's - Redundant Array of Inexpensive Devices

### **Monitors**

\$700-\$30,000





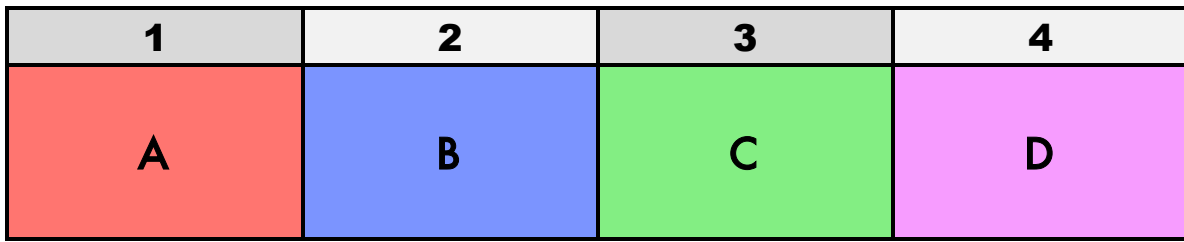
## Pulldown

**How do 24 frames become 30?**

**3:2 Pulldown Sequence**

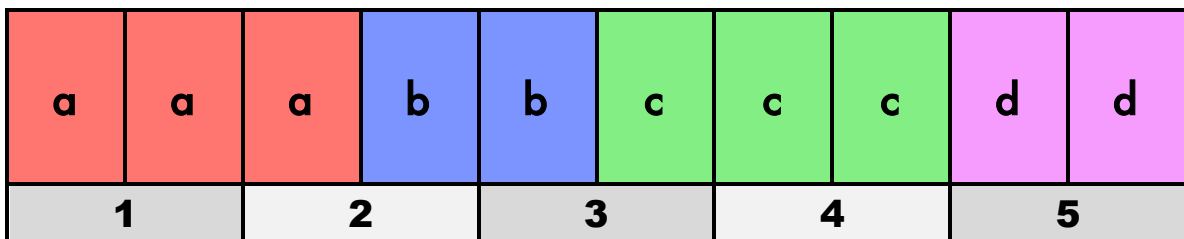
(2:3, etc.)

24 frames/sec



$$6 \times 4 = 24$$

60 fields/sec

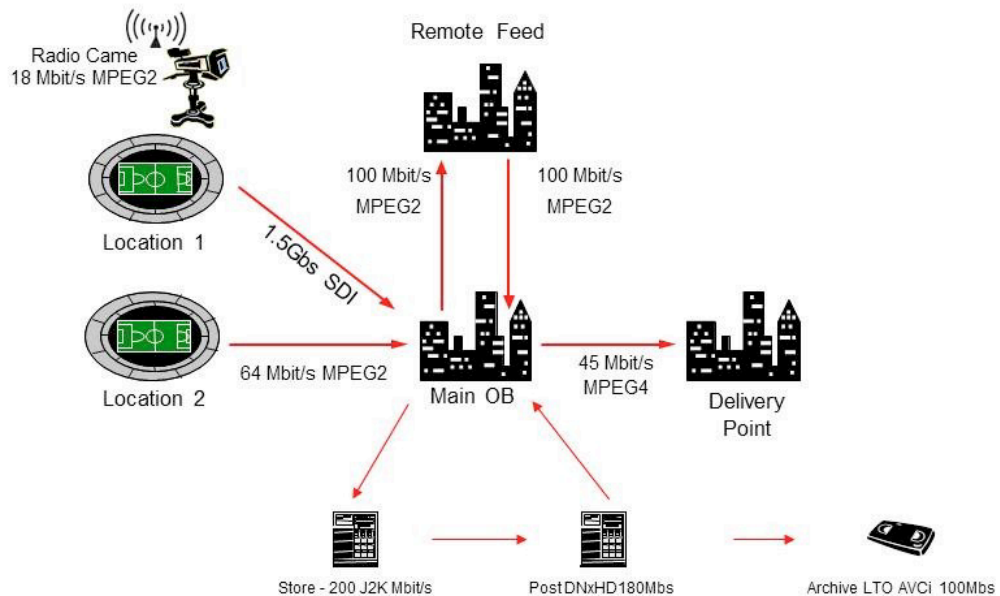


$$6 \times 5 = 30$$

## Output & Deliverables

### **BBC**

Requires a “codec map” showing all codecs – including bitrates – as program goes through to mastering.



### **HD THEATER**

- Won't allow more than 10% DSLR footage in a show.

### **DISCOVERY HD**

- Won't allow more than 15% DSLR footage in a show.

### **BBC**

- Won't allow more than 25% DSLR footage in a show.

**ABC, ESPN, FOX** use **720p**

**CBS, NBC, HBO, HDNET, DISCHD** use **1080i**