The Big Picture:
Digital Cinema Technology and Security

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Film: How its always been done

• 35mm film is the standard, more than a mile of it for one movie.
• IMAX film is 10 times larger than 35mm.
• The image hasn’t been upgraded much in the more than a century that movies have been playing.
• The only real upgrade was from Black and White, to Color.
Film Sound and Image

- DTS Timecode
- Analog
- Dolby SRD
- Sony SDDS
Distribution/Security of Film Prints

- 70 lbs (32 kg) cans with the film inside.
- Security measures include:
  - Codenames for content
  - Separate shipments
  - Physical locks on the cans
DLP technology

• First designed in 1987 By Dr. Larry Hornbeck at Texas Instruments.
• It took a long time to make a splash in the Movie market.
• The first major release in digital cinema was in 2005.
The DLP Chip
So how tiny are these mirrors?
Even closer!
Creating an image (greyscale)
And finally, what it really looks like

- Red DMD
- Green DMD
- Blue DMD
- Prism
- Light Pipe
- Lens
A couple different DLP projectors
Sony SXRD

- Silicon X-tal Reflective Display
## Resolution

<table>
<thead>
<tr>
<th>Format</th>
<th>Dimensions</th>
<th>Aspect Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DCI 4K</strong></td>
<td>4096x2160 (8.8MP)</td>
<td>1.90</td>
</tr>
<tr>
<td><strong>DCI 2K</strong></td>
<td>2048x1080 (2.2MP)</td>
<td>1.90</td>
</tr>
<tr>
<td><strong>SD 480i</strong></td>
<td>704x480 (0.3MP)</td>
<td>3/2</td>
</tr>
</tbody>
</table>
Digital Cinema Distribution

• Multiple methods of delivery
• Hard Drive
• Network Transfer
• Satellite

• Interesting facts about content
Security in Digital Cinema

Step 1:
1. Content is served out from a storage point, to the Media Block
2. The content is encrypted.
• The Show Player decodes the video/audio with the KDM, the audio is passed to the audio processor.
• The video is re-encrypted with Cinelink II, and sent to the projector.
Cryptography Section

- Sha1 256 key
- Correct Date Range
- Correct content
- No tampering detected

Any of these fail, and you cannot play the movie
KDM or Key Delivery Message

- `<ds:X509IssuerName>dnQualifier=\+62TOmh@eqB0D1966oR2gdu7SdM=, CN=Root.CA.DC.Cinea.Com,OU=CA.DC.Cinea.Com,O=DC.Cinea.Com</ds:X509IssuerName>`
- `<ds:X509SerialNumber>1799</ds:X509SerialNumber>`
- `</X509IssuerSerial>`
- `<X509SubjectName>dnQualifier=TRxe7YERGorsOlg1M/WegWTolvrs=,CN=SM.Dolby-DSP100-00000000,O=DC.Cinea.Com,OU=DolbyShowPlayer</X509SubjectName>`
- `</Recipient>`
- `<CompositionPlaylistId>urn:uuid:d12ky0XqY-f997-c039-aece-4a0af0b982d3</CompositionPlaylistId>`
- `<ContentTitleText>DEFCON_FTR_S_EN-XX_US-NC_51_2K_DI_20080808_Mike</ContentTitleText>`
- `<ContentKeysNotValidBefore>2008-08-08T06:01:00-00:00</ContentKeysNotValidBefore>`
- `<ContentKeysNotValidAfter>2008-08-10T09:59:00-00:00</ContentKeysNotValidAfter>`
When a security breach is detected
A couple other security methods in Digital Cinema
Searching for Pirates...
Forensic Marking DCDM
Forensic Marking POM
Security Wrap up

• How tough is Digital Cinema Security Overall?
• Are there any weaknesses?
3D Technology

- Have you seen a film in 3D before?
- What did you think?
Anaglyph Technology
Two problems with 3D films
How digital cinema fixes the problem
Digital Cinema 3D technologies

• There are a couple of major companies that produce 3D equipment.
• They use different methods to make the 3D effect. The main methods are:
  • 1. Circular Polarization
  • 2. Wavelength Multiplex
Method 1: Basic Circular Polarization
Method 1: Circular Polarization

- Projector
- Z Screen
  - Polarizes Left
  - And
  - Polarizes Right
Method 1: Circular Polarization
Circular Polarization continued...

- Real D was the first major 3D format in digital cinema.
- These glasses are disposable, due to the low cost in making plastic circular polarized lenses.
Method 2: Wavelength Multiplex

- Dolby 3D is new on the block
- Uses Wavelength Multiplex Technology. Licensed from INFITEC.
- These glasses are reusable.
Method 2: Wavelength Multiplex
Which is better?

• This is my opinion on it:

Real D

Dolby 3D
So, what’s coming in 3D

• Tim Burton’s ALICE IN WONDERLAND
• SHREK GOES FOURTH
• James Cameron’s AVATAR
• Michael Bay’s TRANSFORMERS 2
• And of course, STAR WARS
3D Wrap-up

• Where are the best 3D presentations found?
• Do your research. This can be a bit difficult, as many theatres don’t have a clue which 3D system they use, but can save you a headache, and enhance your viewing experience.
Alternative Content

• Metropolitan Opera...yup, you know you love opera.
• Sports Events-Dallas Mavericks games have been aired at local movie theatres in 3D.
• Concerts: U23D and others
• Oh, and if you are in any way interested, Some places let you:
Play HALO 3 on the big screen!
Thanks for Coming!
Q & A continues across the hall in room 104 (Q&A 3)

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Resources:

- Some images and design elements by:
  - Craig T. Morris ([f1lt3r3d0ut@gmail.com](mailto:f1lt3r3d0ut@gmail.com))
  - Taylor & Brett for FTP and PDF resources

- Slides 7 and 8: TI/dlp.com
- Slide 12: Sony SXRD
- Slide 26: Library of Congress; Jaws 3D Poster (Universal Pictures)
Resources Continued:

- Texas Instruments: [www.dlp.com](http://www.dlp.com)
- NEC Projectors: [www.necam.com/dc](http://www.necam.com/dc)
- Infitec: [http://www.infitec.net/infi_e.html](http://www.infitec.net/infi_e.html)
- Dolby Labs: [www.dolby.com](http://www.dolby.com)
- Real D: [www.reald.com](http://www.reald.com)
- Special thanks to Dr. Pepper (for keeping me awake): [www.drpepper.com](http://www.drpepper.com)