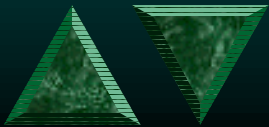




INNOVATIVE
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INC

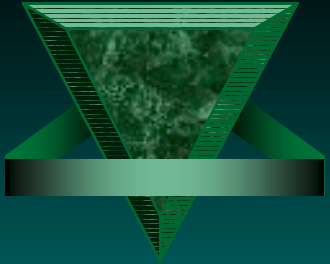
BROADCAST GROUP
A. CODY CLAXTON
DIRECTOR



08/08/2000

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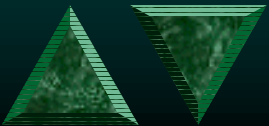
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Technology Changes

▼ Digital Television

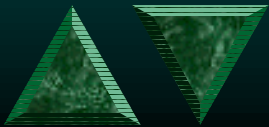
- Terrestrial, DBS, Cable, Wired Networks
- High Definition Production & Transmission
- Low Definition Production & Transmission
- Interactivity and Video/Audio on Demand
- Packet-based transmission & distribution
- IP protocol over any network





Low Definition-Webcasting

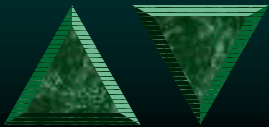
- ▼ Real Video, Microsoft Media, Others
- ▼ 80h X 50v, 320h X 200v typically
- ▼ Slower Frame Rates, Variable Frame Rates
- ▼ Interactivity, Mixed Media, Slides, Stills, Multiple Channels, etc.
- ▼ Ideal for Training Applications, News, and other Apps not requiring good imaging.
- ▼ Big Advantage: Low Cost Video/Audio On Demand





Presentation Technologies

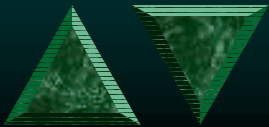
- ▼ Plasma & LCD Flatscreens
- ▼ Smaller, Brighter, lower cost projectors
- ▼ High Definition Projection
- ▼ 5.1 Channel Audio Systems
- ▼ DTS Audio Systems
- ▼ Surround Decoding (L, R, Center, Rear)

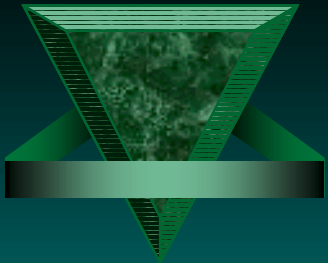




Compression

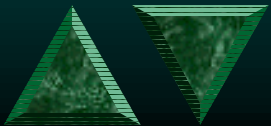
- ▼ JPEG: Original Still Image Application
- ▼ M-JPEG: Sequence of Stills
- ▼ MPEG 1/2: Full Spectrum of Toolsets
- ▼ Wavelet:
- ▼ DV: Limited Set of Compression Tools mainly for Tape-based applications
- ▼ Digital Betacam, Others
- ▼ All except wavelet use DCT Transforms





Interactive Systems

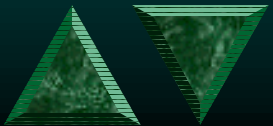
- ▼ Set Top Boxes (STB's)
 - Provide variety of services: Gaming, DVD, On Demand, Internet (Web-TV)
- ▼ Video & Internet Appliances
 - Computers used for Video, Audio & Multimedia





Convergence

- ▼ Traditional Broadcast & Production
- ▼ Computer-based Editing & 3D Rendering
- ▼ Data Networks for Distribution & Transmission
- ▼ More use of Video and Audio File Servers
 - lower cost, on-demand programs, automation

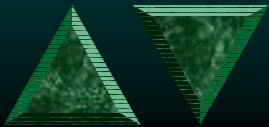


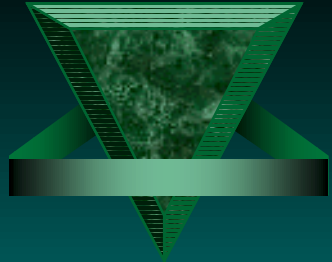


Business Changes

▼ Distributed Production Services

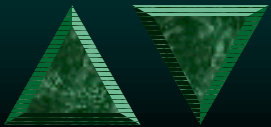
- Artists, Editors, Producers don't have to sit in the same edit suite
- Networks allow work to be done in remote locations, and pulled together at a single site.
- Take advantage of talent in remote locations
- Reduces overhead
- Distribution over many media: CD-ROM, DVD, Transmission, Real Video, etc.

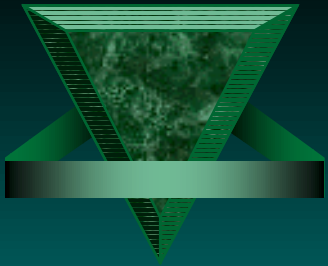




Everything is Application Dependent

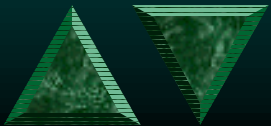
- ▼ Selection of technologies are dependent on the APPLICATION
- ▼ Training migrating from Satellite to Webcasting
- ▼ Application defines video/audio quality, distribution, level of interactivity, audience, etc.

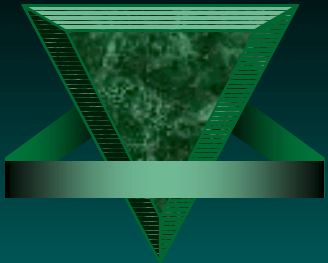




Video Systems Integration

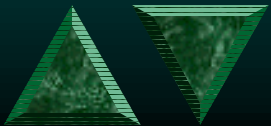
- ▼ Design and Installation Plan for Video, Audio, Control and Other Subsystems
- ▼ Conceptual Signal Flow Diagram
- ▼ Detailed Single Line Diagrams-AutoCAD
 - Audio, Video, Control & Other Layers
- ▼ Rack Elevations & Custom Furniture
- ▼ Optional 3D Drawings
- ▼ Meets Wiring Standards & Interoperability Requirements





Video Systems Integration

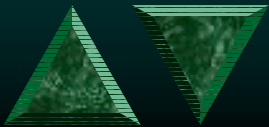
- ▼ Signal Interfacing
- ▼ Control Protocols
- ▼ File Formats
- ▼ Compression Types
- ▼ Software Interoperability
- ▼ Dynamic Process Control
 - Smoothing Procedures

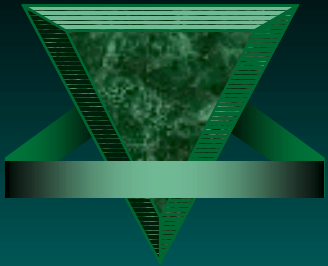




Video Systems Integration

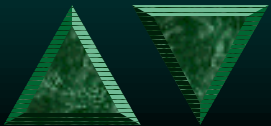
- ▼ Reliability
 - Clustering vs. Switchover to Redundant System
 - Dedicated UPS vs. System UPS
 - Technical Power
- ▼ Backup Systems and Procedures
 - Duplicating Primary Signal Paths
 - Emergency and Failover Procedures





Traditional Systems Integration

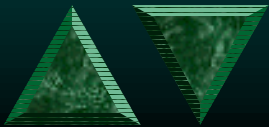
- ▼ Discrete Equipment
- ▼ Interconnected via one-way communications
- ▼ Coaxial for one-way Video
- ▼ Shielded Twisted Pair for one-way Audio
- ▼ RS-422 Bidirectional Pairs for Control
- ▼ Other proprietary connections
 - Tally Displays, Relays, etc.





Traditional Systems

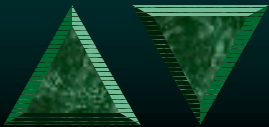
- ▼ Composite NTSC Signal-Simple
- ▼ Mono or Stereo Analog Audio
- ▼ Dedicated Automation Controllers
- ▼ Rare use of data networks or packetized data
- ▼ Heavy use of video & audio tape formats
- ▼ Little or no use of compression





Digital TV Systems

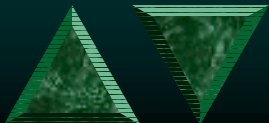
- ▼ Multifunction Equipment
- ▼ Directional and Bidirectional streams
- ▼ Coaxial for digital and analog streams
- ▼ Coaxial for digital Audio (Some XLR)
- ▼ RS-422 AND TCP/IP for Control
- ▼ Other proprietary Connections

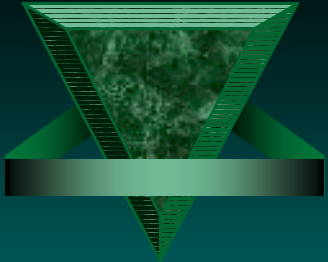




Digital TV Systems

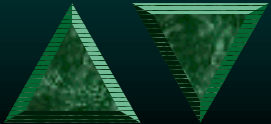
- ▼ Three Video Signals (Y,R-Y, B-Y)
- ▼ Cross conversions for legacy work
 - NTSC to/from Component
 - A/D and D/A
- ▼ 5.1 Channel Dolby Digital
- ▼ Heavy use of compression
- ▼ Heavy use of Video File Servers





Digital TV Systems

- ▼ Automation and Content Management combined
- ▼ Heavy use of data networks using IP
- ▼ Wide Area Networking
- ▼ Computer-based non-linear editing
- ▼ Video Tape moving to Acquisition and Intake



Encoder Pre-Processing

PP 1

Precision

A to D / Decode or Upconvert
(NTSC to 601, SD to HD)

PP 2

Level and Color
Adjustments

PP 3

Noise
Reduction

PP 4

MPEG Specific
Pre Processing

Encoder

1

Extract VBI Data
Discard Non Active Lines

2

3:2 Pull Down Detection
Discard Redundant Images

3

Chroma Sub Sampling

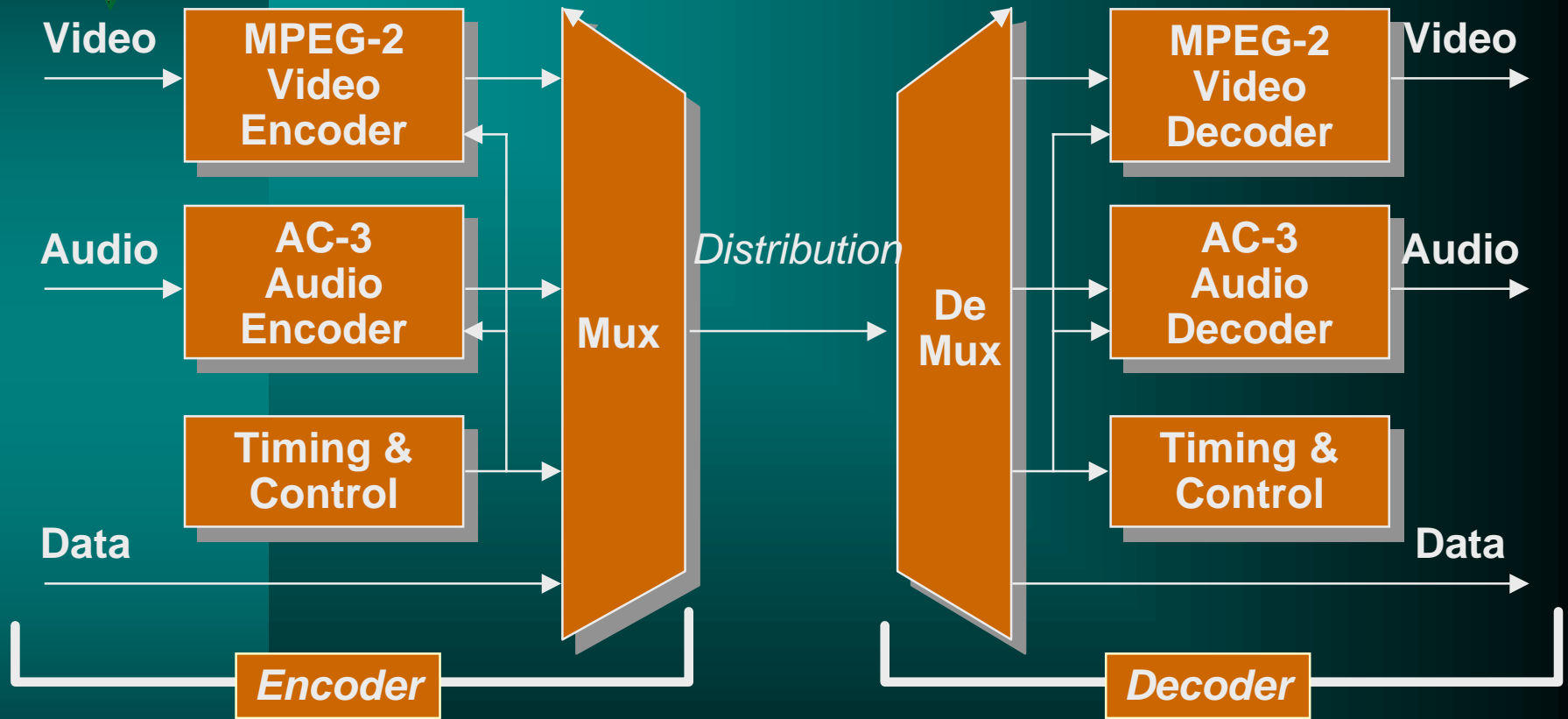
4

Intra Frame Coding

5

Inter Frame Coding

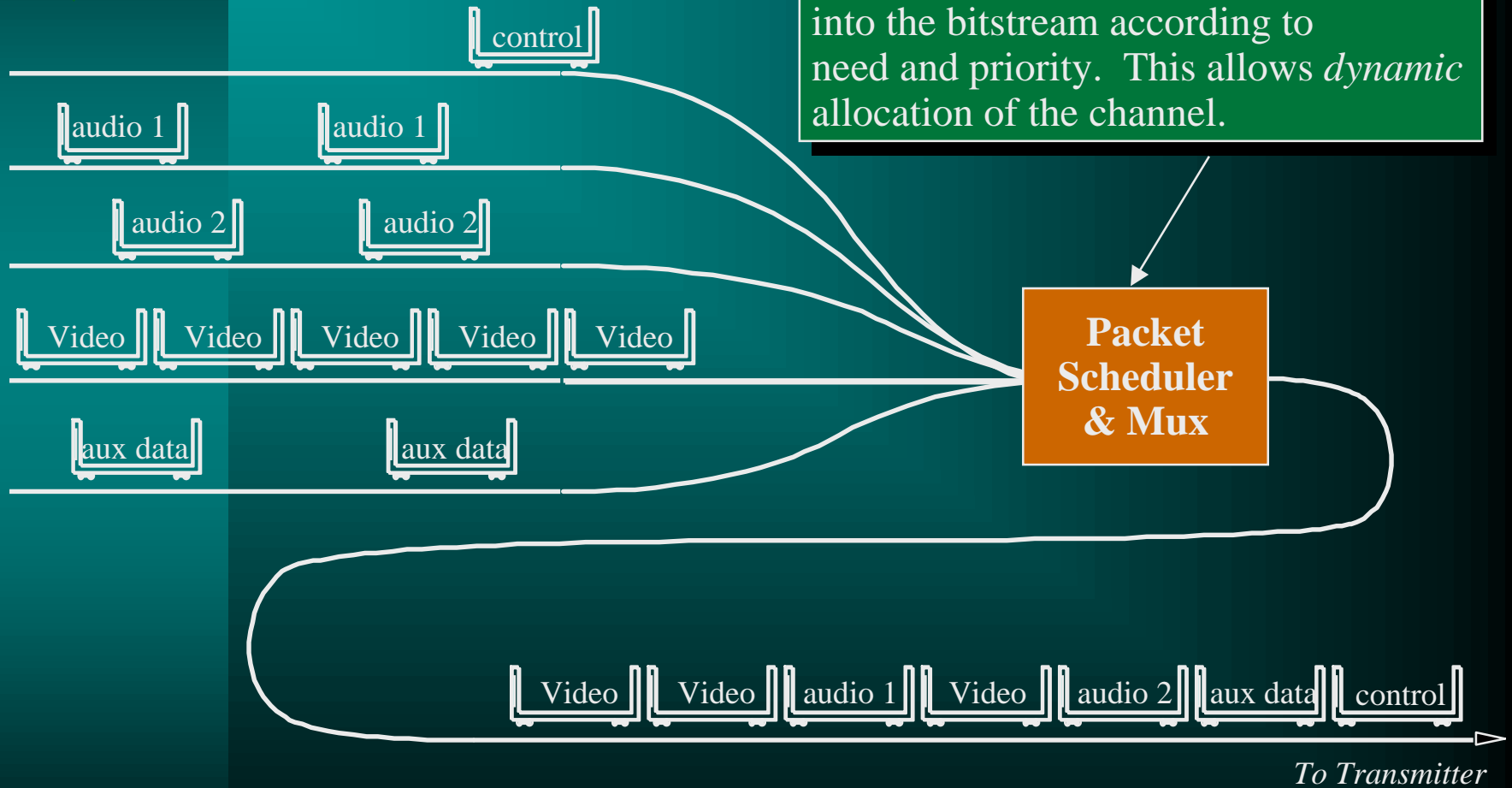
ATSC Transport



ATSC Transport is based on the MPEG-2 Systems Spec (ISO/IEC 13818-1), which covers Muxing, Timing and Control

Packet Multiplexing

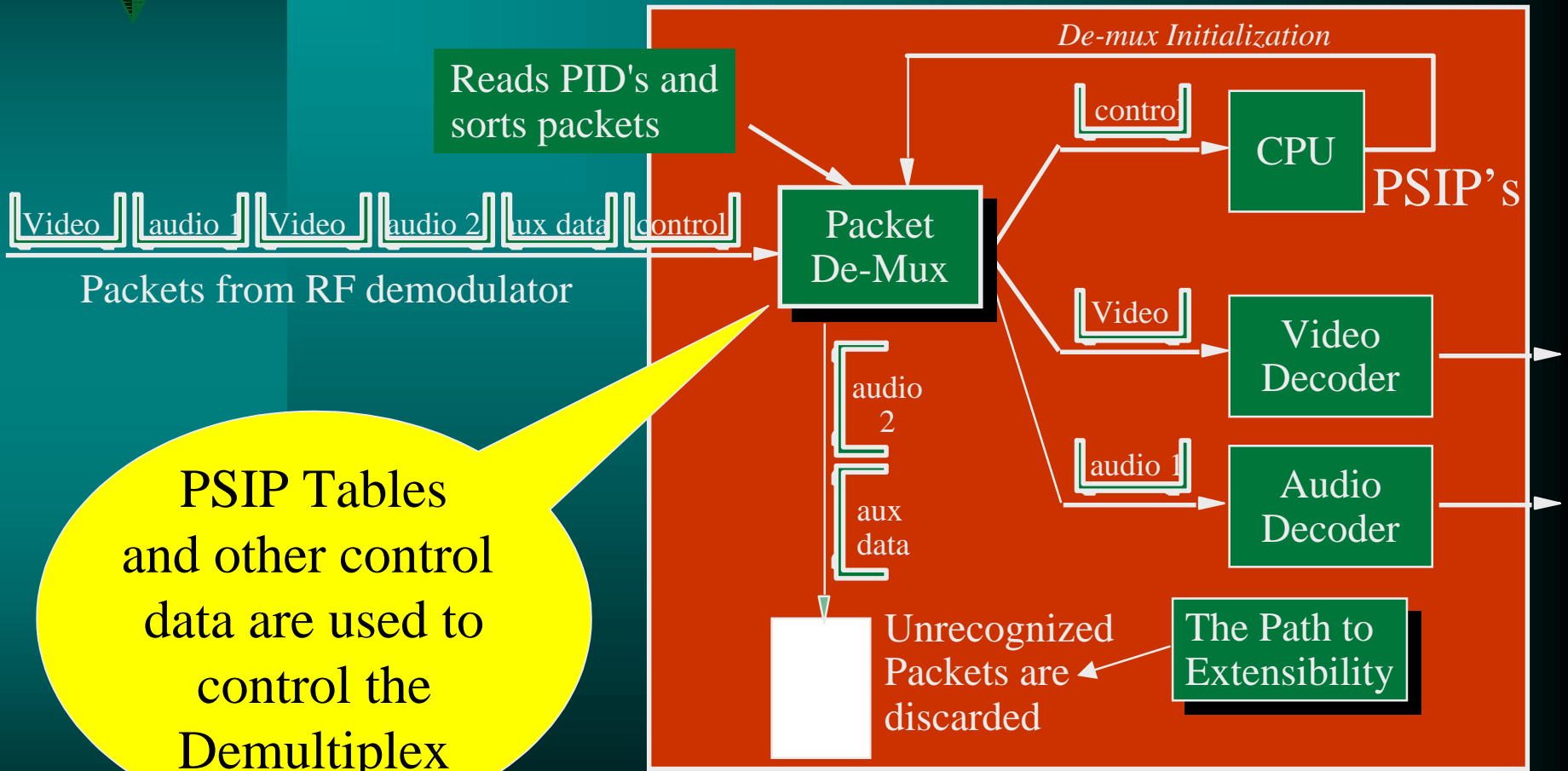
...like a freight car switch yard...



Courtesy of Sarnoff Laboratories, 1999

Packet Demultiplexing

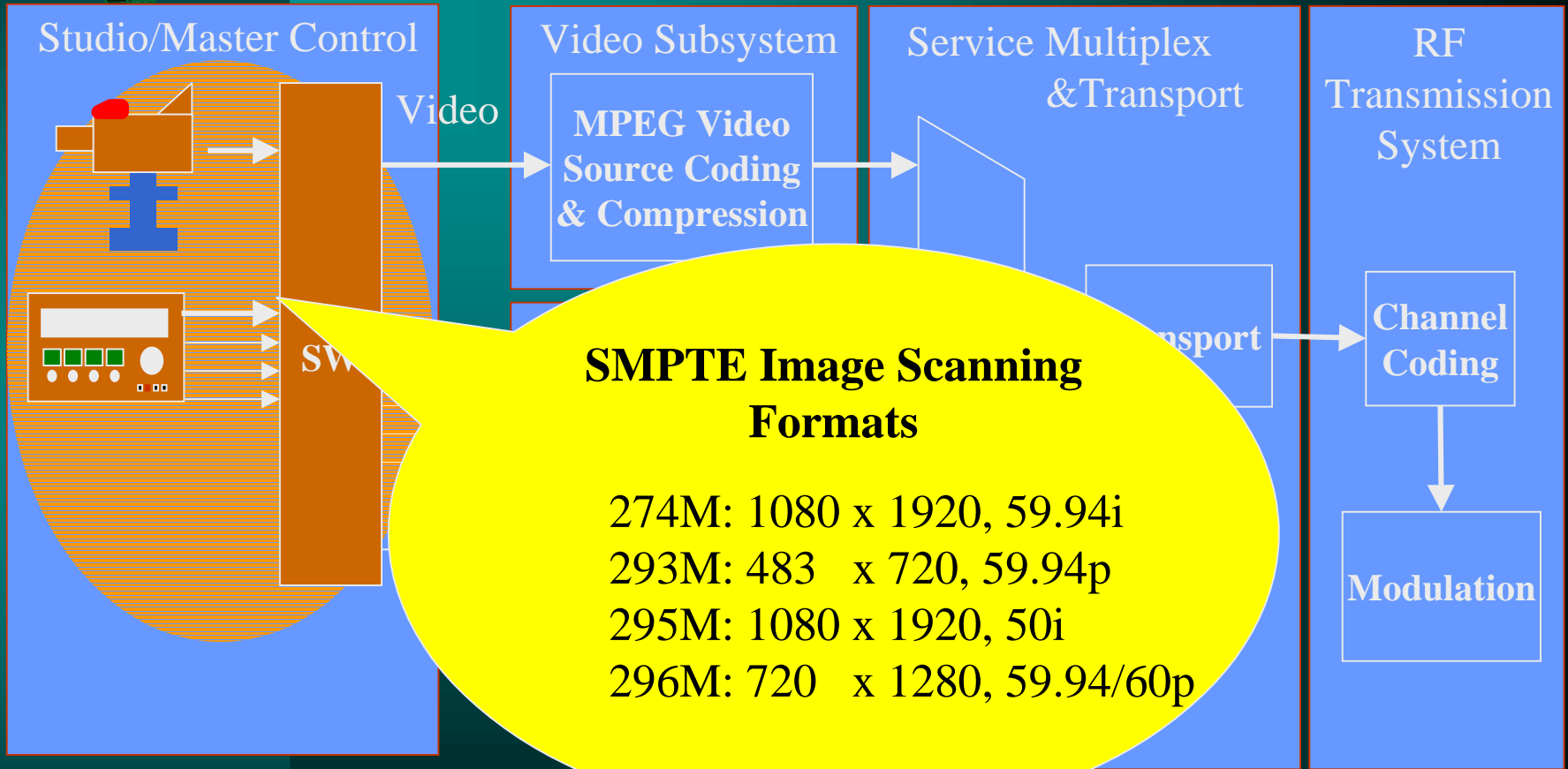
...unrecognized packets are discarded...



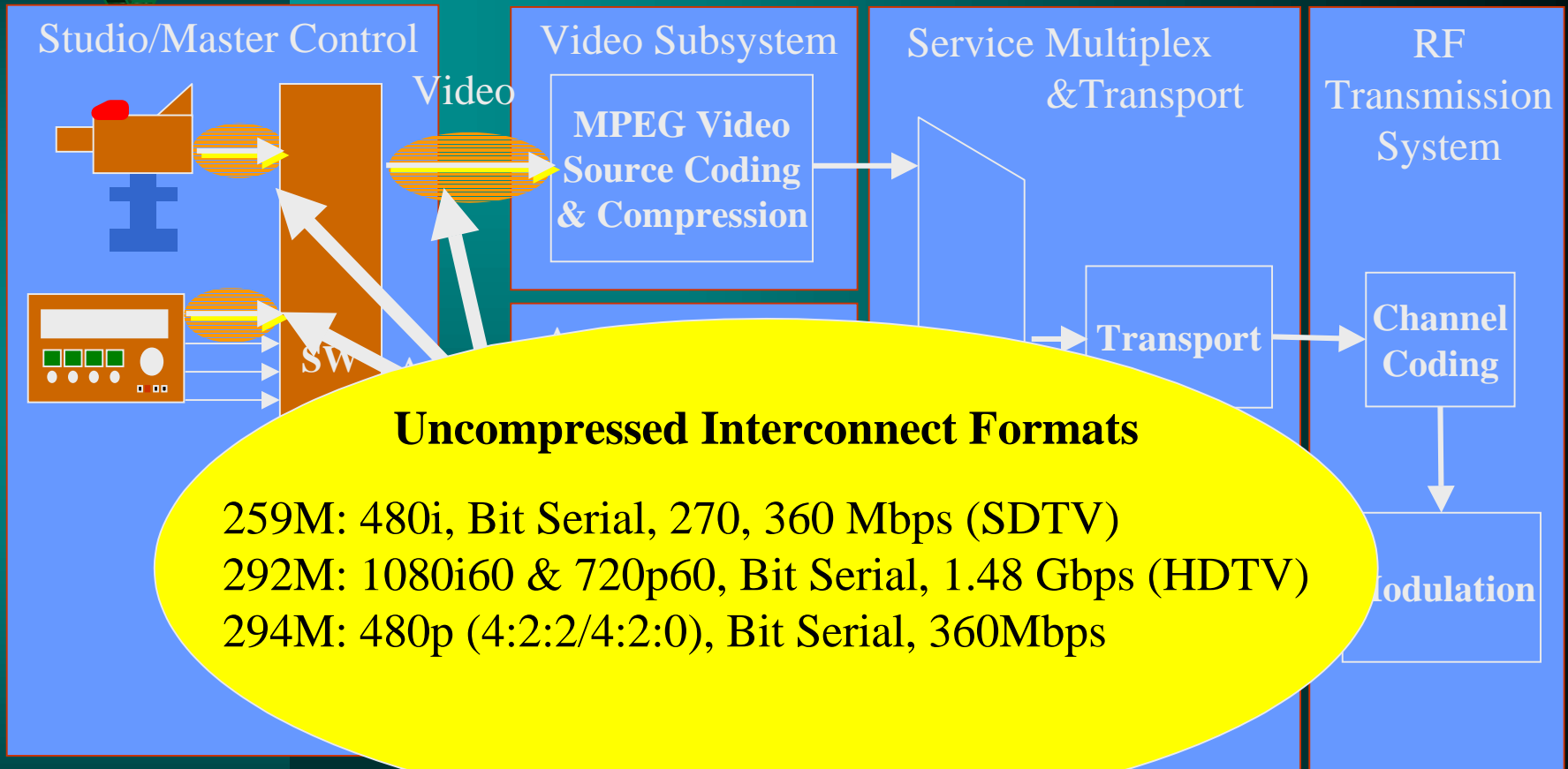
Digital Broadcast Receiver

Courtesy of Sarnoff Laboratories, 1999

SMPTE Image Scanning Formats



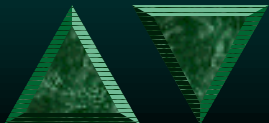
Uncompressed Video Interconnect



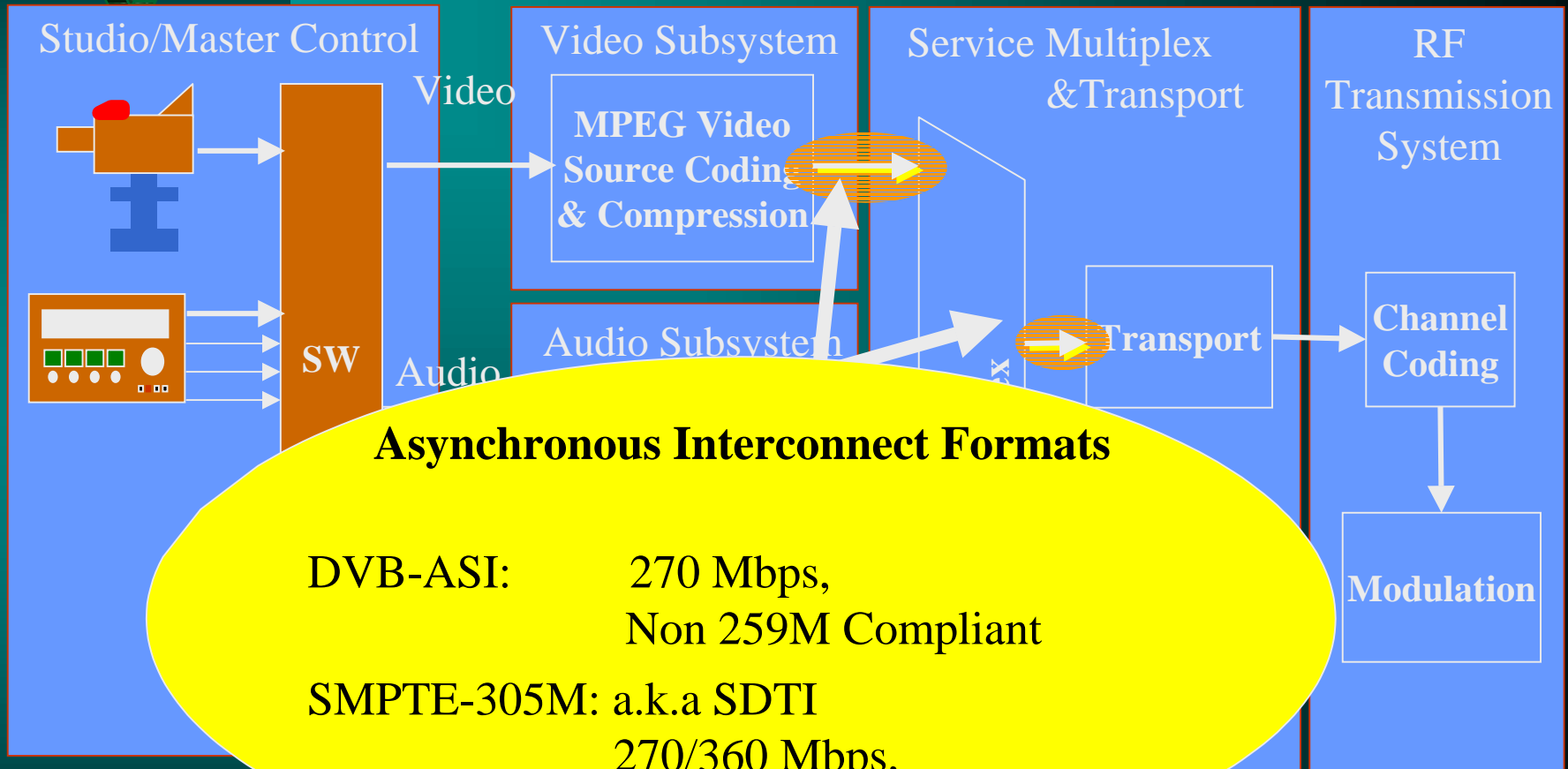


SMPTE 292: HD SDI

- ▼ 1.485 Gbps Data Rate
- ▼ Currently 1080i & 720p Digital Grade Coaxial Cable
 - Expected to be 100 Meters
- ▼ Single and Multimode Fiber option



Compressed Video Interconnects

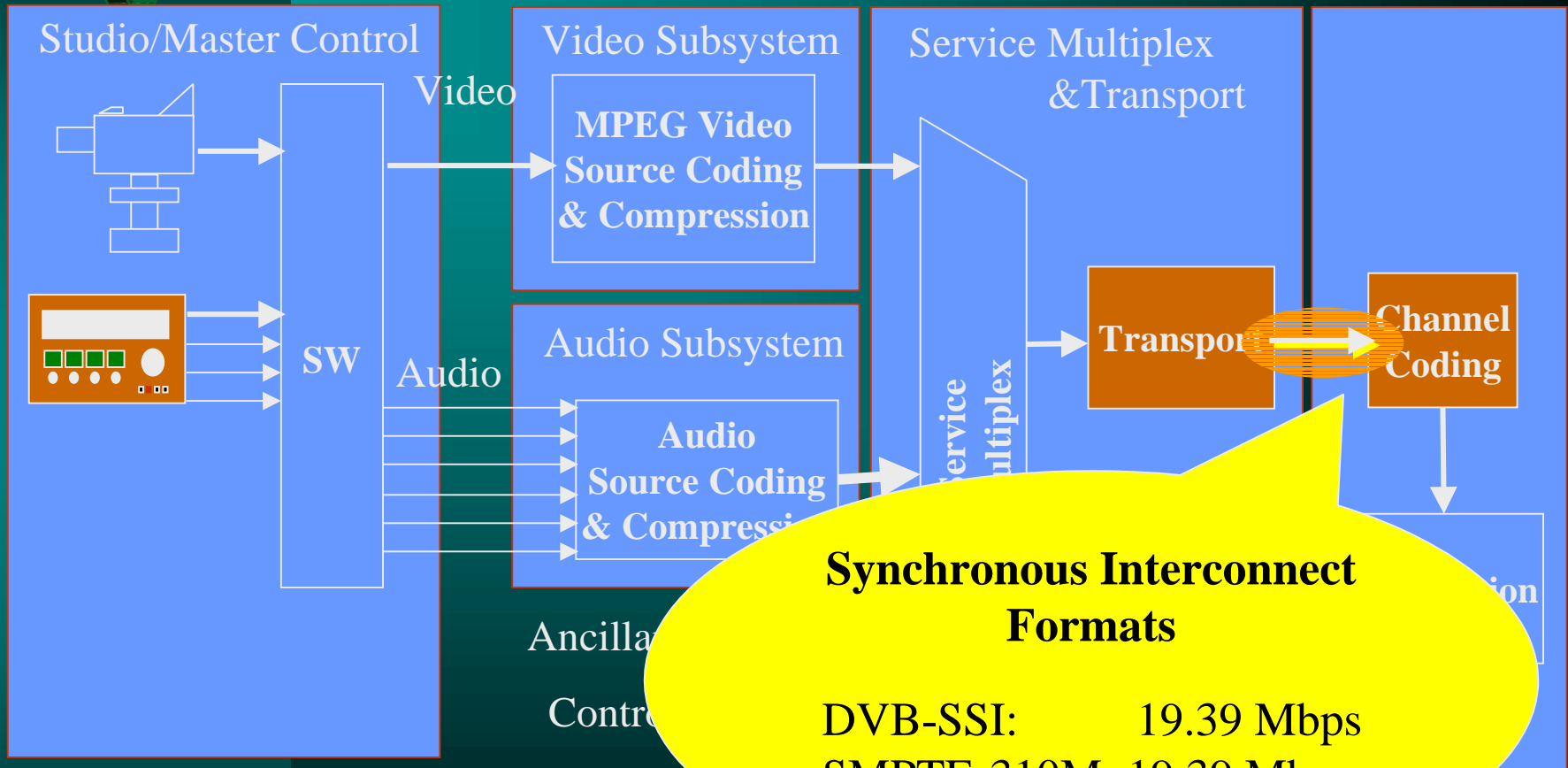


Asynchronous Interconnect Formats

DVB-ASI: 270 Mbps,
Non 259M Compliant

SMPTE-305M: a.k.a SDTI
270/360 Mbps,
259M Compliant

Compressed Video Interconnects (cont.)



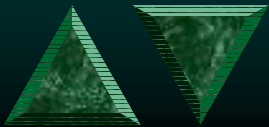
Synchronous Interconnect Formats

DVB-SSI: 19.39 Mbps
SMPTE-310M: 19.39 Mbps



What Is ASI ?

- ▼ Asynchronous Serial Interface
- ▼ Popular interface in DVB implementations
- ▼ Carries MPEG2 transport packets directly at 270 Mbps
- ▼ If compressed payload is less than 270 Mbps, we simply insert null packets





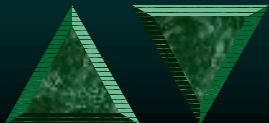
What Is SDTI ?

- ▼ Asynchronous Serial Interface
- ▼ Allows SMPTE-259M SDI (270/360 Mbps) to carry MPEG-2 transport packets
- ▼ Allows compressed video streams to be routed and distributed using SDI equipment
- ▼ Similar to DVB-ASI but more compliant with SMPTE-259M (SDI)
- ▼ Now standardized as SMPTE-305M

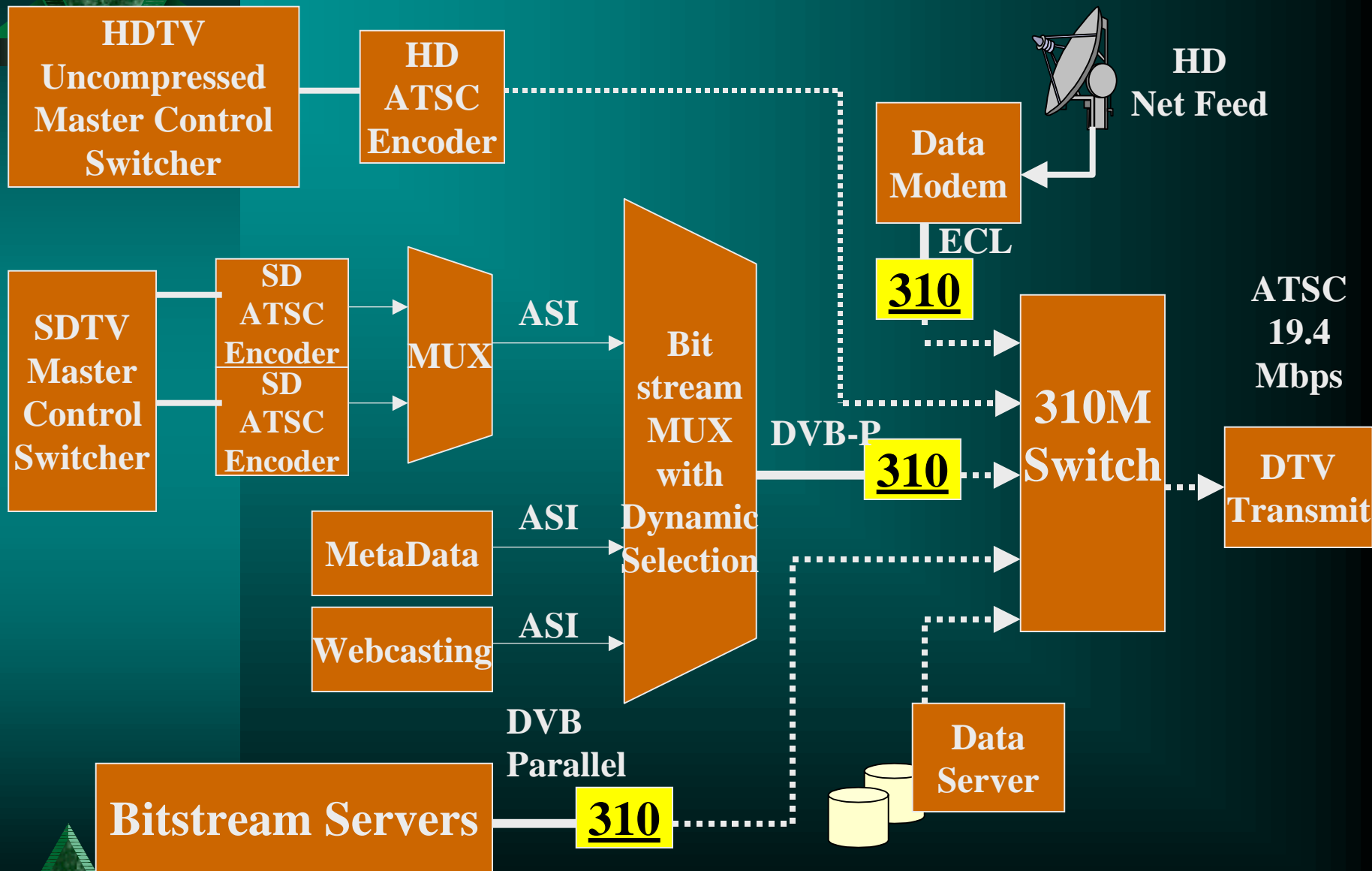


DVB SSI and SMPTE 310M

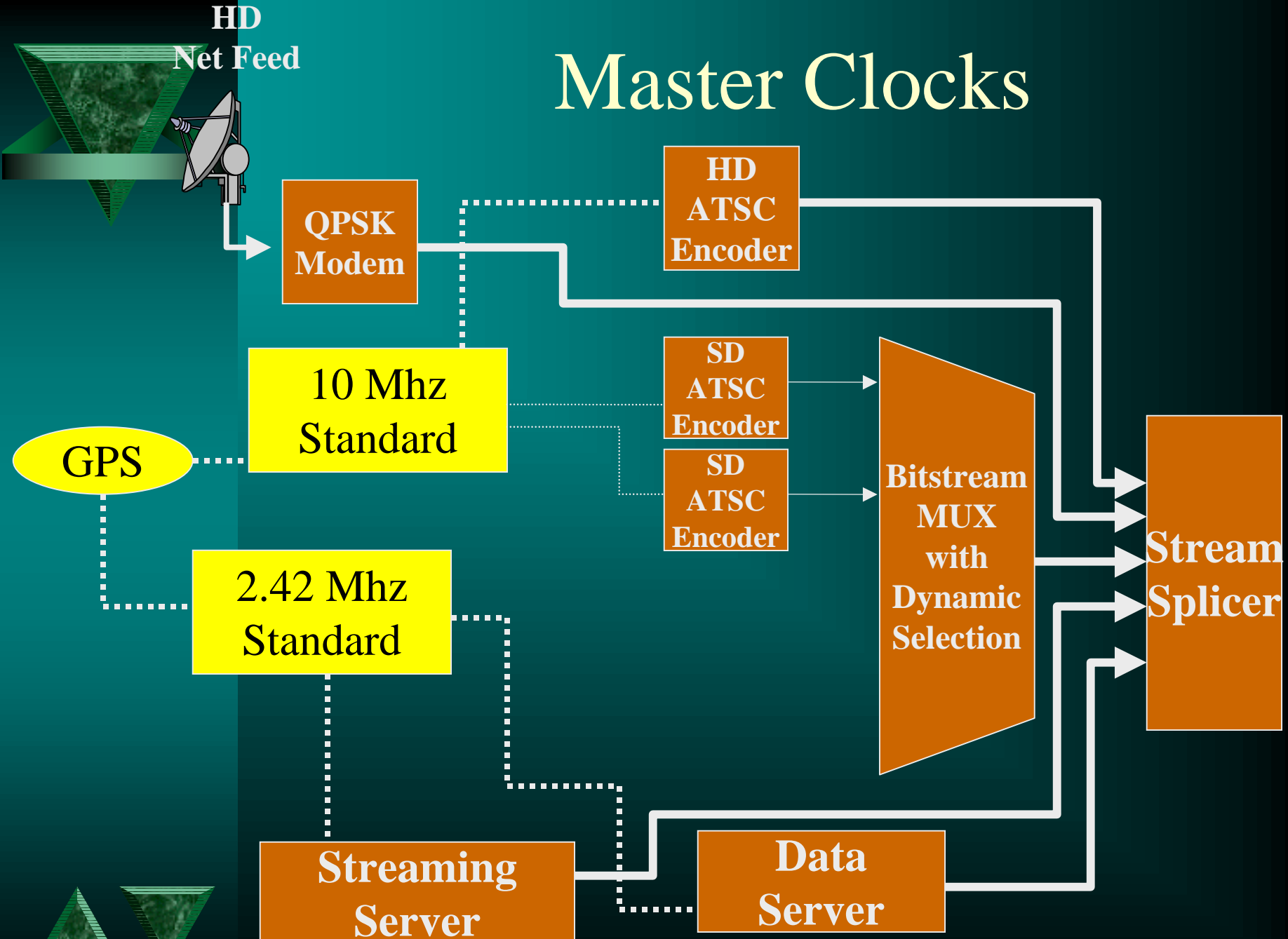
- ▼ Synchronous Serial Interfaces
- ▼ The destination device is slaved to the source device
- ▼ Clock rate of transport equals clock rate of payload



Bitstreams



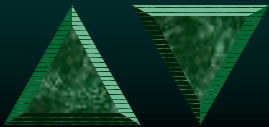
Master Clocks

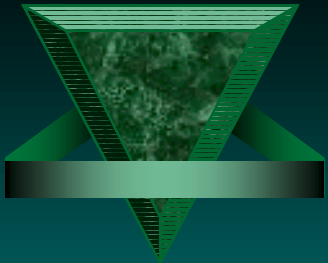




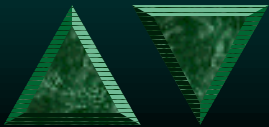
Broadcast Services

- Digital Television transition plans for SDTV and HDTV
- Technical Facilities Design, Engineering & Integration
- Consolidation or Centralizing of TV Station Operations
- Implementing Automation or Video & Audio Server Additions
- Resource Scheduling, Content Management
- Software Customization, Database Bridging & Design
- Studio Lighting and Technical Facilities
- Paint and Graphics Systems
- Non-Linear, Linear & DV-Native Edit Systems





US F&W Studio



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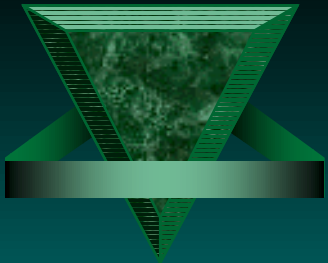
US Fish & Wildlife Dub Area



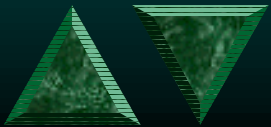
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National Park Service Racks



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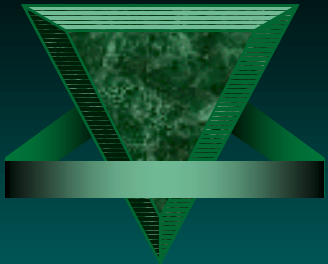
IBB Radio Console



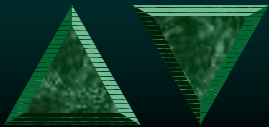
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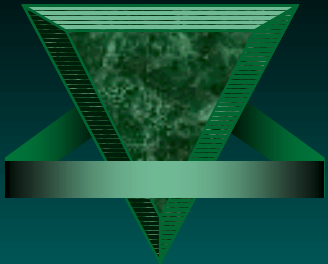
SSA Avid Console Loaded



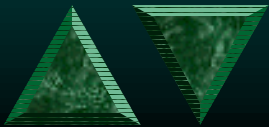
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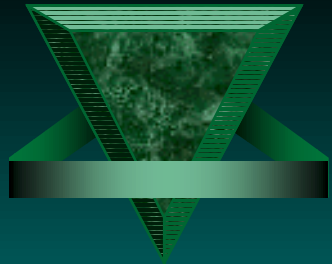
Custom Interconnect Panels



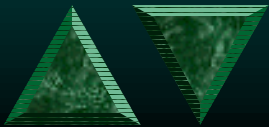
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National Park Service Projection Room



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DTV Issues

- ▼ Content Management
 - Media, WAN Media, Low Res Browsing
- ▼ Automation and Control of Encoders, Multiplexers and Bitstream Splicers
- ▼ Statistical Multiplexing of Video Streams
- ▼ QOS Data Hierchies
- ▼ Process Control, Quality Control Procedures
- ▼ Resource Scheduling