

# Quality and Interoperability in Digital Cinema

Michael Karagosian

**kmp**

Karagosian MacCalla Partners

napoli **film** festival



# Quality: Determination

- **Quality is determined by those who provide the content**
- DCI – strong effort made to determine high quality level for feature motion pictures
- Specialized cinema – quality level can be less than “DCI” quality
- Advertisements – lower quality acceptable

# Quality: Audience

- Exhibitors with trial digital cinema systems note that audiences FIRST comment on high quality audio
  - Audio uncompressed vs compressed for film
  - 1.3K projectors

# Perception of Quality: Image

- Many factors affect image quality
  - Color
  - Contrast
  - Steadiness
  - Softness
  - Resolution
  - Screen perforations

# Quality: Image

- Technical requirements
  - DCI / SMPTE: 2K / 4K, 12-bit color depth, XYZ color space, high bit rate compressed data
  - Specialized cinema: HD, 8-bit color, lower bit rate
  - Advertising: SD / HD, 8-bit color, commercial bit rates

# Perception of Quality: Audio

- Room characteristics affect intelligibility
  - Screen rolloff (perforated screen)
  - Room reverberation
  - Room EQ
- Other factors
  - Compression – loss of detail
  - Number of channels

# Quality: Audio

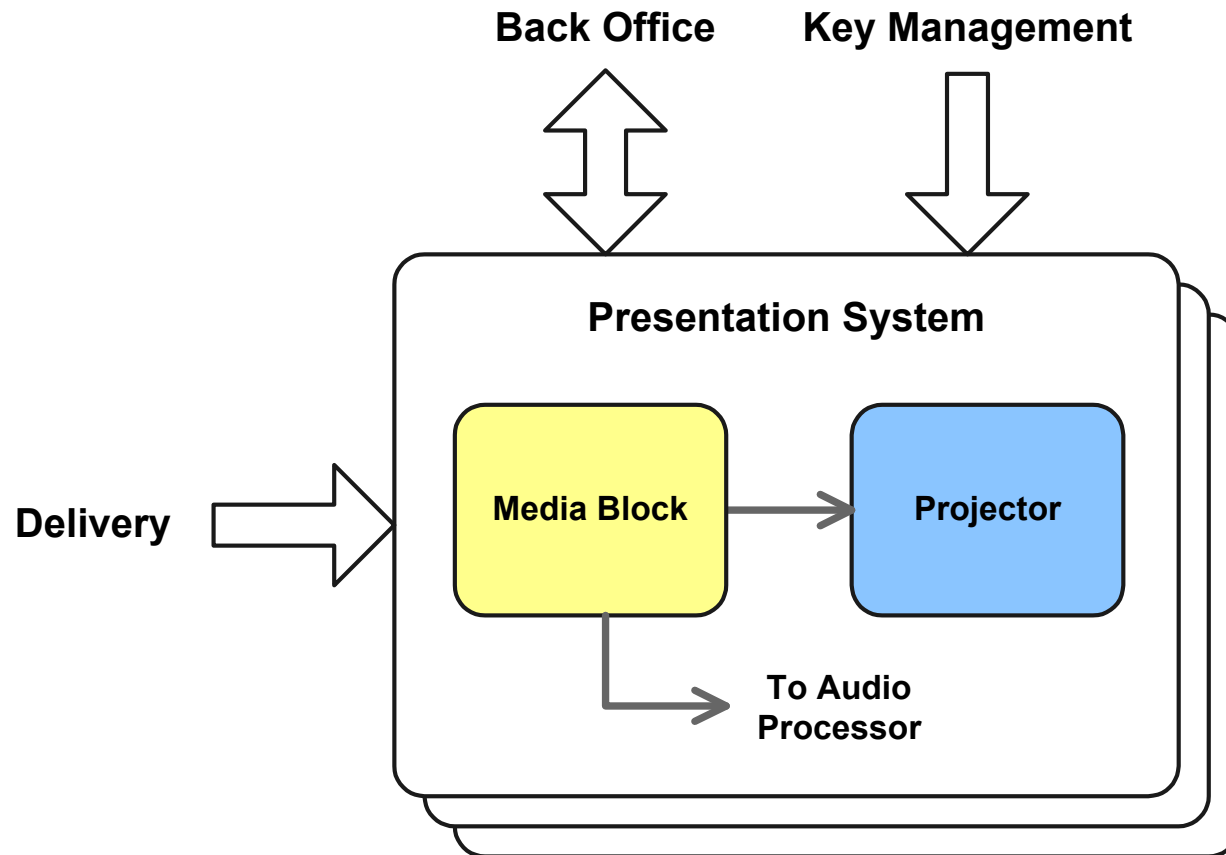
- Technical requirements
  - DCI / SMPTE: 48KHz / 96KHz sampling rate, uncompressed, 24-bit depth, up to 16 channels
  - Specialized cinema: 2-channel to compressed 5.1
  - Advertising: 2-channel

# Interoperability: Quality

- Cinemas today will address multiple quality levels through the use of multiple systems
- Cinemas of the future will have a single system addressing multiple quality levels
  - MXF packaging and multiple compressions will enable this goal

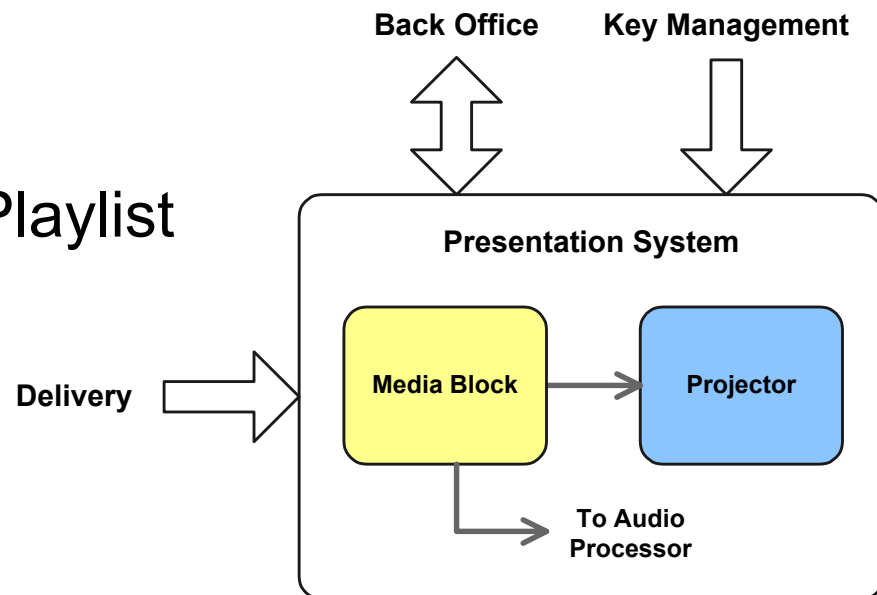


# System Interoperability



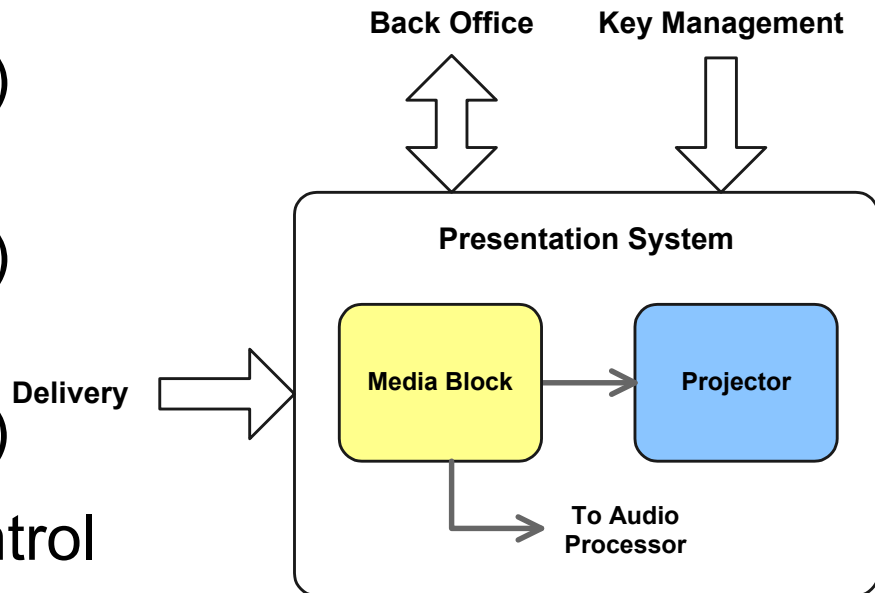
# Delivery Interoperability / Package

- Structure
  - MXF track files
  - XML Composition Playlist
- Compression
- Encryption
- Metadata



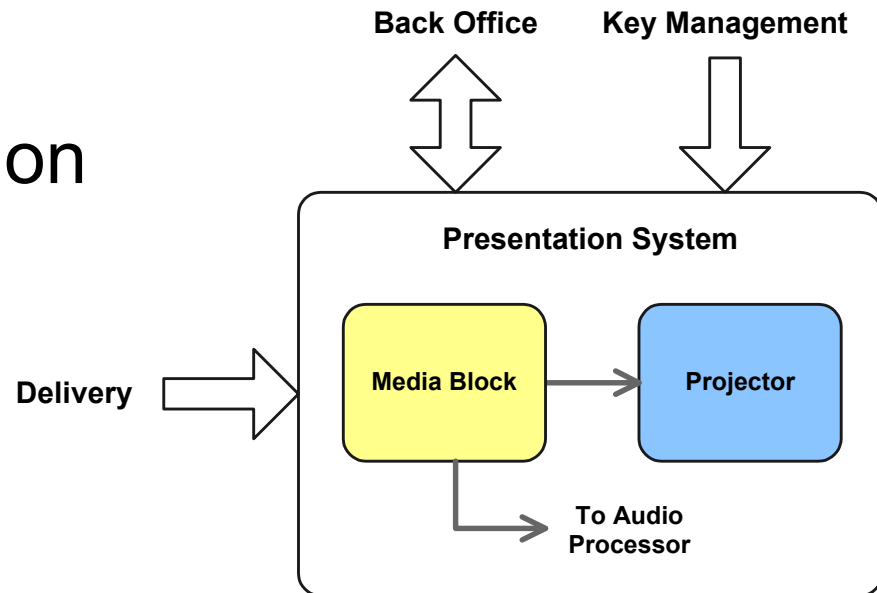
# Back Office Interoperability

- Show Playlist  
(back office → system)
- Show Schedule  
(back office → system)
- Logged Data  
(system → back office)
- System Override / Control
- Monitoring



# Key Management Interoperability

- Key Delivery
- Device Authentication



# DCDM / Image Interoperability

- Fixed containers for variable image sizes
  - Allows synchronous interfaces
- Square pixels
  - Simplifies projector image processing
- XYZ color space
  - Can be transformed to local color space

# Projector interoperability

- 2K: HD-SDI links
- Link encryption
  - TI's CineLink™
  - Sony HD-SDI LE
- 4K: To-be-defined

## In Review

- The perception of quality is dependent upon many factors, and cannot be reduced to a single factor
- Ultimately, quality is determined by the content provider
- Interoperability is complex, and much remains to be defined

# Thank you

Michael Karagosian

<http://kmpartners.org>