Desktop Digital Video: DV to DVD

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Overview: DV to DVD

Digital Video Now Accessible

- **Analog to Digital: Tape to DVD**
- **DVD Conversion**
  - Conversion Services, Set-Top DVD Recorders
- **Desktop Video Processing**
  - Digital Video – on the Desktop
- **Import: Capturing Video**
  - Analog, DV / FireWire
- **Video Data Rates and Formats**
  - DV and MPEG-2 / HD & HDV
- **Process: Video Tools**
  - Video Editing and DVD Authoring
- **Export: Saving and Sharing Video**
  - DV, Analog, File formats, Web, DVD

1

What's All this About Digital?
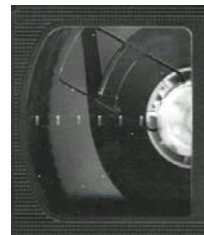
Analog to Digital: Tape vs. DVD

- **Higher Quality**
  - Video resolution, sharpness, colors
  - Surround sound, multiple channels
- **Robust**
  - Analog tapes wear out, degrade
  - Exact copies of digital data
  - Tape lasts 10 - 30 years, more delicate
  - Optical media lasts 25 - 100 years
- **Accessible**
  - DV and DVD span set-top to computer
  - DVDs provide direct access

The Problem With Tapes

Degradation, Accessibility

- **Transient Analog Recording**
  - Analog signal on consumer magnetic tape
  - Copies have lower quality
  - Wear and tear from playing
  - Degrades, Lifetime 10 – 30 years
  - Should store on end, Shuttle yearly
  - Protect from temperature and humidity
- **Difficult to Access**
  - Need VCR and TV to play
  - Can't preview contents
  - Manually shuttle and rewind to find clips

National Media Laboratory
www.clir.org/pubs/reports/pub54

The DVD Alternative

Exact Copies, Direct Access

- **Permanent Digital Data**
  - Optical media lasts 25 – 100 years
  - Can make exact digital copies
  - DVD and MPEG are long-term standards
    - CE & computer, consumer & professional
  - Higher quality video and sound
- **Highly Accessible**
  - Play on set-top or computer
  - Menus with thumbnails
  - Jump directly to clip
  - Skip rapidly between chapters
  - Reuse: Edit on set-top or computer

But Will It Play Tomorrow?

DV and DVD are Long-Term Digital Formats

- **DV Bridges Consumer to Professional**
  - DV-25 to DV-50, DVCAM, DVCPRO
  - Well supported by systems and applications

- **DVD is the Fastest Selling Consumer Electronics Product of All Time**
  - DVD sales surpassed VCRs in Sept. 2001
  - DVD players in half of U.S. homes by end 2003
  - DVD & VHS outsold movies 2X in 2002
  - MPEG used in broadcast, satellite
  - Family of products: Players and recorders
  - Interchange consumer to computer, Set-top to desktop

Getting From Tape to DVD

- **DVD Conversion Services**
  - Special events: Professional look
  - Make copy before shipping
  - Some local services
- **Set-Top DVD Recorders**
  - Bulk conversions / copy large library
  - DVR for off-air television
  - Limited editing, personalization
- **Desktop DVD Authoring**
  - Part of a digital video system
  - Design your own DVDs
  - Meaningful menus, chapters, titles
  - Turn-key to fully custom

DVD Conversion Services

Automated Conversion

- **Mail in tape, return DVD**
  - YesVideo and HomeMovie
  - Professional and event videos
- **Automated**
  - Chapters, Thumbnails
- **Customized**
  - Edit and Layout on Web
- **Additional Services**
  - CD video, Images, Case
- **Consumer formats: VHS, VHS-C, 8mm, Hi-8**
  - Some professional (YesVideo)
  - Super8 or 16mm film (HomeMovie)

YesVideo

- **Automated conversion**
  - www.YesVideo.com

- **Offered through partners**
  - Retail Kodak and Konica photo-finishing services: Walgreens, Rite-Aid, CVS, Eckert, Target, K-Mart
  - Sony ImageStation

- **Products**
  - YesDVD: Automated transfer, $35 - 40
  - YesCD: MPEG video files, $30
  - YesPix: Still images, $10 addl.

HomeMovie.com

- **More customized options**
  - www.HomeMovie.com
- **Direct over the Web**
  - Consumers & prof. videographers
- **Basic Products**
  - Basic DVD: Straight transfer, $49
  - Enhanced DVD: Chapter points and titles, $99
- **Customized Products**
  - Design and edit over the Web
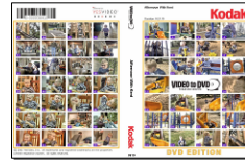 - Director's DVD: $99
  - Snapshots: Photo gallery, $20 addl.

Conversion Services Summary

Least Effort, Least Control

- **Summary**
  - Good for special events, multiple copies
  - Professional look: Cases, labels
  - Pay as you go: $35 and up
  - Minimum hassle
- **Features**
  - Higher quality: Professional video equipment
  - Additions: PC files, Still images, music video
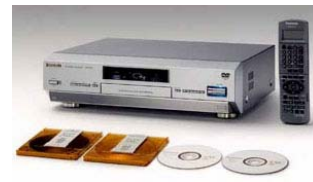 - Some customization: Web interface
- **Issues**
  - One tape at a time
  - Entire tape contents, fixed length
  - Must mail tape to factory

Set-Top DVD Recorders

Next-Generation VCR, Plus Conversion

- **Digital Video Recorder**
  - Record off-air TV, like VCR
  - Analog input: VCR, camcorder
  - FireWire input: DV digital
  - Local hard disk
- **Multiple Formats**
  - R – Read-only
    - Permanent, more compatible
  - RW / RAM – ReWritable
    - Temporary, re-use in recorder
    - Edit menus and clips

6

DVD Recorders - Features

Permanent Record vs. Reuse

- **Recordable Discs**
  - Record multiple segments
  - Organize clips into menus
  - Enter title text
  - Finalize

- **ReWritable Discs**
  - Edit: Append, divide clips
  - Add chapter points
  - Rearrange, delete
  - Create playlist

Set-Top DVD Recorders Summary

One-Click, or More Control

- **Summary**
  - Fixed investment: Under $400
  - It's also a digital VCR …
  - Good for straight copies of library of tapes
  - Black box operation: Load and record
- **Features**
  - Some flexibility in recording time vs. quality
  - Edit on rewritable, finalize to write-once
- **Issues**
  - Limited customization
  - Clumsy interface with remote control
  - Reduced features with DVD-R
  - Editing, but reduced compatibility, with RW/RAM

7

Desktop DVD Authoring

Full Control, More Effort

- **Summary**
  - Best for computer video enthusiasts
  - Most flexibility and personalization
  - Prices dropping: Burner $150, Software $50-100
- **Features**
  - Good for automated transfers, like DVD recorder
  - Upgrade to customized: Navigation & graphic design
  - Integrate with video editing
- **Issues**
  - Not as turn-key as recorder product
  - Requires higher-end system, dedicated time
  - Transfer to DV first: Archive, easier transfer
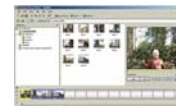
Desktop Digital Video

- **Digital Video – on the Desktop**
  - Full-quality video, No compromises
  - Inexpensive: DV / FireWire, Burners
  - Convenient software tools
- **Import**
  - Analog, DV / FireWire
- **Process**
  - Video Editing, DVD Authoring
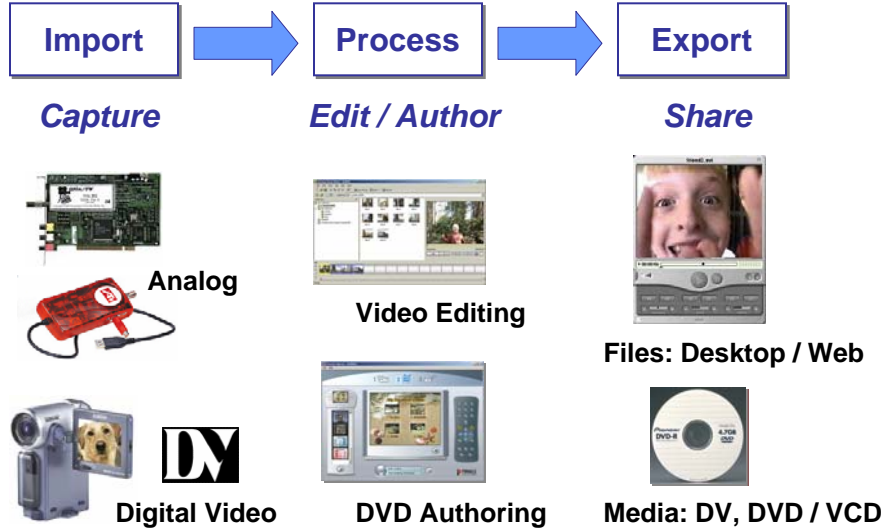 - Consumer to Professional
- **Export**
  - DV, Analog, PC Files, Streaming, DVD

8

Desktop Video Processing

Import → Process → Export

Capture   *Edit / Author*   *Share*

Analog

Video Editing

Files: Desktop / Web

Digital Video   DVD Authoring   Media: DV, DVD / VCD

Import: Capturing Video

- **Analog Capture**
  – PCI boards
  – Laptops
  – USB TV tuners

- **Digital Capture**
  – Digital camcorders
  – FireWire / DV

- **Media Files**
  – Video, audio, stills

Import - Analog Video Capture

Use External USB Devices for Quick Capture

- **Video Capture / TV Tuner Cards**
  - Full resolution, even remote control
  - ATI All-In Wonder, TV Wonder
  - Device-specific interface
- **Laptops**
  - USB, PCMCIA
- **USB Video Capture**
  - Lower resolution / data rate – USB-2
  - For presentations, Web, TV in window
  - ADS, Pinnacle, $200 - MPEG-2

- **Analog via DV**

Import - Digital Camcorders

Digital Camcorders Replacing Analog

**VHS
8mm
Analog**

**Sony
Micro MV**

Mini DV

Sony Digital 8

10

Import - DV / FireWire

Step Up to DV / FireWire

- **DV Camcorders**
  - Technically Mini-DV, DV-25
  - Full-quality video: professionals use DV-50
  - Record compressed digital video
  - No analog capture, don't crack the case
- **FireWire Interface**
  - Apple FireWire, IEEE 1394, Sony i.Link (USB 2.0)
  - Fast interface: Plug and play
  - Not capture: Digital transfer, exact copies
  - Camera control: Time code, stripe tape
  - Also peripherals: External hard disk, DVD burners

DV Tape Formats

DV Spans Consumer to Professional

- **Consumer Standard**
  - Compression for tape - single fixed data rate, symmetric
  - High Quality: 500 lines (S-Video & Hi-8 425, VHS & 8mm 300)
  - 25 Mbps video rate (DV-25)
  - 4.5 min. = 1 GB disk space
- **DV (Mini-DV)**
  - 1 hour, 1/4" tape
  - Half the size (and thinner) than 8mm
- **Sony Digital 8**
  - Compatible with 8mm, 2X speed
- **Professional**
  - Sony DVCAM, Panasonic DVCPRO (DV-50)

11

Video Data Rates

Images Keep Coming at 30 Frames per Second

- **Full Rate Video is Too Much**
  - 720 x 480 x 3   240 Mbps   (2 GB/min, 100+ GB/hour)

- **Need Video Compression**
  - DV   25 Mbps   (10x: 187 MB/min, 11 GB/hour)
  - MPEG   ~6 Mbps   (+3x: 45 MB/min, 2.6 GB/hour)

- **PC Interfaces Can Handle**
  - USB 1.x   12 Mbps   Keyboard, mouse, scanner
  - FireWire   to 400 Mbps   Camcorders, disk drives (800)
  - USB 2   480 Mbps   Now arriving

Digital Video Formats

Trade off Space vs. Editability

- **DV – Tape – Editing Format**
  - Light compression
    - Fixed data rate: 25 Mbs
    - Intra-frame: Each frame separately
  - Strong software support
  - Good for extensive editing
- **MPEG-2 – Delivery Format – DVD**
  - Heavier compression
    - Variable rate: 9 - 6 - 3 Mbps
    - Inter-frame: Similarities to adjacent frames
  - Limited software support
  - Limited for editing: Assemble clips, trim
  - Good for direct to DVD

12

High-Def is Here

HDTV for Consumer Electronics

- **Consumer Electronics Association (CEA)**
  - More than 1.35M LCD units 2004
  - Cumulative DTV sales 14.3M units, $23B
    - Integrated sets and monitors at least 480p
      ATSC terrestrial digital broadcasts
  - DTV unit sales forecast
    - '04 - '08 – **6.97M - 10.77M - 16.77M - 23.25M - 27.05M**

- **Mass Merchandisers: Best Buy, Wal-Mart**
- **PC to CE: Dell, Gateway, Hewlett-Packard**

Shoot HD – HDV Format

HDV – Affordable HD on MiniDV Tape

- **HDV Format – Sony & JVC**
  - www.hdv-info.org

- **Video: MPEG-2 (MP@H-14), 16:9, NTSC / PAL**
  - **720p** (**1280 x 720**) – **19 Mbps**
    - 60p, 30p, 50p, 25p
  - **1080i** (**1440 x 1080**) – **25 Mbps**
    - [vs **1920** display, DVCPRO HD 1280]
    - 60i, 50i
- **Audio: MPEG1 Layer II**
  - 48 kHz, 16-bit – Stereo at 384 kbps
- **Transport**
  - MPEG-2-TS (Transport Stream) over FireWire

13

Shoot HD – HDV Cameras

Affordable HD Acquisition

- **JVC – JY-HD10U – $2900 – 6/03**
  – Single-chip
  – DV, SD progressive, HDV (720/30p)

JVC JY-HD10U

- **Sony – HVR-Z1U Pro – $4900 – 11/04**
  – 3-chip – DV, DVCAM, HDV 1080
  – SD or HD; 60i or 50i; 30, 25, 24 fps
  – "Cinema like" (25F/30F/24F)
- **Sony – HVR-M10U HDV VCR – $3,700**

Sony HVR-Z1U

- **Sony - HDR-FX1 Handycam camcorder - $3700**
  – HDV 1080i

Edit HD – On the Desktop

Affordable HD Editing

- **Software with Native Editing**
  – Hardware Capture / Acceleration
- **Native MPEG-2**
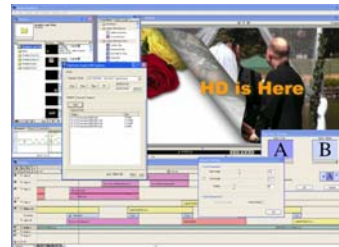 – HDV – 19, 25 Mbps
  – Pinnacle Liquid Edition
- **Native DVCPRO HD**
  – Panasonic Varicam – 100 Mbps
  – Final Cut Pro HD, Avid Xpress Pro HD
- **Intermediate Format**
  – Trancode – Lightly compressed
  – CineForm Aspect HD – 100 Mbps
  – Adobe Premiere Pro, Sony Vegas
- **Uncompressed …**

14

Deliver HD – Where's the Format?

Need Ubiquitous HD Delivery Format
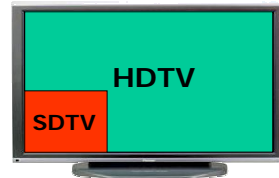
D VHS   D THEATER

- **HD Tape?**
  - D-VHS recorders for SD and HD digital TV broadcasts
  - Prerecorded D-Theater HD movies
- **HD Disc? Coming soon …**
  - (WMV HD on PC)

1920 x 1080 x 30 = <u>62 million</u> pixels/second →

720 x 480 x 30 = <u>10 million</u> pixels/second →

HDTV

SDTV

- **Need 6 X improvement for "HD"**
  - High-Density   – More physical bits   – Storage capacity
  - High-Definition – Better compression – Data rate

Process: Video Tools

"Editing" vs. "Authoring"

- **Video Editing**
  - Import / capture - Analog, DV, files
    - Scene detection - DV
  - Organize - Layout
    - Clips - storyboard; Tracks - timeline
  - Effects - Transitions, overlays, filters
  - Export - DV, files, DVD
- **DVD Authoring**
  - Import - Clips, photos
  - Menu design - Buttons, background, titles, motion
  - Navigation design -
  - Transcode & build - DVD, VCD, folder, DLT

Process – Consumer Tools

Simplified: Templates, automated, ~ $50 - $100

- **Consumer Video Editing**
  - Clips, tracks, automated; $50 - $150
  - Apple iMovie, Microsoft Windows Movie Maker
  - Adobe Premiere Elements
  - Sony Vegas Movie Studio, Pinnacle Studio
  - Roxio VideoWave , Ulead VideoStudio
- **Consumer DVD Authoring**
  - Automated layout, Template designs, $50 - $100
  - Apple iDVD, Sonic MyDVD, Ulead DVD MovieFactory
- **Streaming Format Tools**
  - Apple QuickTime Player Pro (free, Pro $30)
  - Microsoft Windows Media Encoder (free)
  - RealNetworks Helix Producer (Basic free, Plus $200)

Process – Professional Tools

Control and Customization

- **Professional Video Editing**
  - Projects: Compositing, motion, effects
  - $300 - $1700
  - Apple Final Cut Pro, Adobe Premiere Pro, Sony Vegas
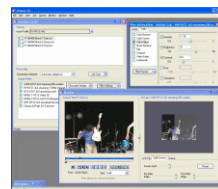 - Avid Xpress, Pinnacle Edition, Ulead MediaStudio Pro
- **Professional DVD Authoring**
  - Multiple audio, subtitles, custom design, navigation
  - Apple DVD Studio Pro, Adobe Encore DVD
  - Sonic DVDit!, ReelDVD, DVD Producer
  - Ulead DVD Workshop / $350 - $1000
- **Automated Video Processing**
  - Automated, batch, $500 - $700
  - Discreet Cleaner, Canopus ProCoder
  - Sorenson Squeeze

16

Export: Saving and Sharing Video

- **DV Tape**
  - Export to tape, Analog video
- **Analog Video**
  - Print to video
- **Computer Video Files**
  - Desktop, CD
- **Web Streaming Video**
  - Reduce for streaming, download
- **Handheld / PDA Download**
  - Shrink for PDAs, phones
- **DVD / CD Media**
  - DVD Authoring tools

Export - DV Tape

Transfer DV File to Tape

- **Output to Camcorder via FireWire**
  - Just copy data over same cable
  - Record back to DV tape
  - Archive at full DV quality
  - (187 MB/min, 11 GB/hour)

- **Pass-Through to Analog**
  - Monitor on TV, Record on VCR
  - Some digital camcorders
  - Break-out box

17

Export - Analog Video

Video Output to VCR / Camcorder

- **Display to Video**
  - Play video full-screen ("print to video")
  - VGA Display to video (lower screen resolution)
  - Display converter (built in to laptops, some video cards)
- **Capture Cards**
  - A-D input, editing acceleration, video out
  - Break-out box

- **DV to Analog**
  - Record on DV camcorder, play to VCR
  - Some DV cams have live DV to analog pass-through

Export - PC Video Formats

- **Consumer Electronics Digital Video**
  - "Full-quality" video for display on consumer televisions
  - DV, DVD-Video / MPEG-2
  - 720 x 480 video, 30 fps, Stereo / surround audio
- **Desktop Video**
  - Presentation video for PC playback or CD-ROM productions
  - Microsoft AVI, Apple QuickTime, MPEG-1, MPEG-2
  - Typically 640 x 480 -> 320 x 240, 30 / 24 / 15 fps
- **Web Streaming Video**
  - Bandwidth reduces resolution, frame rate, quality
  - Dial-up to Broadband; Handheld to High Definition
  - QuickTime, Win Media, RealNetworks, MPEG-4, Kinoma
  - Typically 320 x 240 -> 160 x 120, 15 / 10 / 5 fps

Export - Desktop Video Formats

Save and Share Video Files

- **Format and Compression**
- **Presentations**
  - DV, DVD
  - Embed in PowerPoint
- **Share**
  - Files: Network, E-mail
  - Physical: CD / DVD, DV tape
  - Web Streaming, Handheld / PDA
- **Save: Export to Files**
  - Desktop: AVI, QuickTime
  - Consumer: DV, MPEG-1, MPEG-2
  - Streaming: Windows Media, RealNetworks, MPEG-4

Export - Formats

File Format vs. Compression

- **File Formats**
  - File format is just a wrapper for contents
    - Identifies video & audio formats / compression
    - Players attempt to load required codecs
  - AVI, Windows Media (.WMV), QuickTime (.MOV)
    - Contains DV, MPEG-4
  - MPEG flavors (.MPG, .M2V, .MP3)
- **Data Formats**
  - Not Raw / Uncompressed, older formats
  - Standards: MPEG-1,2 (DVD), DV
  - Older: AVI / Indeo, QuickTime / Sorenson
  - Newer: QuickTime 6 / MPEG-4, Windows Media

Export - DVD Burners and Media

Burn Your Own Discs

- **DVD-ROM Readers / Players**
  - Becoming standard
  - CD-RW and DVD
- **DVD Burners / Recorders**
  - Under $150, 4X
  - Internal
  - External FireWire / 1394, USB 2
  - Sony Dual-format: +/-, R/RW
- **DVD Media**
  - DVD-R dropping to $2 - $1
  - DVD-RW to $3 - $2 (bulk)
  - (Also Video CD)

What's Next: Trends & Futures

Automation, Convergence, High-Def

- **Automated Editing**
  - Automated Editing: "Music Video" summary
  - Direct to DVD Recording: One-button
- **Bridge Set-top to Desktop**
  - DVD camcorders
  - Re-Edit On DVD
- **Streaming to High Definition**
  - MPEG-2 to MPEG-4, Windows Media; HDV
  - Cell phone & PDA to HDTV
- **Next-Generation High-Def DVD**
  - Stronger compression, Blue-laser, 4.7 to 30 GB

20

For More Information

Manifest Technology®
www.manifest-tech.com

The Manifest Technology site by Douglas Dixon
contains over 150 articles and technical references
on multimedia technology, especially digital video
editing and DVD authoring.