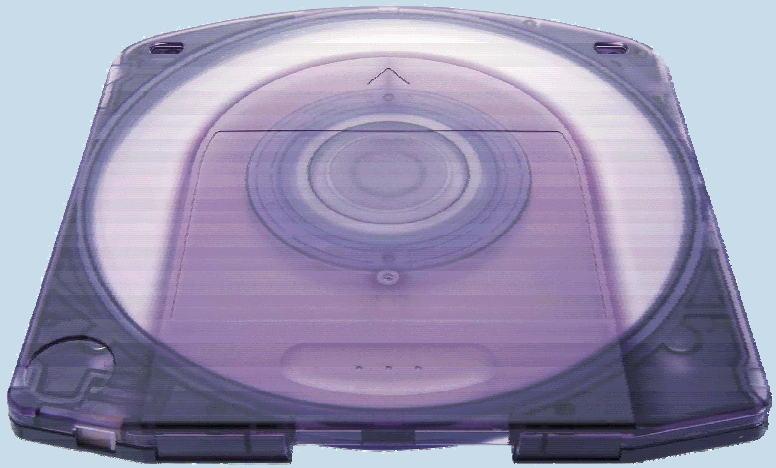
SONY

XDCAM Essentials

Working with XDCAM



Version 1.1

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Summary of topics

- Terminology & jargon.
- Advantages of XDCAM.
- XDCAM in a production environment.
- Optical disc technology.
- The XDCAM product range.
- Supporting software (PDZ-1 & XPRI).
- XDCAM 3rd party support & alliances.
- Version 1.1 upgrade highlights
- XDCAM & workflow.
- Ownership.
- Support and service guidance.
- XDCAM data.
- Network setup guidance.

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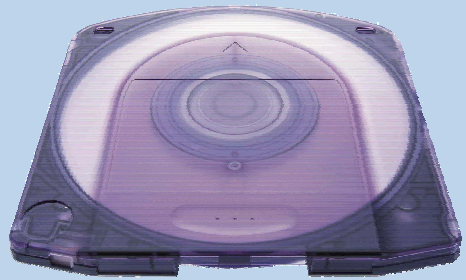
Terminology and jargon



What is XDCAM?

- XDCAM is an new media recording technology.
- XDCAM provides broadcast quality recording.
- XDCAM allows for enhanced metadata support.
- XDCAM uses *Professional Disc* as its recording media.

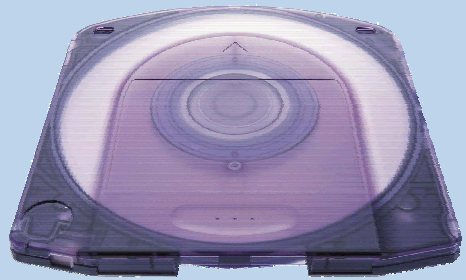
What is Professional Disc?

- Professional Disc is the same size as CD and DVD.
- Professional Disc uses blue-violet laser technology.
- Professional Disc has 23.3GB capacity.
  - 45 minutes of IMX recording.
  - 85 minutes of DVCAM recording.
- Professional Disc is mounted in a single sided cartridge.
  - Good protection from incidental damage.
  - Cartridge includes record disable switch.
  - Cartridge allows for dual-head operation.
- Professional Disc is the medium used by XDCAM.

Professional Disc & Blu-ray

- Blu-ray is a domestic format.
  - Used for home recordings.
- Blu-ray is multi-vendor. Professional Disc is Sony proprietary.
  - Blu-ray is collaborative : Hitachi, LG, Matsushita, Philips, Pioneer, Samsung, Sharp, Sony, Thomson.

Advantages

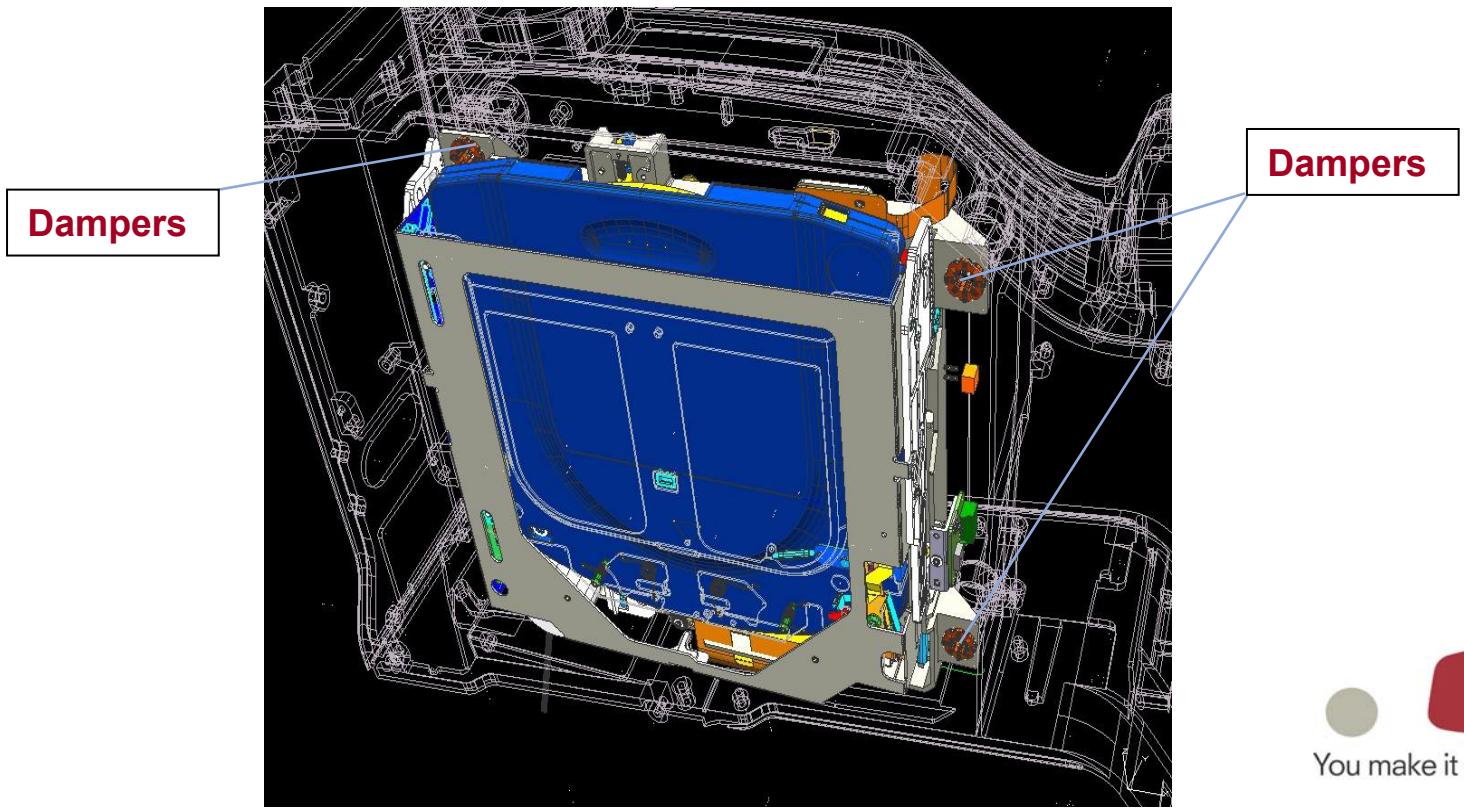


Advantages of Professional Disc

- Professional Disc is cost effective. **30 Euro per disk.**
- Professional Disc is removable.
  - XDCAM professional disk media can be ejected like tape.
- Professional Disc is contact free.
  - Unlike tape the record/playback head does not touch the media.
  - Profession Disc makes no electrical contact to the recorder.
- Professional Disc allows instant access.
  - The record/play head can jump to any point quickly.
  - Using 2 heads allows pre-seek to increase access speed.

Advantages of XDCAM

- XDCAM makes Professional Disk very robust
  - Good mechanical and electronic shock protection.
  - Fast servo system with good focus tracking.
  - Good error protection. Superb scratch error elimination.



Advantages of XDCAM

- XDCAM only records to the blank areas of the disk
  - This prevents accidental recording over previous material.
- Fast load and instant record.
  - Recording can start as soon as the disk door is closed.
- Clips can be deleted instantly.
  - Allowing bad takes to be deleted freeing up disk space quickly.

Advantages of XDCAM

- XDCAM can record either IMX or DVCAM material.
- XDCAM provides metadata support.
  - Support on disc for record date & time, titles, identifiers …
  - … key frames, frame count, user specific data, etc..
- XDCAM supports thumbnails.
  - Clips can be recognised quickly using thumbnails.
  - Thumbnail can be taken from anywhere in the clip.

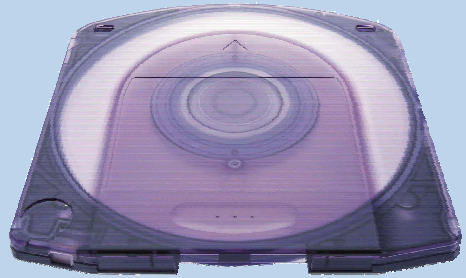
Advantages of XDCAM

- Scene selection data can reside on disk.
  - Clip Lists can be stored on disk …
  - … and used to play out original clips in any order.
- XDCAM support IT based media transfer.
  - XDCAM material can be transferred using Ethernet …
  - … or IEEE1394 (iLink or Firewire) connections.
  - XDCAM supports MXF transfer to AAF based systems.

Advantages of XDCAM

- XDCAM supports low resolution proxy AV material copy.
  - XDCAM automatically records a MPEG-4, low data rate copy.
  - The proxy can be transferred at up to 50x play speed to editor.
  - This proxy copy can be used for fast editing.
  - The proxy can be transferred to media servers for browsing.
  - Proxy edits produce Clip Lists.
  - Clip Lists can be applied to original clips for final playout.
  - Proxy AV data is good enough for emergency playout.

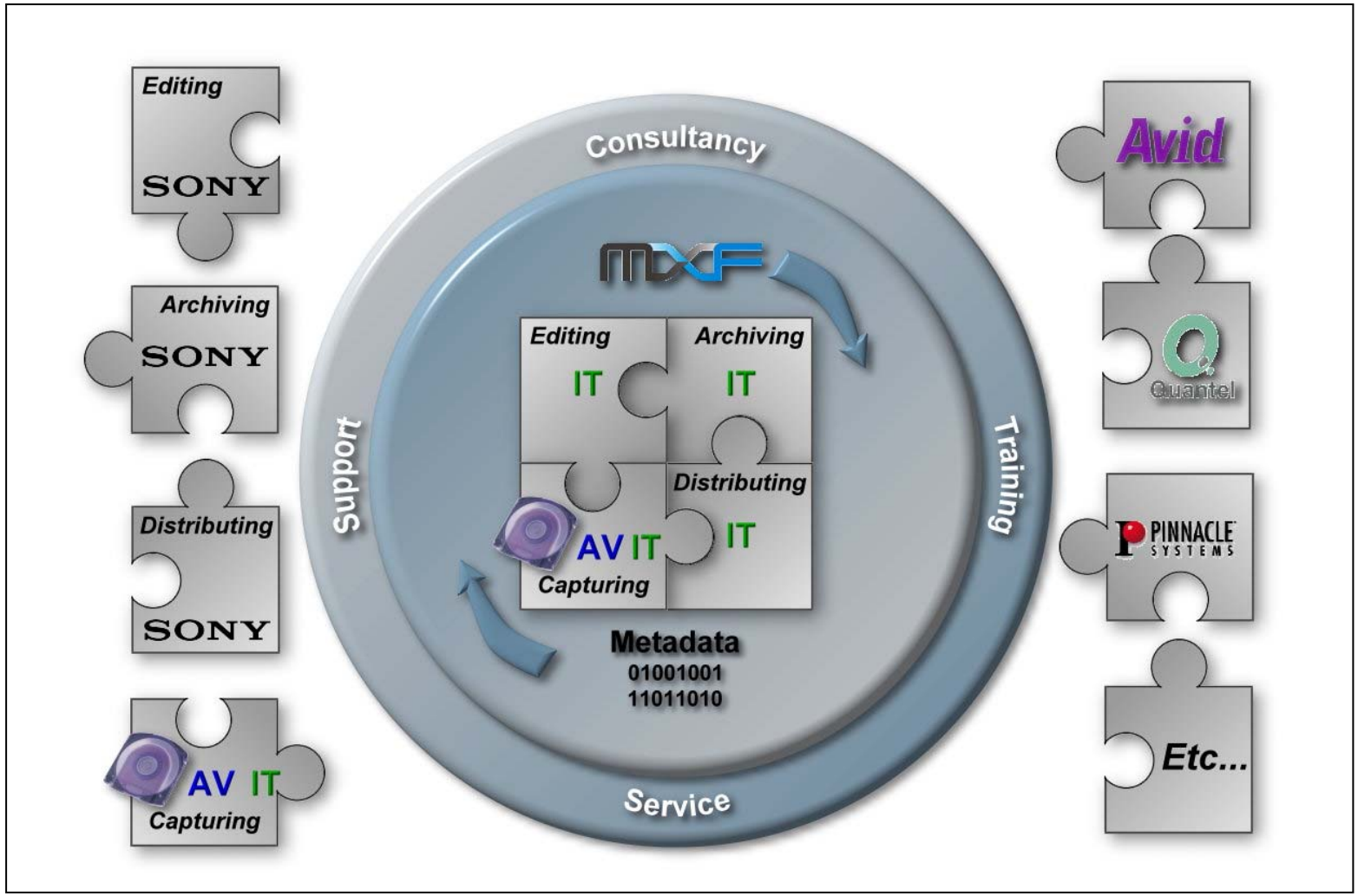
XDCAM in the production environment



XDCAM in the production environment

- In the past production elements were separate.
- MXF & metadata allow elements to work together.
- Sony & 3rd party partners deliver comprehensive support.
  - File base acquisition, with metadata, proxies and thumbnails.
  - Consistent media and metadata support across whole workflow.
  - Multi-vendor support.
  - Compliance with industry wide accepted standards.

XDCAM in the production environment



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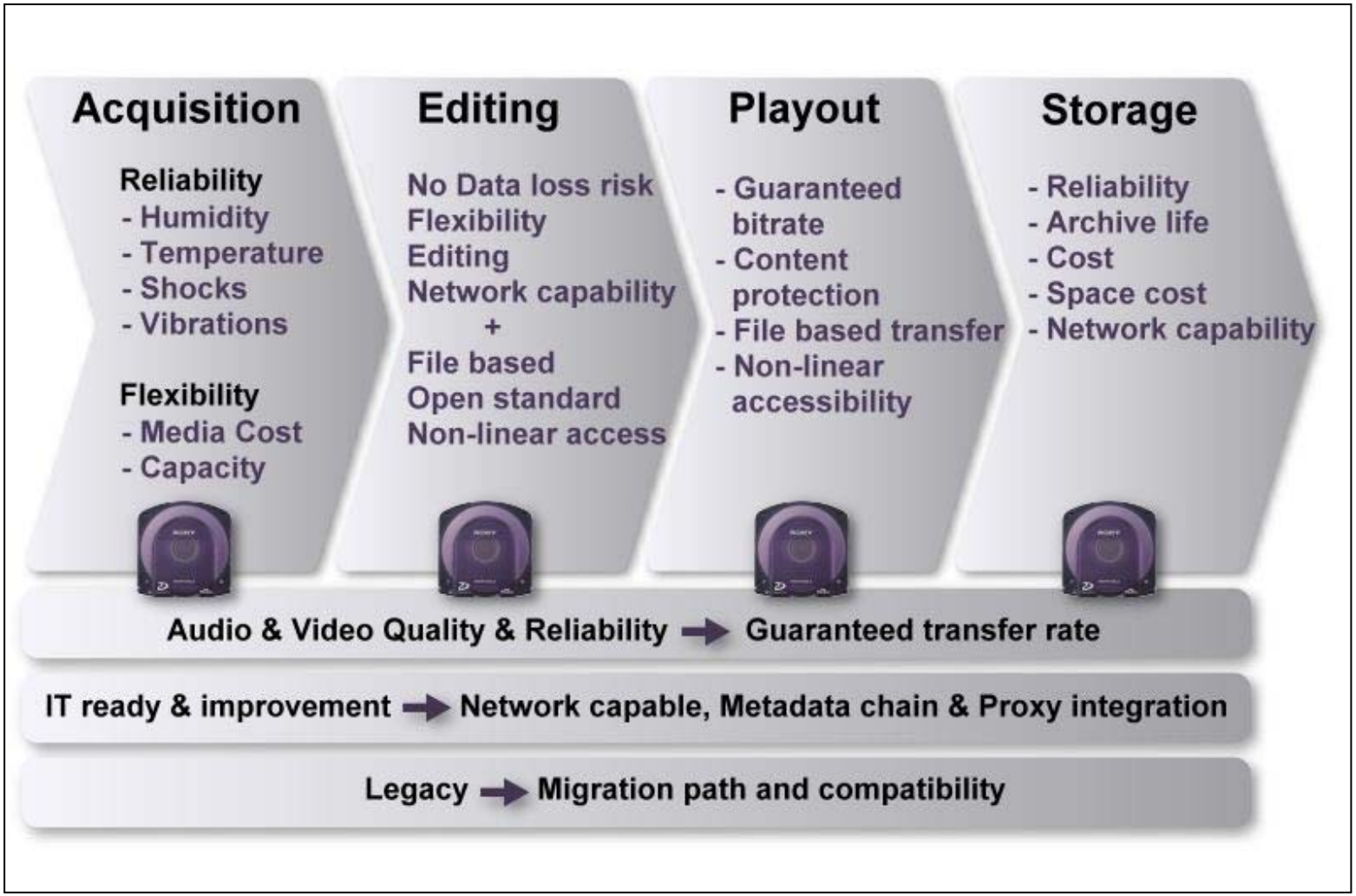
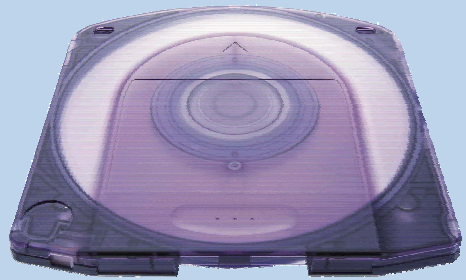
XDCAM in the production environment



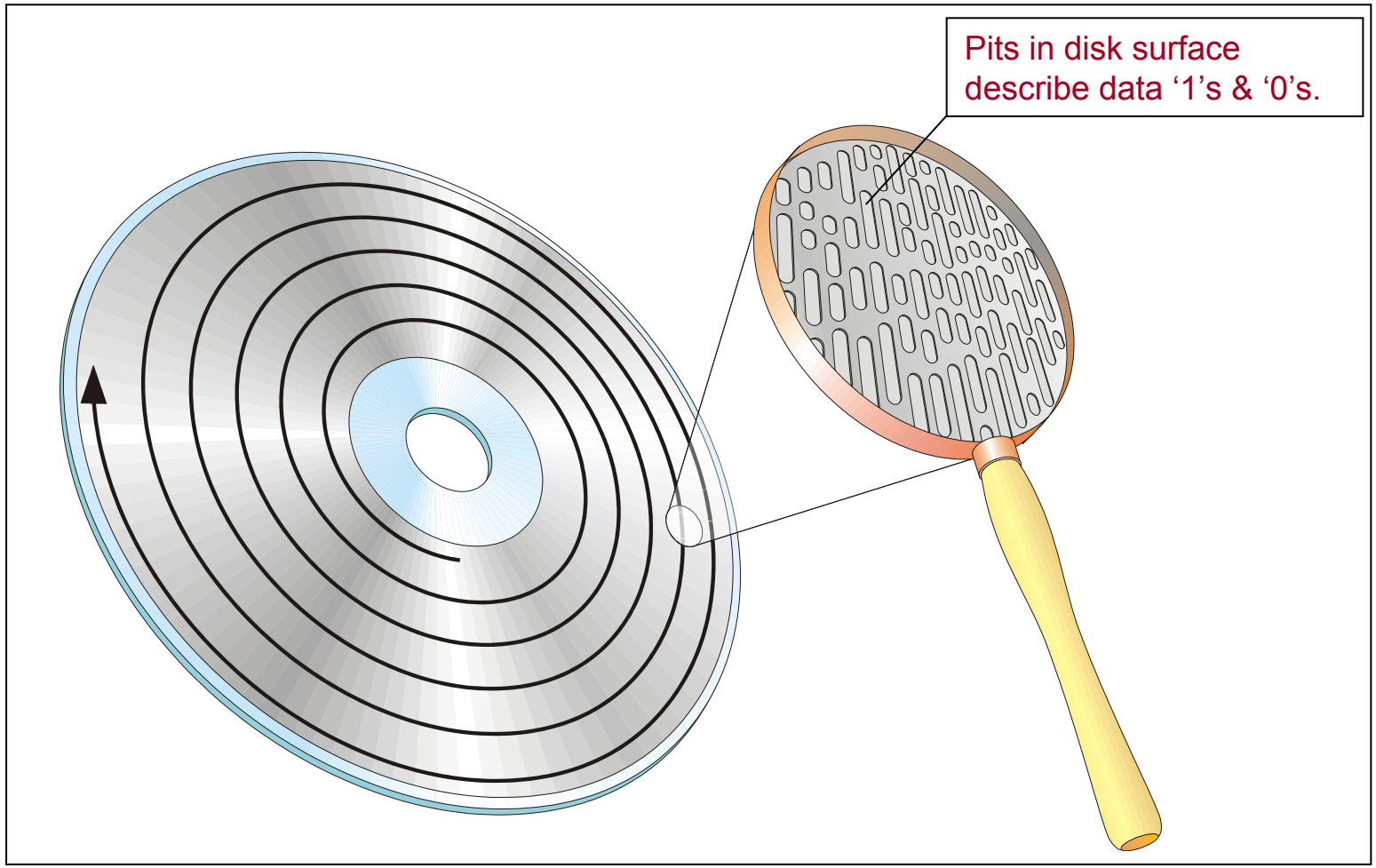
Technology



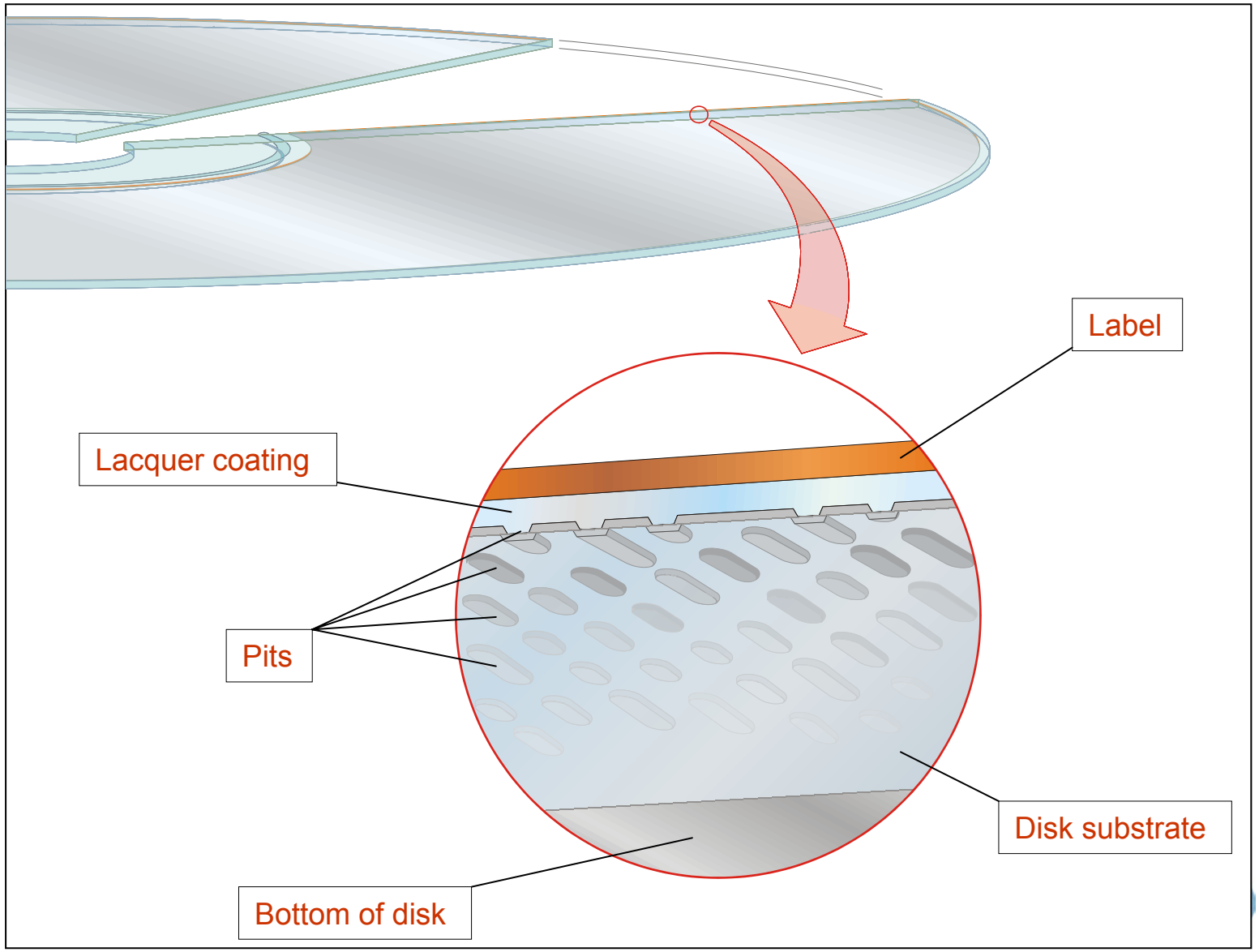
Optical disk technology background

- Music and software CD's
  - CD is pre-stamped with data pits on top surface.
  - Top surface is sputtered with aluminium to make it shiny.
  - Top surface is coated with lacquer to protect data.
  - Label printed on top.
  - Laser focuses from the bottom, through 1.2mm of disk.
  - Each disk can hold 650MB of data.

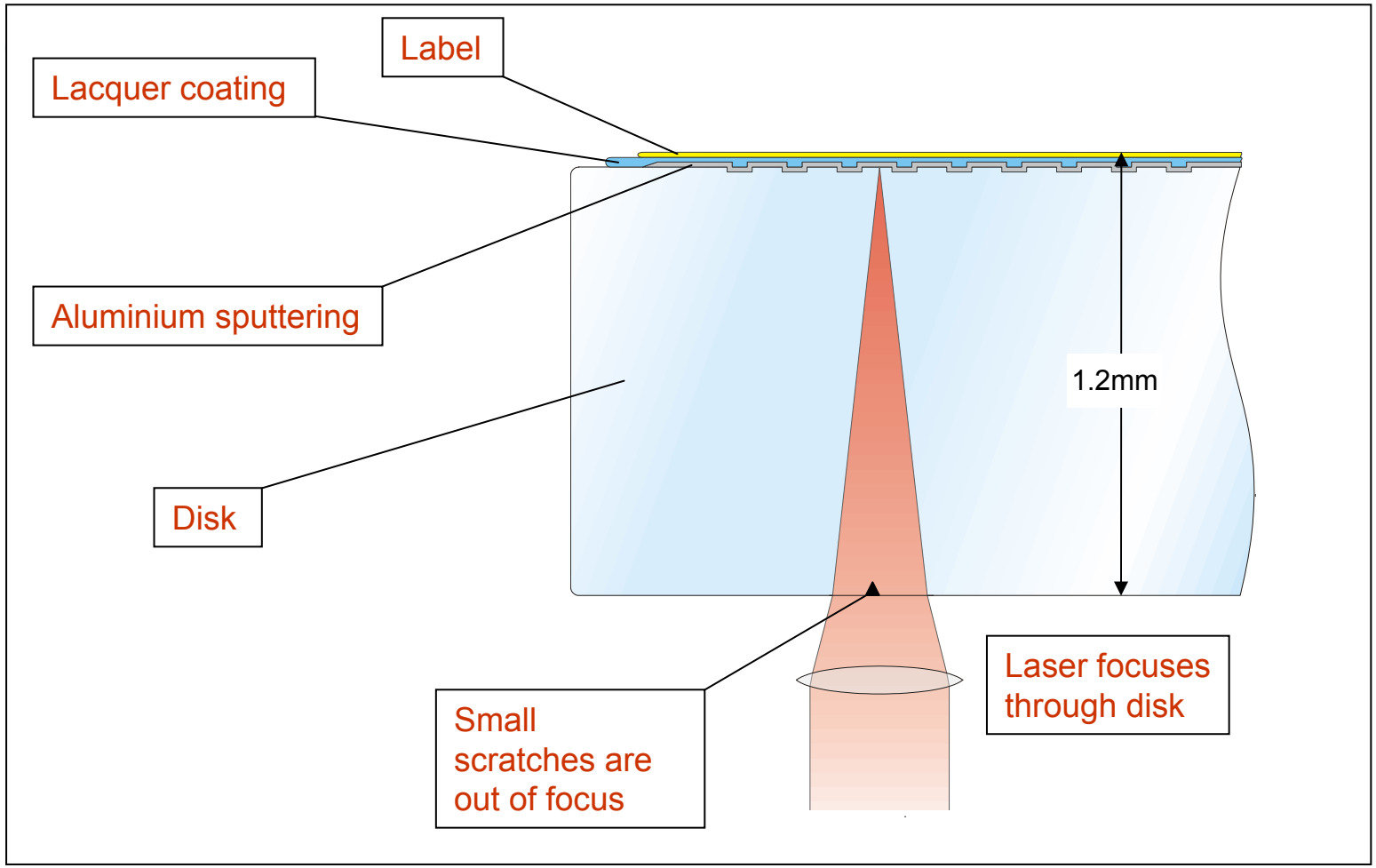
Optical disk technology background



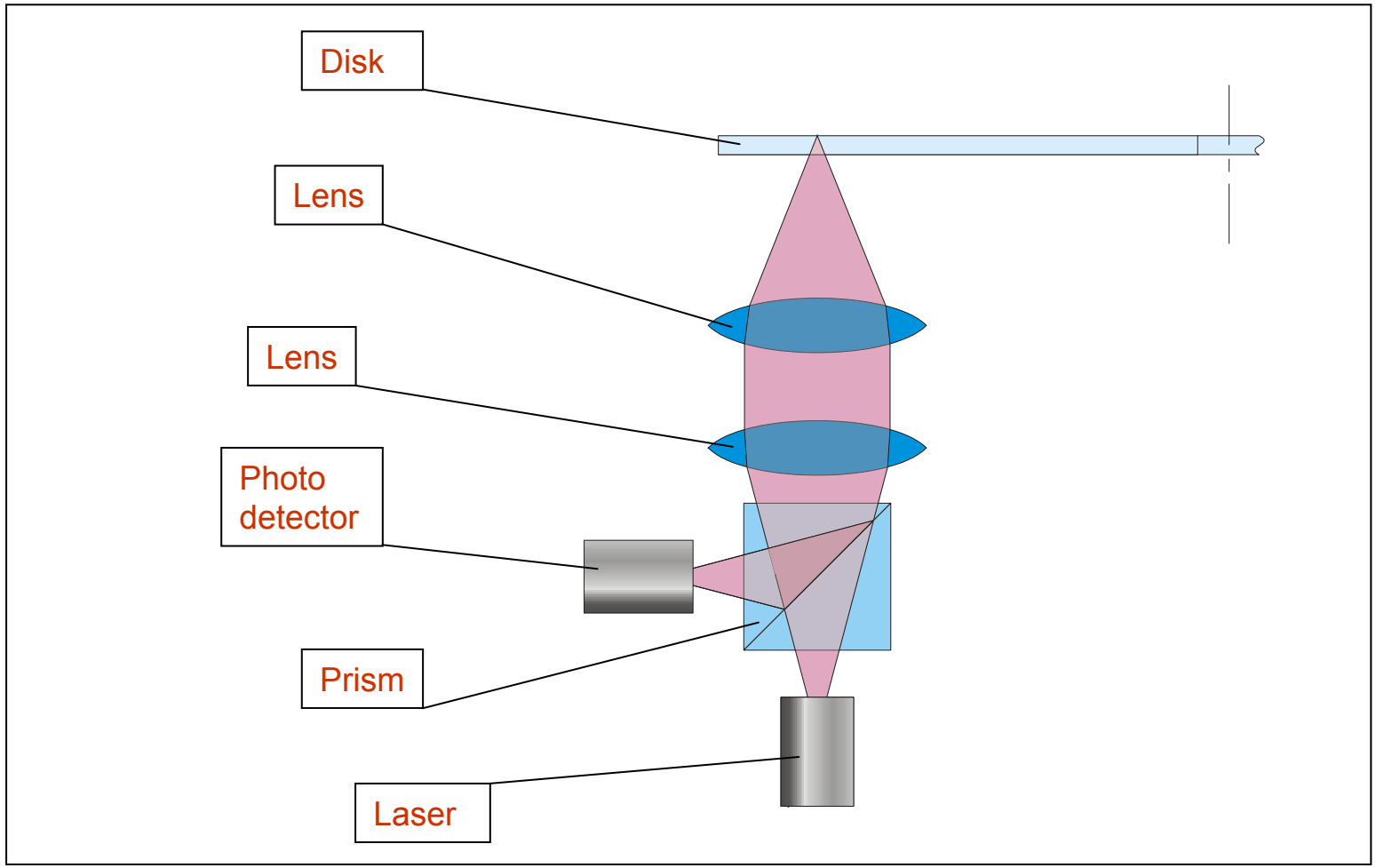
Optical disk technology background



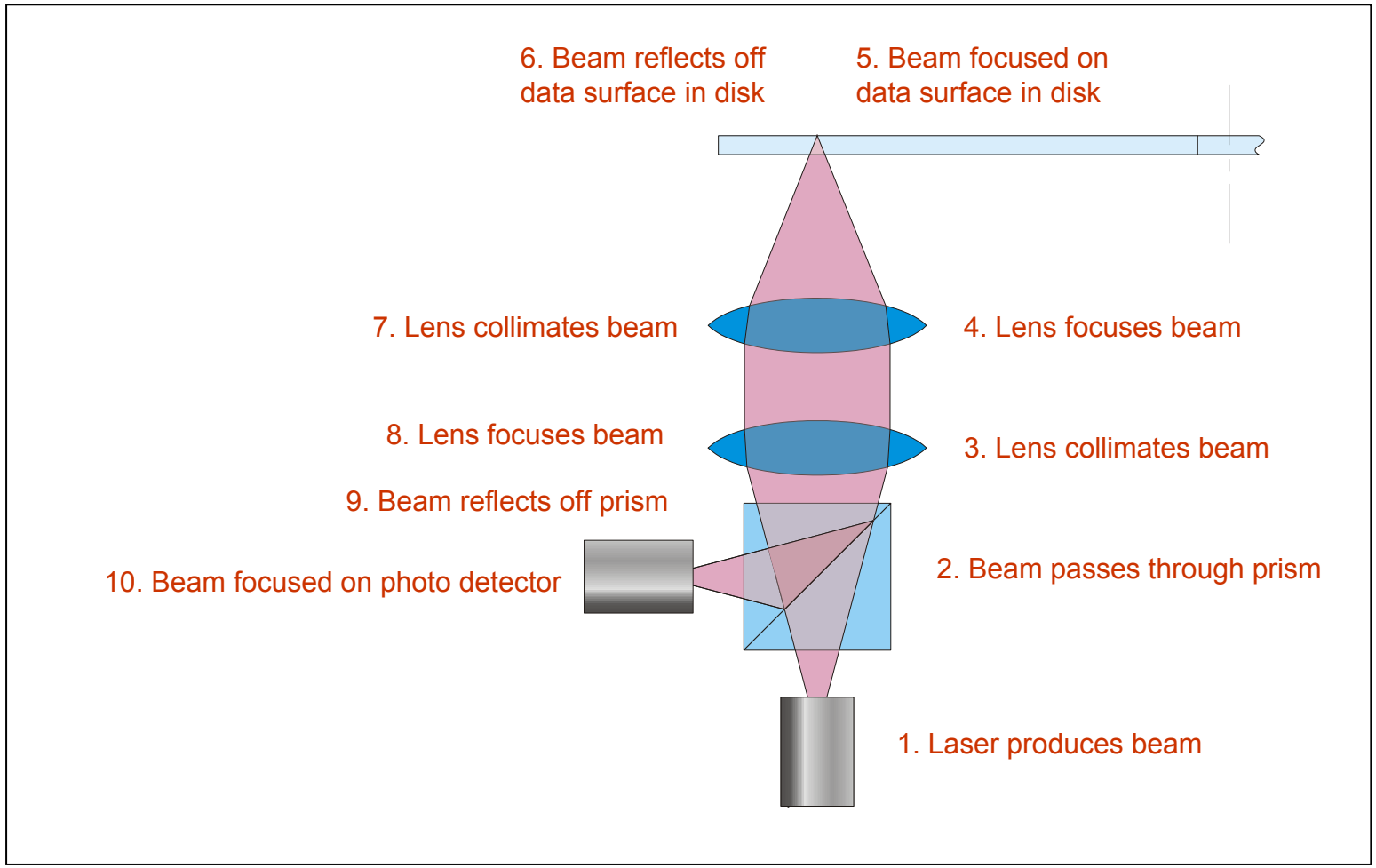
Optical disk technology background



Optical disk technology background



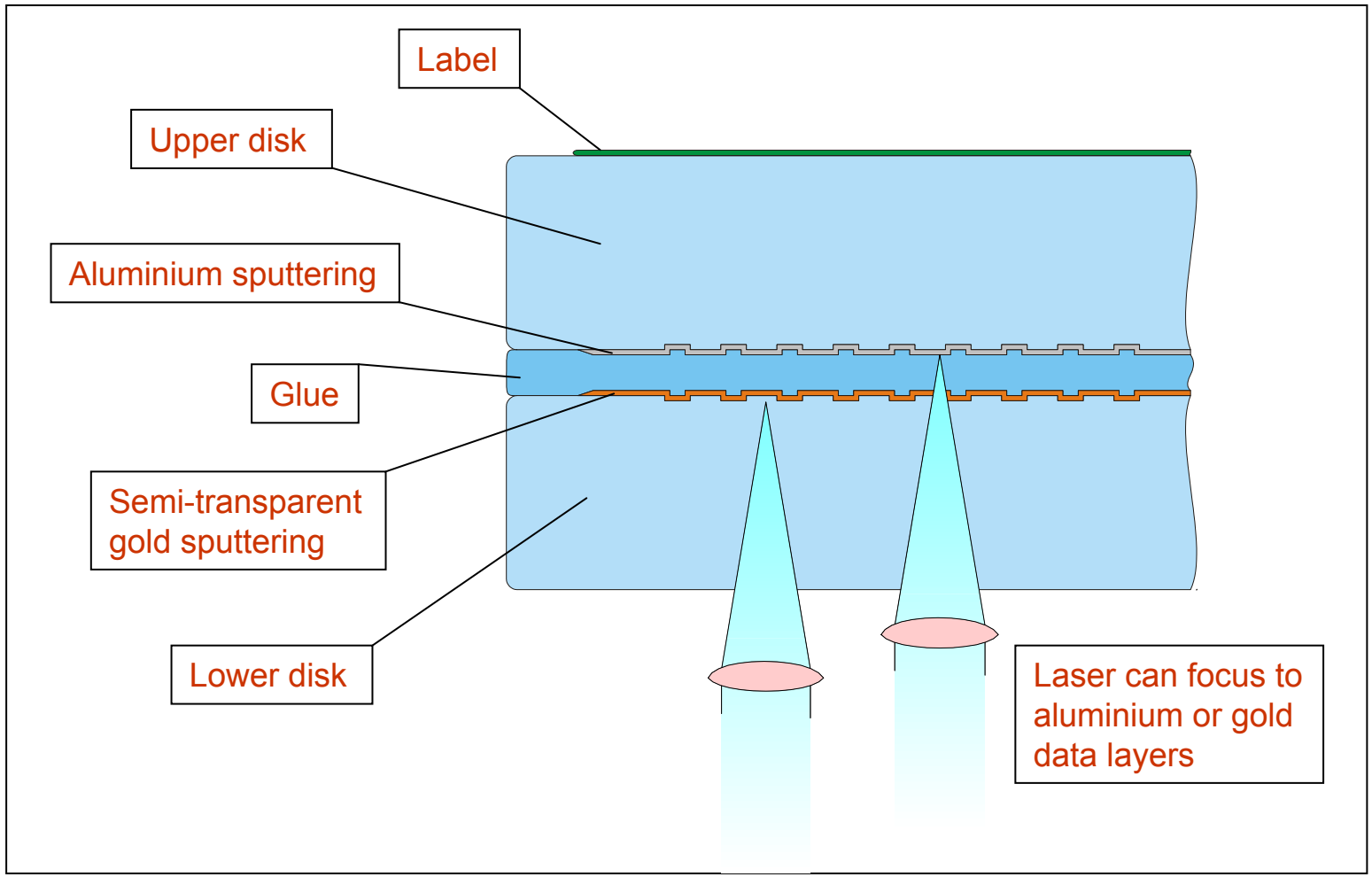
Optical disk technology background



Optical disk technology background

- Pre-recorded DVD's
  - Each DVD is made from 2 disks 0.6mm thick.
  - Top disk is pre-stamped with data pits on bottom surface.
  - Bottom disk is pre-stamped with data pits on top surface.
  - Bottom of top disk sputtered with aluminium.
  - Top of bottom disk sputtered with semi-transparent gold.
  - Two disks glued together with data on inside.
  - Label printed on top.

Optical disk technology background



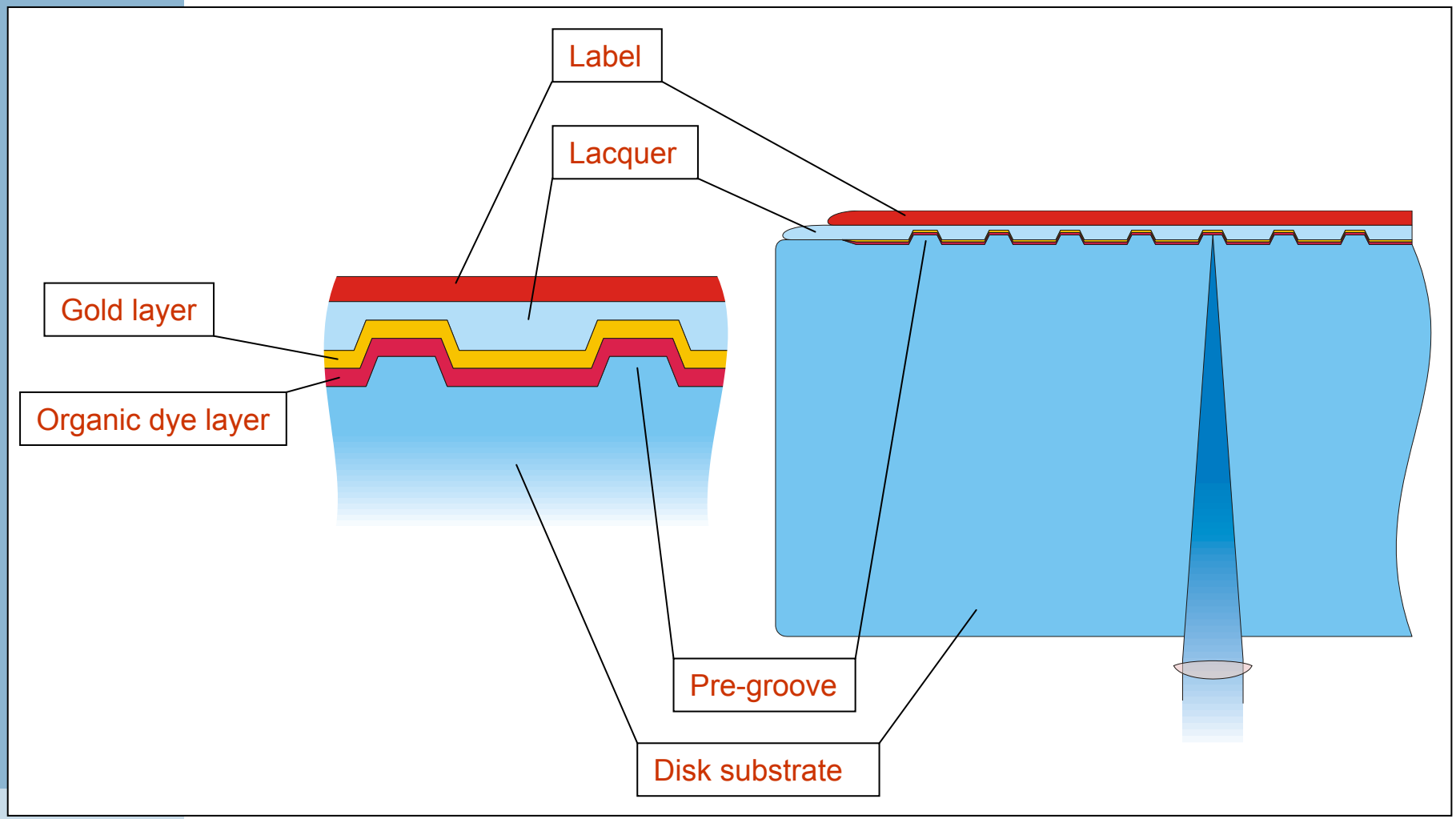
Optical disk technology background

- Pre-recorded DVD's
  - Overall disk thickness is still 1.2mm. Glue layer is thin.
  - Laser focuses from the bottom, through 0.6mm of disk.
  - Laser can focus on either data layer …
  - … top of the bottom disk or bottom of top disk.
  - Not all DVD's are dual layer, some have a 'dummy' top layer.
  - Each data layer can hold about 4.7GB.

Optical disk technology background

- CD-R disks (one time recorded)
  - Disk stamped with spiral guide on top surface (pre-groove).
    - Pre-groove guides laser during writing and reading.
    - Pre-groove has a ‘wobble’ that acts as sync signal.
  - Top surface coated with organic dye.
  - Top surface then sputtered with gold.
  - Top surface then coated in protective lacquer.
  - Label printed on top.

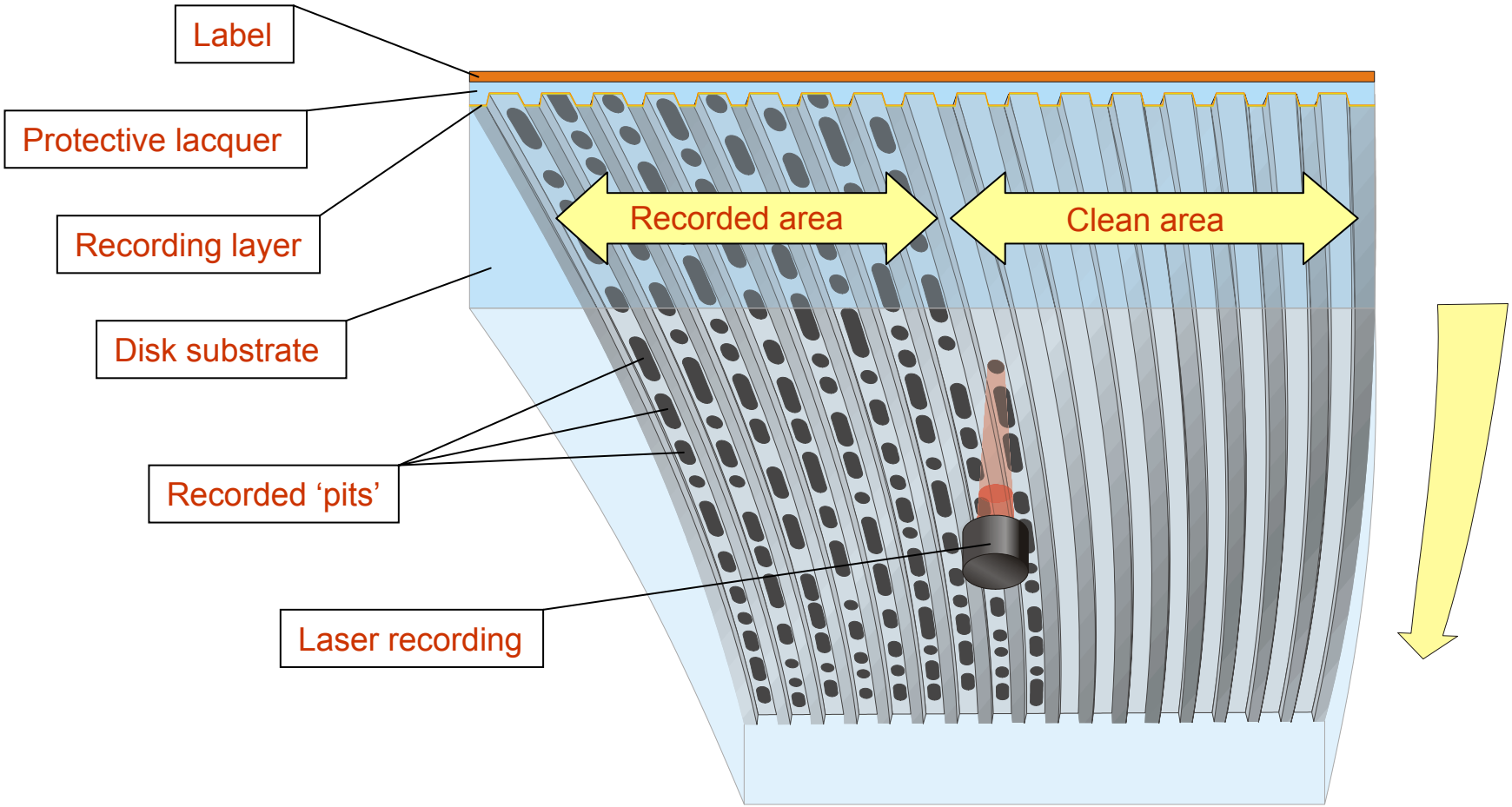
Optical disk technology background



Optical disk technology background

- CD-R disks (one time recorded)
  - Write laser ‘burns’ dye, changing its characteristics.
  - Burnt dye acts like pits on a pre-stamped disk.

Optical disk technology background



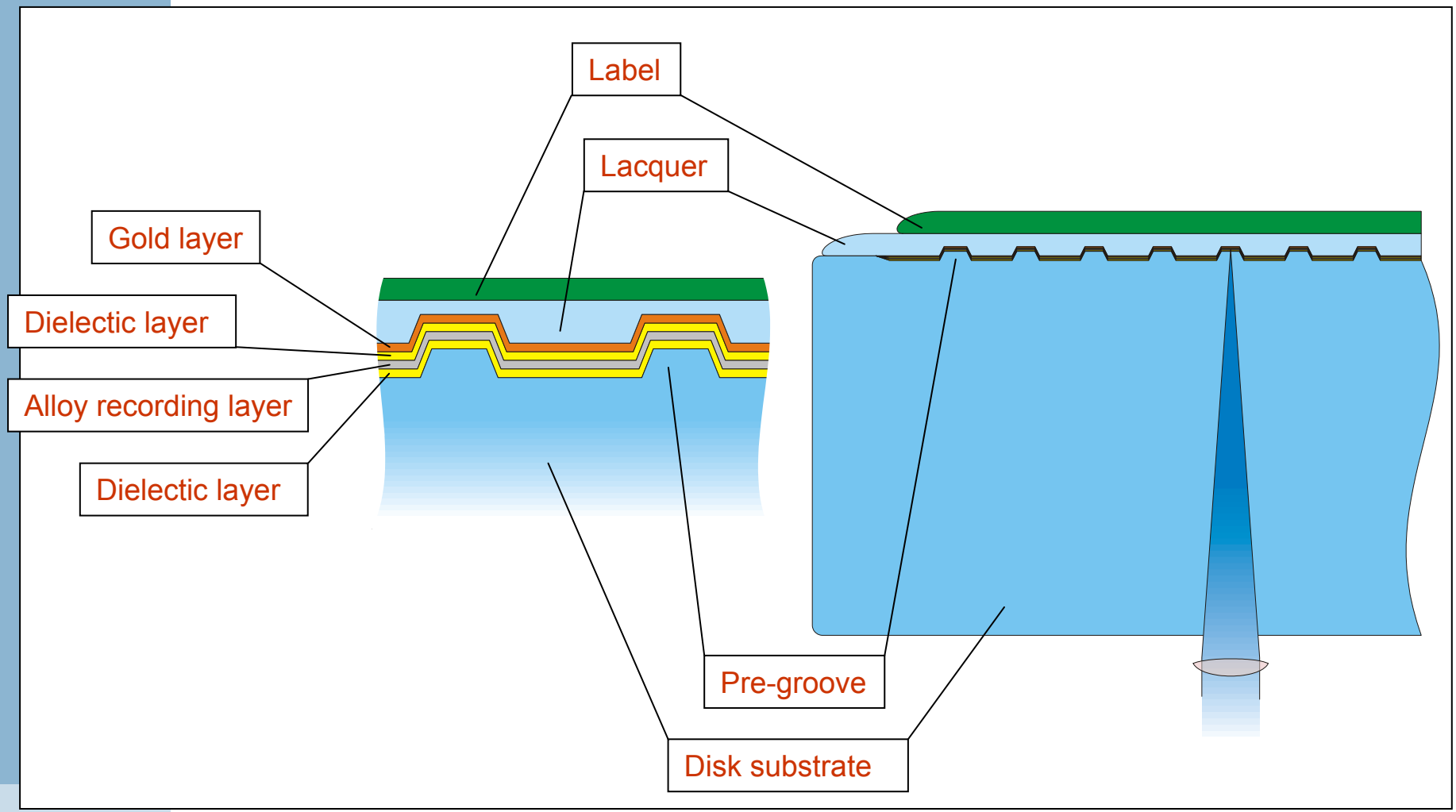
Optical disk technology background

- 700MB CD-R disks
  - First CD-R disks recorded 650 MB (like original CD)
  - Some later CD-R disks have higher 700MB capacity.
  - Pre-groove ‘wobble’ is at a higher frequency.
  - This slows the disk and allows for longer write times.

Optical disk technology background

- CD-RW disks
  - Disk stamped with spiral pre-groove on top surface.
  - Top surface sputtered with dilectric layer …
  - … then metal alloy layer …
  - … then another dilectric layer …
  - … then gold layer.
  - Top surface then coated in protective varnish.
  - Label printed on top.

Optical disk technology background



Optical disk technology background

- CD-RW disks
  - Metal alloy layer is the recording layer.
    - Metal alloy can have two states, reflective and non-reflective.
  - Dilectric layers sandwich the metal alloy layer.
    - They soak heat away from metal alloy layer during recording.

Optical disk technology background

- CD-RW disks
  - Before writing to disk alloy is in highly reflective.
    - The alloy is in a crystalline state.
  - When writing laser changes alloys optical characteristics.
    - Laser heats alloy to 600 degrees C.
    - Alloy changes from crystalline state to amorphous state.
    - Alloy cools and loses its reflective nature.
    - Change from crystalline to amorphous is called a ‘phase change’.
    - Changes act like pits on a pre-stamped disk.

Optical disk technology background

- CD-RW disks
  - Laser can also erase recording.
    - Laser heats alloy to 300 degrees C.
    - Alloy cools and becomes crystalline again (reflective).

Optical disk technology background

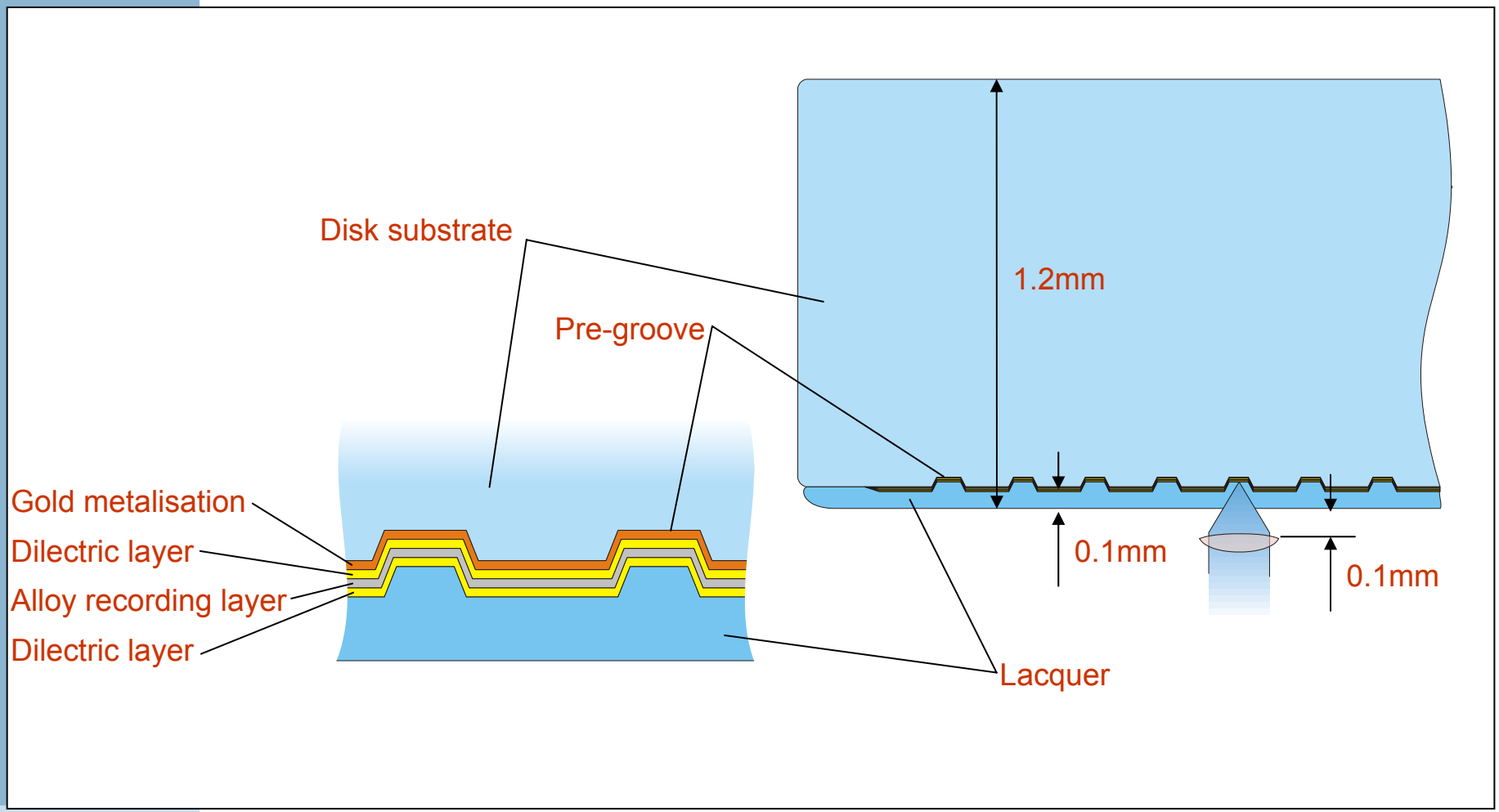
- DVD-R disks
  - Use similar ‘record once’ technology to CD-R disks.
- DVD-RW disks
  - Uses similar phase change technology as CD-RW.
- Both DVD-R and DVD-RW record single layer at present.
  - Research into dual layer recordable DVD on-going.
  - Recordable dual layer DVD’s starting to appear.

Optical disk technology background

- Professional Disc
  - Similar **phase change** technology to CD-RW and DVD-RW.
  - Data layer on the bottom of the disk.

  - Disk stamped with guide grooves on bottom surface.
  - Bottom surface sputtered with gold.
  - Bottom surface then coated with dilectric.
  - Then coated with alloy recording material.
  - Then coated with second layer of dilectric.
  - Bottom surface coated in 0.1mm protective layer of lacquer.

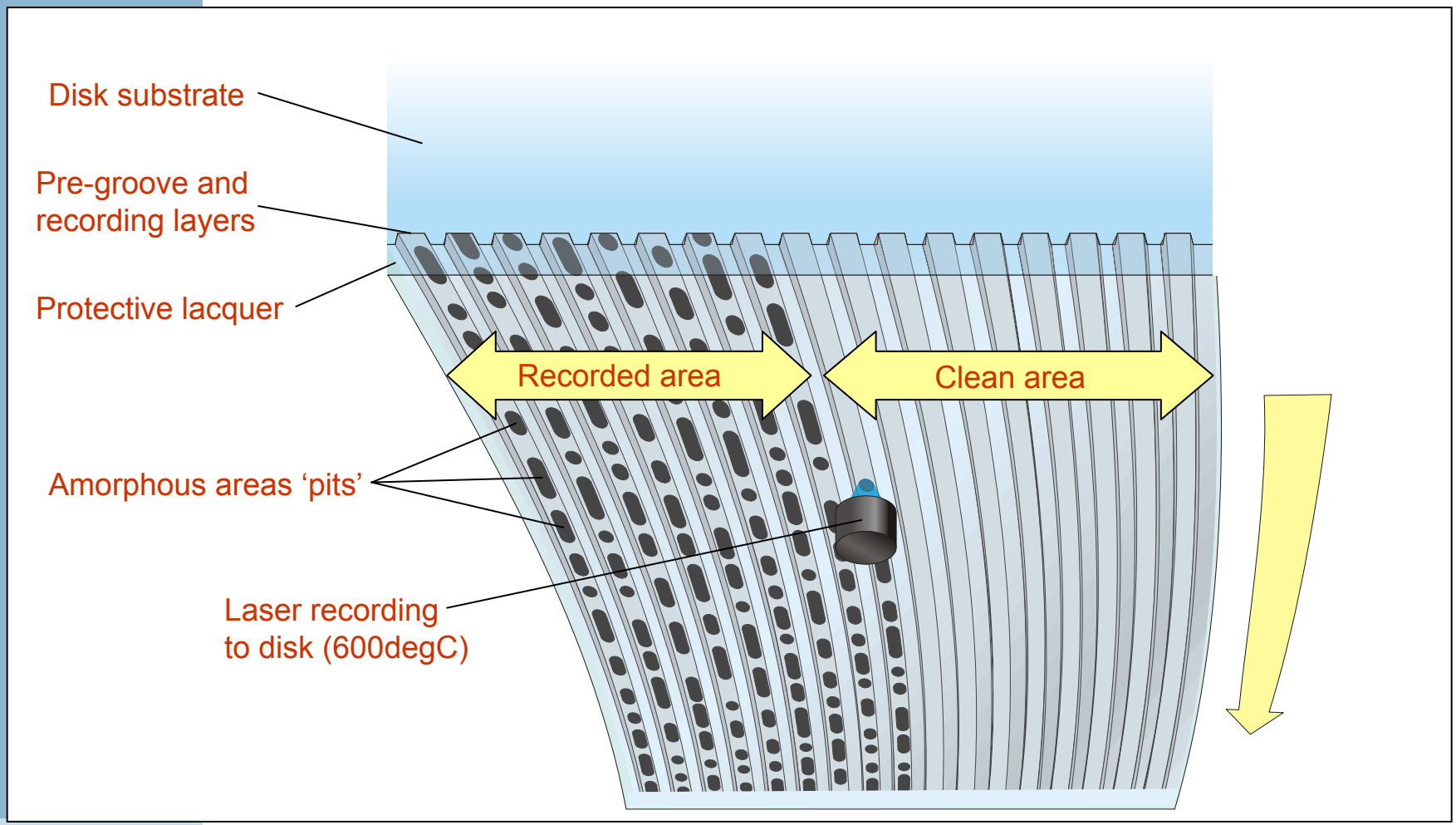
Optical disk technology background



Optical disk technology background

- Writing to Professional Disc
  - Laser follows the pre-groove.
  - Laser writes to disk in bursts of power for ‘1’s and ‘0’s
  - When writing laser heats alloy to 600 degC.
    - Phase change from crystalline to amorphous.
    - Spot of amorphous alloy looks like a pit.

Optical disk technology background



Optical disk technology background

- Erasing Professional Disc
  - Laser follows the pre-groove.
  - When erasing laser heats alloy to 200 degC.
    - Phase change from amorphous to crystalline.
  - This area of the disk can now be re-recorded.

Phase Change Technology

- Picture of recording mechanism, laser waveform, recording mark.

Optical disk technology background

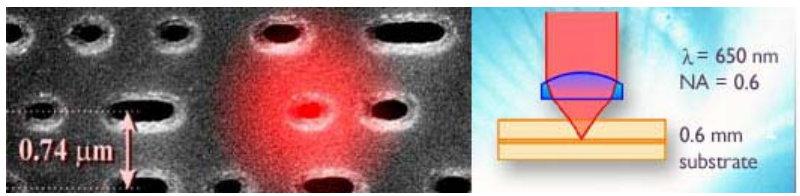
- How does XDCAM read from Professional Disc?
  - Laser follows the pre-groove.
  - When reading laser is low power (no heating).
  - Laser focuses on reflective alloy surface.
  - Reflected light passes back out and into a light sensor.
  - Spots of amorphous alloy scatter light.
  - No light reflected back to sensor.
  - Spots interpreted as ‘1’s and ‘0’s.

Blue/violet lasers & numeric aperture

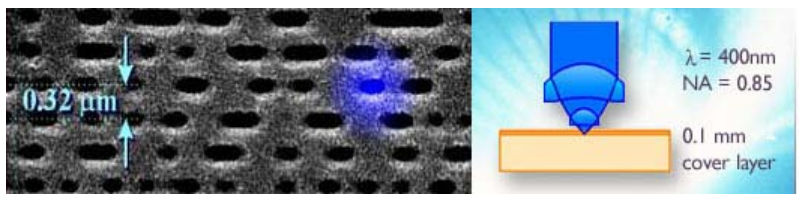
- Why is the laser blue/violet?
  - Smaller data 'dots' = higher data density = more data on disk.
  - Blue/violet lasers have a smaller wavelength (405nm)…
  - … which allows for smaller data dots.

CD track pitch is 1.6um

DVD track pitch is 0.74um



Professional Disk track pitch is only 0.32um



Blue/violet lasers & numeri aperture

- Picture showing pregroove.

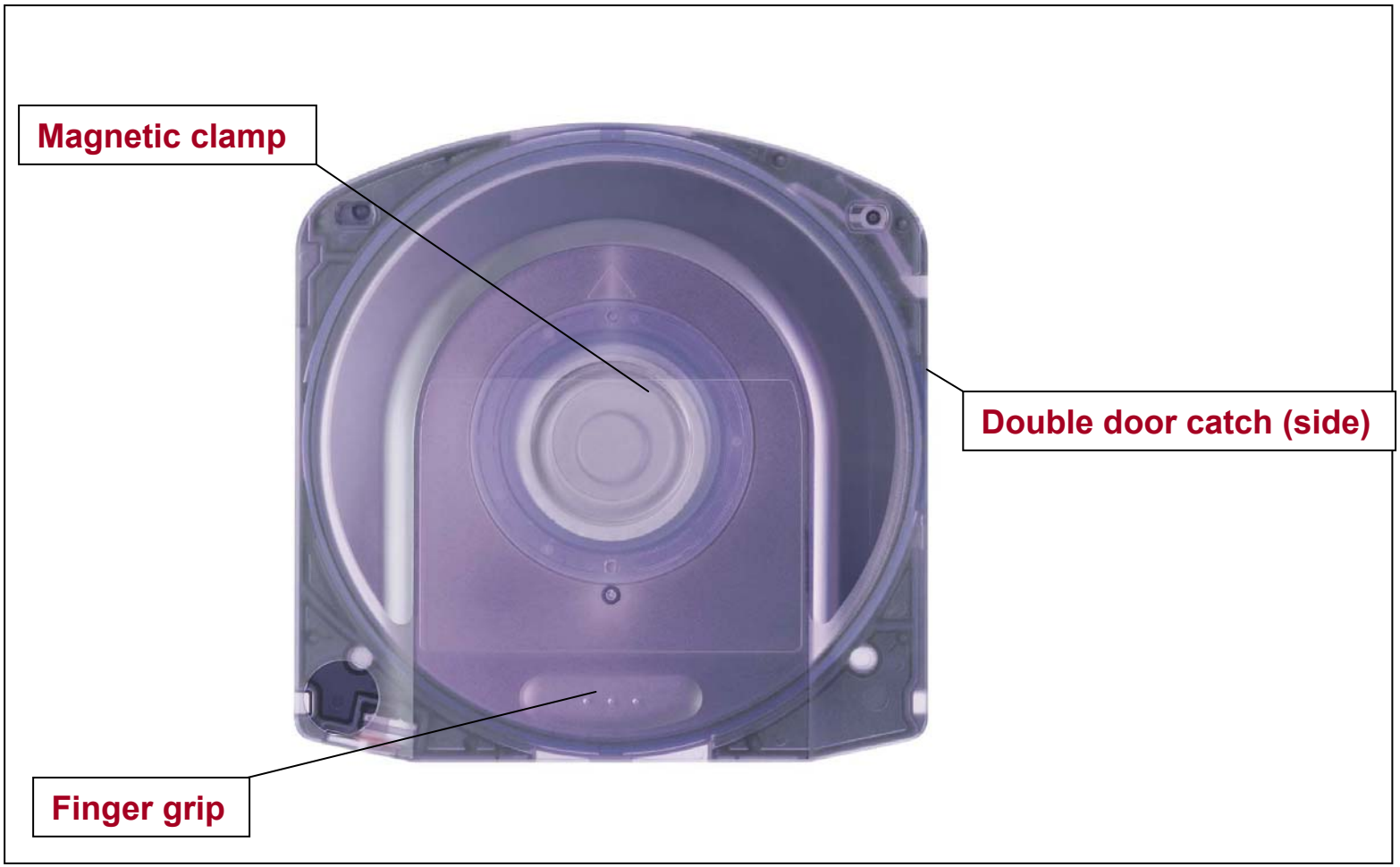
What is numerical aperture?

- A blue violet laser is only half the solution to high capacity.
- Numerical aperture also need to be as high as possible.
- NA is a measure of the detail that a laser can pick up.
  - Mathematics involved (see appendix).
- Lens needs to be close to the data.
- Thus data layer at the bottom of the disk.
- Professional Disc has a high NA.

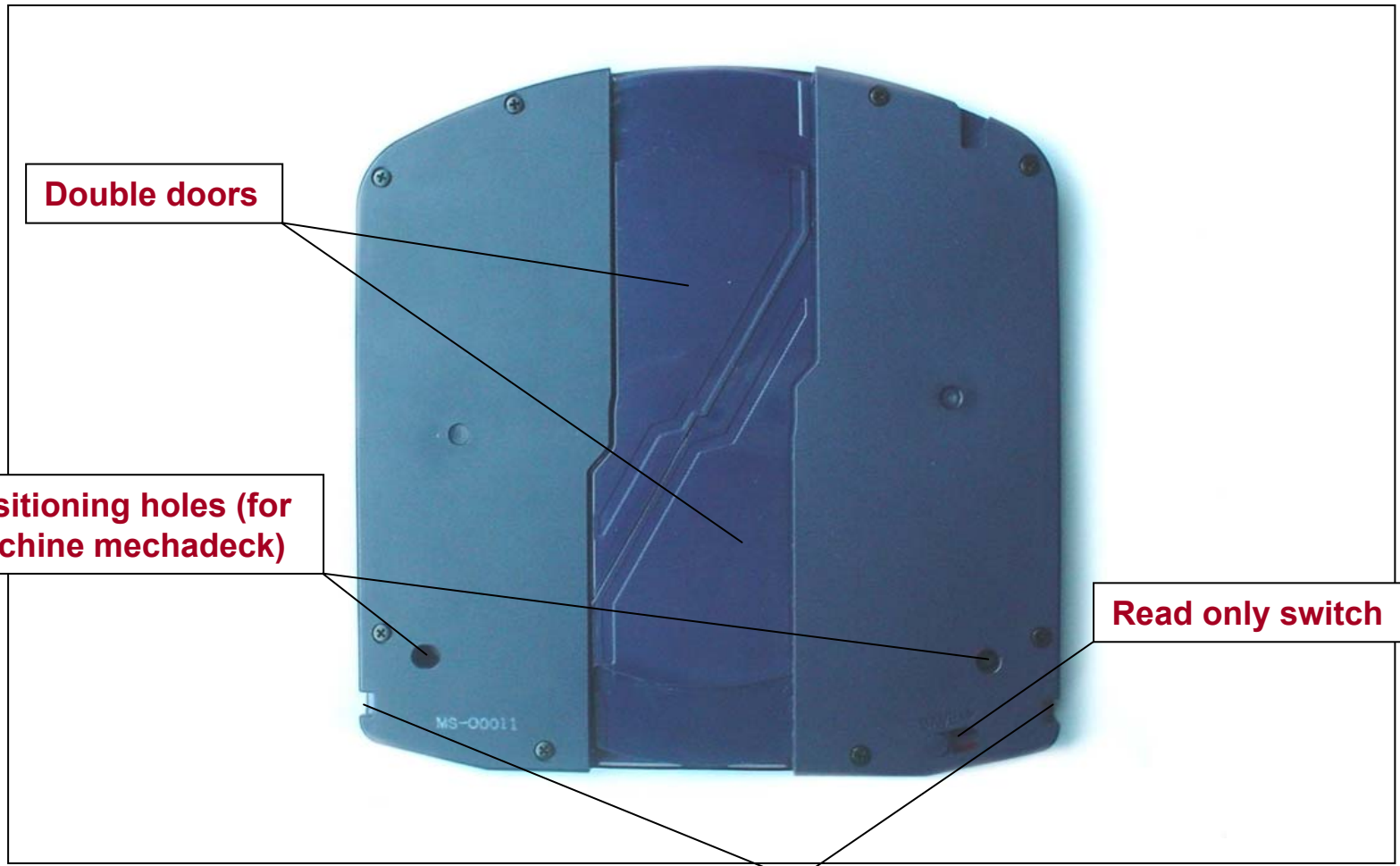
The technology behind XDCAM & Professional Disc

- XDCAM uses Professional Disc.
- Disk is mounted in a hard case (cartridge).
- Disk itself is the same size as CD and DVD disks.
  - 120mm diameter, 15mm diameter hole, 1.2mm thick.
- Wide double doors allow for dual head operation.

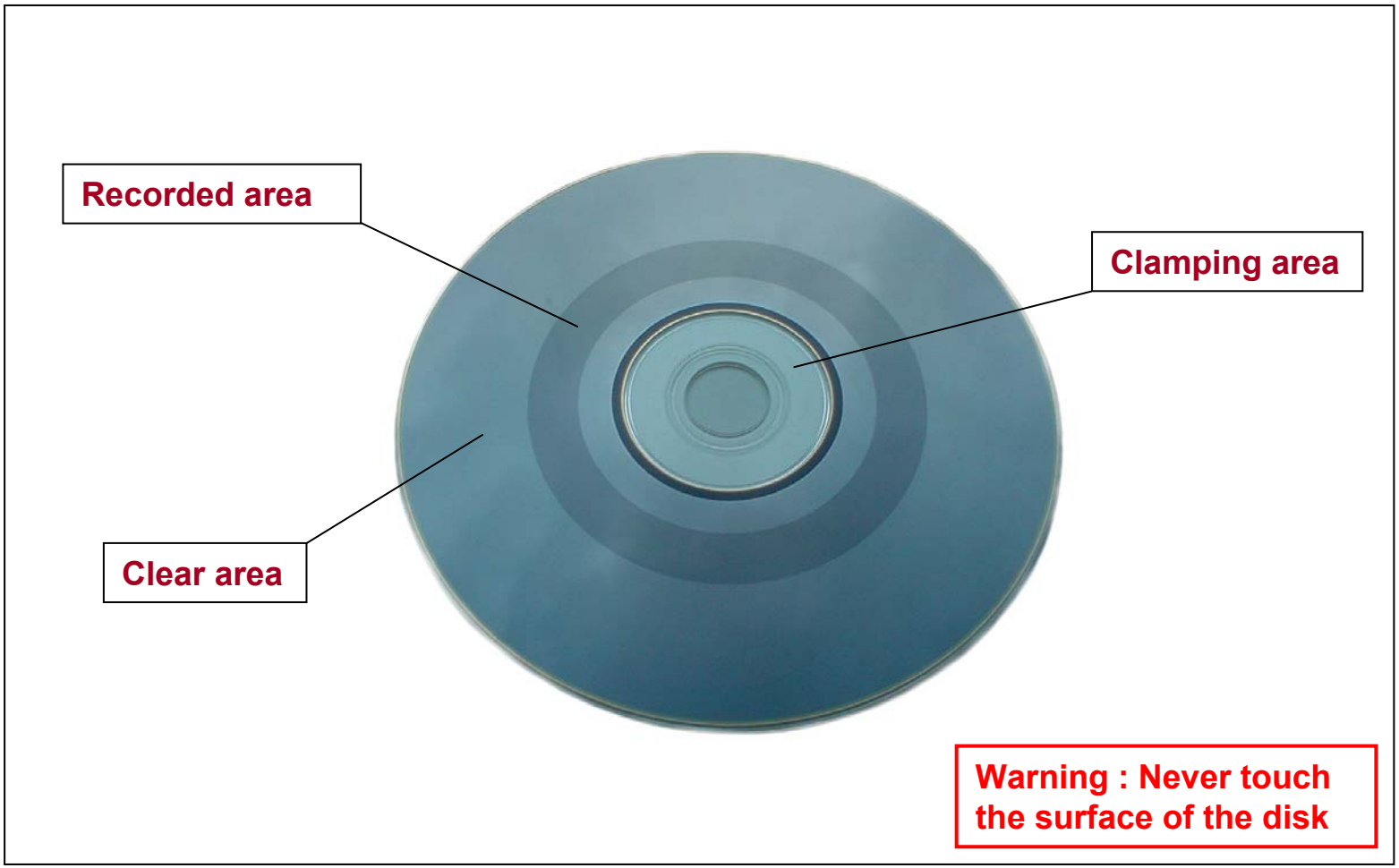
The technology behind XDCAM & Professional Disc



The technology behind XDCAM & Professional Disc



The technology behind XDCAM & Professional Disc



The technology behind XDCAM & Professional Disc

- How fast does it take to load a cartridge?
  - Disk spin-up time less than 2 seconds.
  - Typical data load time is 5 seconds (depends on file quantity).
  - Maximum data load time is 10 seconds.
  - However there is a cache in the XDCAM camcorders.
  - This enables recording to start as soon as door is closed.

The technology behind XDCAM & Professional Disc

- What exactly is proxy A/V data?
  - Proxy A/V data is a very low bit rate copy of the recorded clips.
  - Proxy A/V data contains MPEG4 compressed video (1.5Mbps).
  - … and 64kbps audio.
  - Easy to transfer quickly over Ethernet or iLink (50x).
  - Can be used for off-line archive.
  - Good enough for emergency transmission.

The technology behind XDCAM & Professional Disc

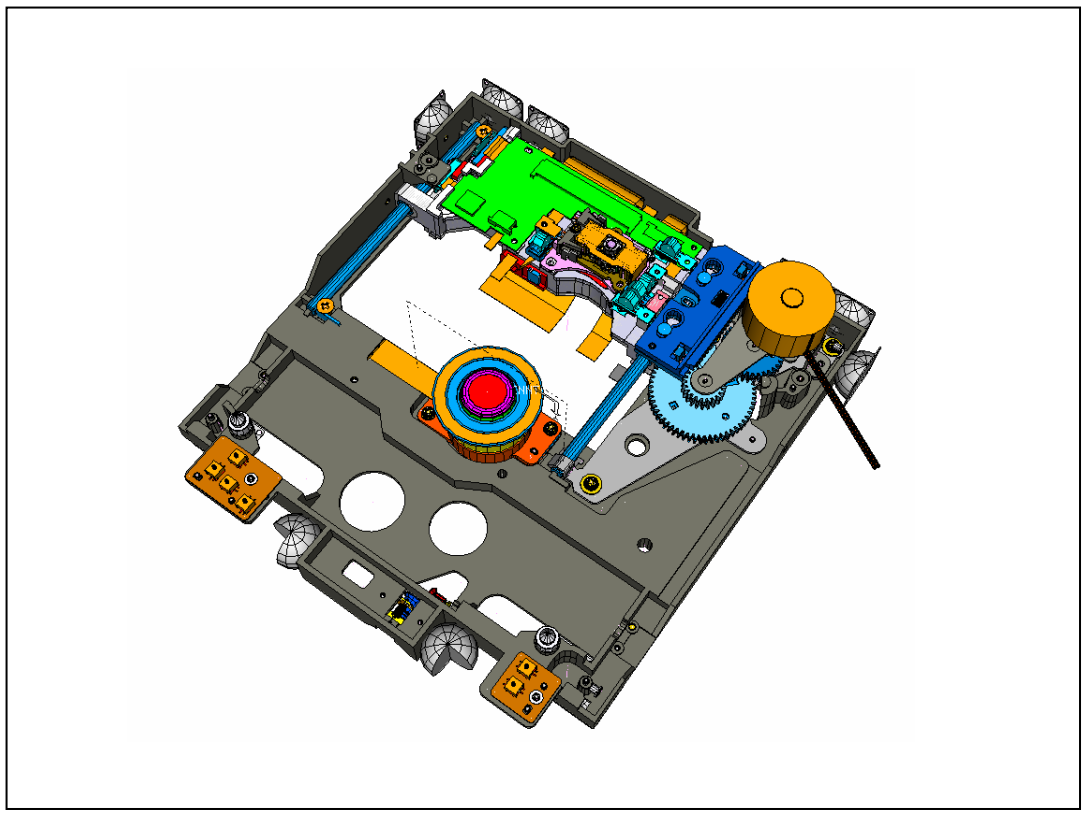
- What exactly is metadata?
  - Data about data.
    - Like the label on a tape, a book's cover & index, titles in a photograph album, or credits at the end of a movie.
  - Data can still be used without the metadata.
  - Metadata is useless on its own.
  - Adding metadata to the data makes it easier to use the data.

The technology behind XDCAM & Professional Disc

- What exactly is metadata?
  - Non real time metadata
    - Date.
    - Video and audio format.
    - Machine type and serial number.
    - UMID (Unique Material Identifier) each clip has unique ID.
    - Essence marks
    - Shotmarks and scene change data
  - Real time metadata
    - Timecode, GPS position.
    - Recovery (salvage) data.

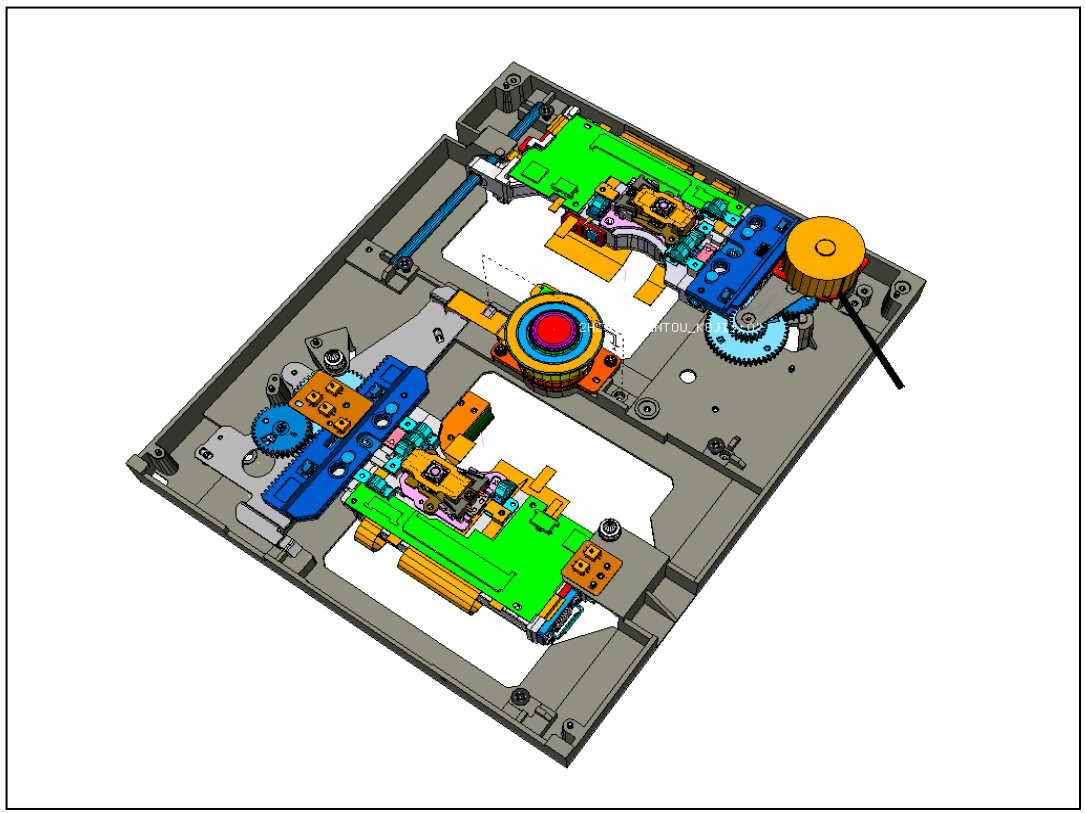
The technology behind XDCAM & Professional Disc

- What does ‘dual head’ mean?
  - Some XDCAM products are single head machines.
  - They have a single read/write head.



The technology behind XDCAM & Professional Disc

- What does ‘dual head’ mean?
  - Other XDCAM products have two read/write heads.
  - This allows high speed data transfer and fast clip change.



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Format comparison table

	Professional Disc	Blu-ray	Blue laser optical data storage
Recorded information	Audio, video broadcast streams Metadata + proxy video (lo- res video)	Audio and video streams	Data storage
Application	Professional video industry	Consumer	Professional data storage
Storage capacity	23GB	23GB/25GB/27GB	23 GB
Laser wavelength	405nm	405nm	405nm
Cartridge type	Double window	Single window	Double window
Data transfer rate	72Mbps (single head) 144Mbps (dual head)	36Mbps (single head)	72Mbps (single head) 144Mbps (dual head)
Disk diameter	120mm	120mm	120mm
Recording format	Phase change recording	Phase change recording	Phase change recording
Video recording format	DVCAM or MPEG IMX30, 40, 50	MPEG2 video	-
Audi recording format	Uncompressed 2 to 8 audio channels	AC3, MPEG1 layer 2	-
Video/audio multiplexing	-	MPEG transport stream	-
Data storage capacity	Space for metadata (scalable)	-	23GB

The technology behind XDCAM & Professional Disc

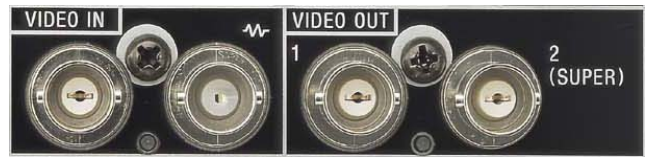
- How much material can you store on Professional Disc?
  - The achievable data rate to disk is 72Mbps per optical head.
    - 2 times faster than domestic Blu-ray.
    - 6 times faster than DVD.
    - (144Mbps for dual head equipment.)
  - 23.3GB per Professional Disc.
  - 45 minutes recording time at IMX50 with 8 channel audio.
  - 55 minutes recording time at IMX40 with 8 channel audio.
  - 68 minutes recording time at IMX30 with 8 channel audio.
  - 85 minutes recording time at DVCAM with 4 channel audio.

The technology behind XDCAM & Professional Disc

- How safe are Professional Disc recordings?
  - Professional Disc can be re-recorded at least 10000 times …
  - … and played back an unlimited number of times.
  - Disk and data shelf life is at least 50 years.
  - Disk contains integral defect management.
  - Advanced error correction.
    - (LDC) Long Distance Code + BIS (Burst Indication Subcode).
    - Similar to Reed Solomon.
  - Salvage markers recorded every 2 seconds.
    - If power is lost, recording is good up to the last salvage marker.
    - File is automatically completed using last good salvage marker.

The technology behind XDCAM & Professional Disc

- Various XDCAM video connections?
  - Analogue composite video.
    - Single BNC coaxial cable connection.
    - Acceptable quality. Analogue compressed.
    - Not good for post-production.

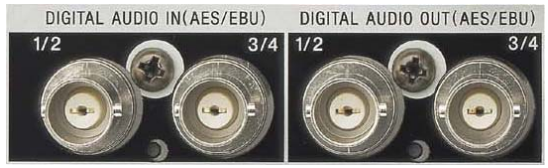


  - SDI.
    - Single BNC coaxial cable connection.
    - Uncompressed component digital video connections.
    - Up to 8 channels of embedded digital audio.
    - Superb quality.

The technology behind XDCAM & Professional Disc

- Various XDCAM audio connections?
  - Analogue audio.
    - Phono or XLR connections.
    - Good quality. Good for post-production.

  - Digital audio.
    - BNC connections. Serial data.
    - Up to 24 bit samples. 32, 44.1, or 48kHz sample rate (internally 48kHz).



  - SDI.
    - Embedded digital audio with the video.
    - 48kHz sample rate. 4 channels, 24 bits. 8 channels 16 bits.
    - Superb quality.

The technology behind XDCAM & Professional Disc

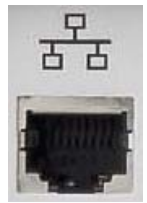
- Various XDCAM compressed material connections?
  - iLink AVC.

    - Common to DV equipment.
    - Point to point connection.
    - Single speed streaming connection for video and audio.
    - No metadata.

  - iLink FAM (File Access Mode).
    - New generation iLink connection based on SBP-2.
    - Point to point connection.
    - File based audio/video connection.
    - Speed independent transfer (slower or faster than play speed).
    - Metadata support.

The technology behind XDCAM & Professional Disc

- Various XDCAM compressed material connections?
  - Ethernet.



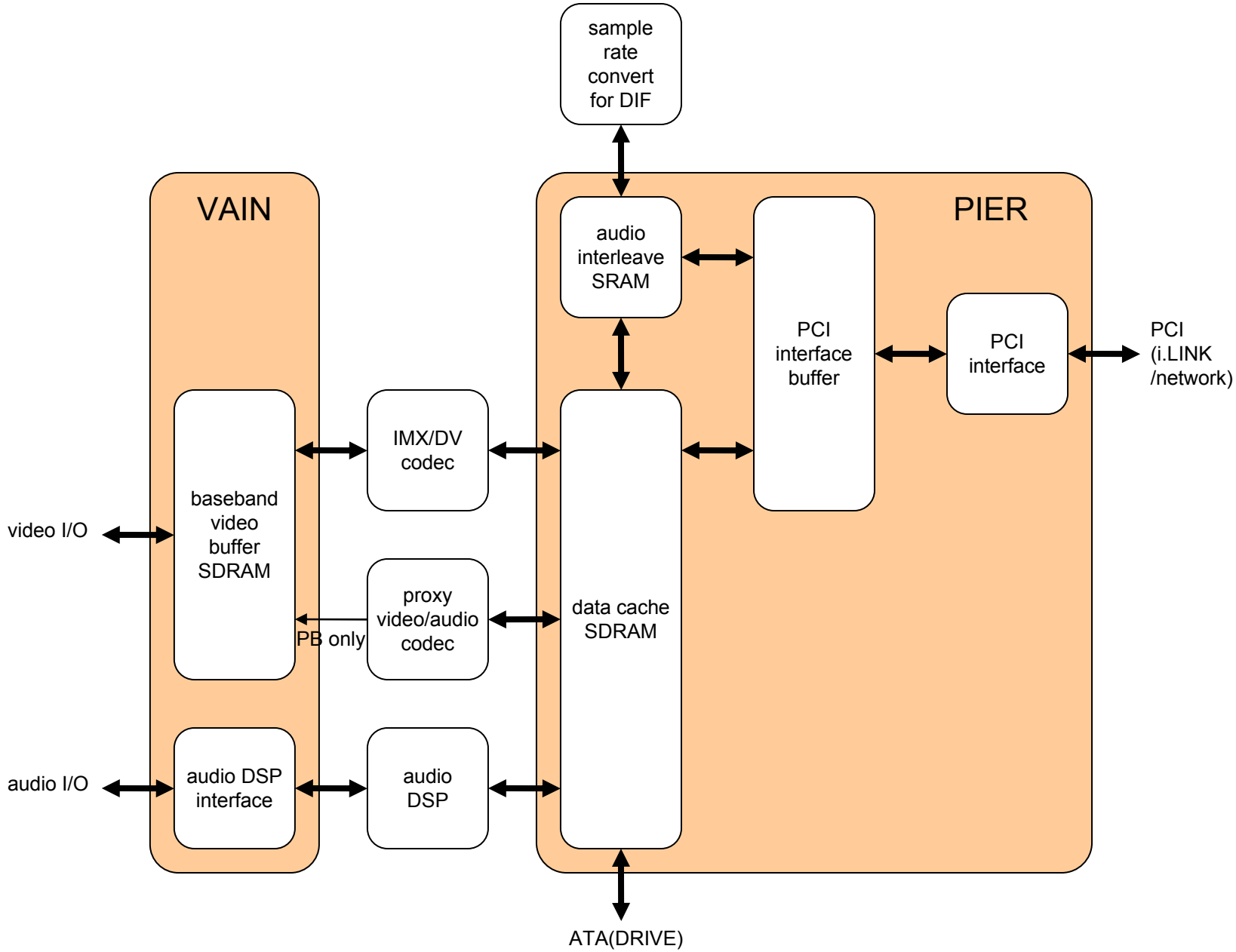
    - Common to most IT equipment.
    - Network connection.
    - Web based capability.
    - FTP (file transfer protocol) capability.
    - File based audio/video connection.
    - Speed independent transfer (slower or faster than play speed).
    - Metadata support.

The technology behind XDCAM & Professional Disc

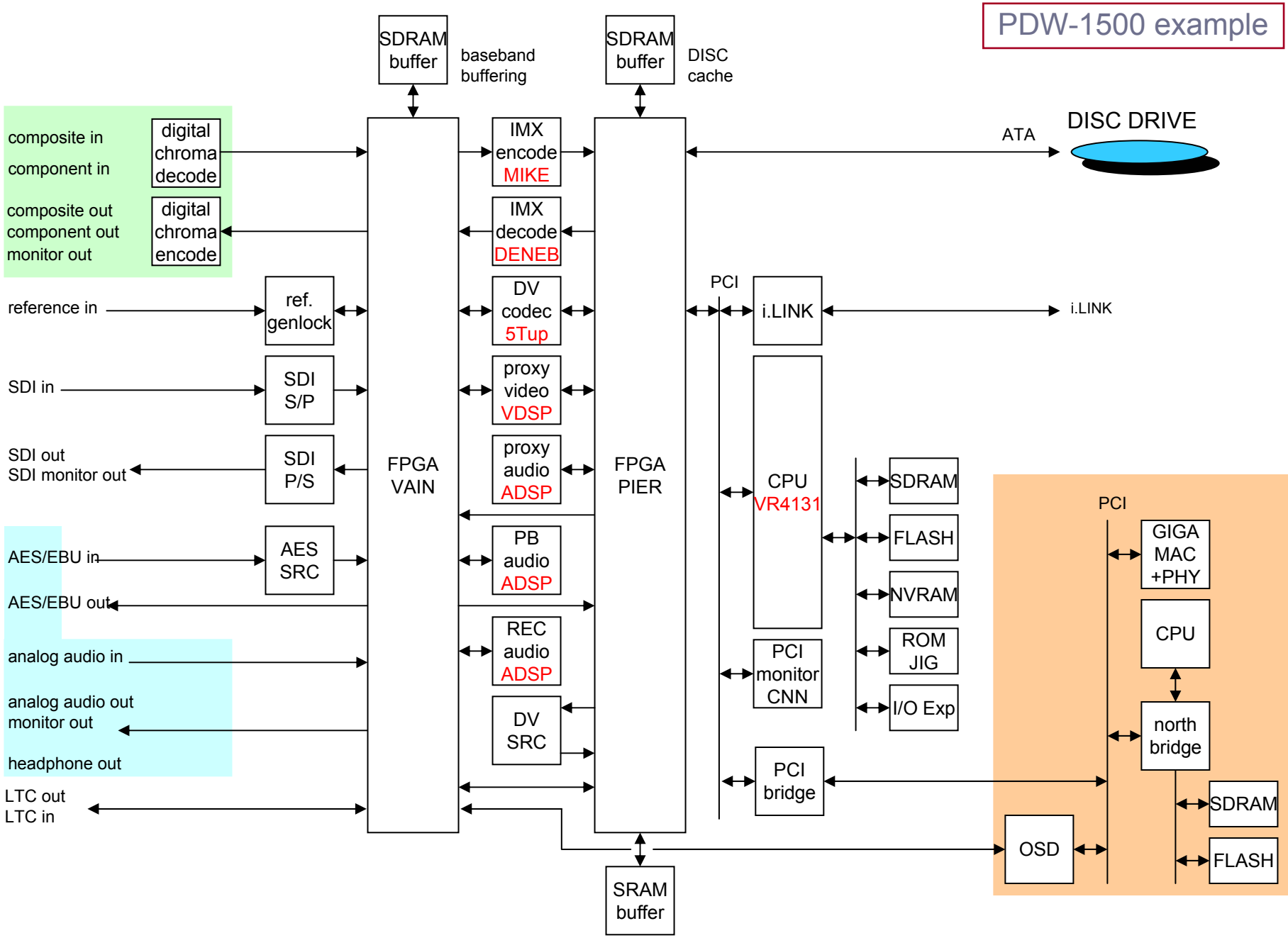
- What is the difference between IMX & DVCAM formats?
  - XDCAM can work in both IMX and DVCAM data modes.
  - IMX : High quality broadcast video.
    - 50Mbps, I frame only, 422p@ML MPEG2.
    - Seamless connection to MPEG production infrastructures.
    - Transcodable using the MSB-2000 Stream Bridge.
    - Perfect for post production, quality advertisement and drama.
    - IMX-30 : 30Mbps. IMX-40 : 40Mbps.
  - DVCAM : Basic broadcast quality video.
    - 25Mbps, frame based, 4:2:0 Europe (4:1:1 USA).
    - Lower bit rate than IMX.
    - Perfect for news gathering, documentaries, etc..

The technology behind XDCAM & Professional Disc

- The XDCAM Engine.
  - Responsible for processing record and playback processes.
  - Common to all XDCAM equipment.
  - Centred around two processing devices.
    - VAIN and PIER.
  - VAIN : video & audio input and output processing.
  - PEIR : Digital, ATA and PCI interfaces.
  - IMX/DV, proxy and audio codecs.


sample rate convert for DIF
VAIN
PIER
audio interleave SRAM
PCI interface buffer
PCI interface
PCI (i.LINK /network)
baseband video buffer SDRAM
IMX/DV codec
video I/O
proxy video/audio codec
PB only
data cache SDRAM
audio DSP interface
audio DSP
audio I/O
ATA(DRIVE)

PDW-1500 example



VAIN details

reference genlock	generate output sync from reference video , SDI and i.LINK
baseband video/SG buffering	video data buffering into SDRAM with signal generator
baseband video filtering	DV chroma(4:2:2⇔4:1:1/4:2:0) proxy video(4:2:2⇔1:1:0) YADD filter ESR filter
video process control	setup/level/hue control
video process interface	IMX/DV(w/shuffling control)/proxy video interface
V-blank data decode/encode	VITC, closed caption, VBID/WSS, UMID, essence mark … encode/decode on video signals
SDI video/audio encode/decode	SDI(REC656) video encode/decode
AES/EBU encode/decode	AES/EBU format audio encode/decode
audio process interface	audio DSP/PIER I/F
audio PLL control	・ generate audio reference clock from video clock ・ generate audio clock for AV/C interface ・ generate audio clock for AES/EBU input(32kHz,44.1kHz…)
AES/EBU input, sample rate convert	sample rate convert from AES/EBU input to rec audio
baseband video data selector	OSD video/character interface baseband video input/output control
LTC reader/generator	Encode/decode LTC time code
host interface	・ memory/register interface from/to PIER ・ other peripherals(u-com,adjust device,I2C…) interface

SONY

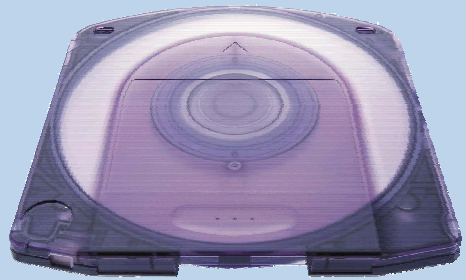
The technology behind XDCAM

PIER details

compressed video data cache buffering	Buffering video stream with MXF formatting
DISC file formatting	Formatting stream into RUB sector
audio process interface	Buffering audio data
ATA interface	DRIVE interface
DV sample rate convert interface	Sample rate convert for i.LINK AV/C
DIF formatting	Formatting DV data into i.LINK/MXF
MXF formatting	Formatting IMX data into MXF
host interface	Interface from/to IMX device, DSP, PIER & VAIN
PCI interface	Interface from/to PCI devices(iTRON,Linux CPU, LINK…)

You make it a Sony

The XDCAM product range



XDCAM product range - Camcorders

- PDW-510P
  - DVCAM material recording with metadata.
    - 25Mbps DV based recording quality.
    - Full XDCAM metadata support.
  - PowerHAD EX CCDs.
    - Advanced hole accumulation diode sensors.
    - Full frame micro-lens technology.
  - 16:9 / 4:3 switchable.
    - Full frame 16:9 CCDs providing broadcast quality at both 16:9 and 4:3.
  - 12 bit A-D conversion.
    - Extra resolution allows greater control of contrast and mid tones.

XDCAM product range - Camcorders

- PDW-510P
  - 10 second Picture Cache Recording.
    - Allows for quick recording start when a disc is loaded …
    - … and recording prior to pressing the Record button.
  - 25P progressive mode recording for filmic look.
    - 25 frames per second progressive mode.
  - Proxy recording
    - Automatic lo-res audio and video recording.

XDCAM product range - Camcorders

- PDW-510P
  - Advanced DSP.
    - 30 bit internal DSP for non-rounded keys …
    - … and high precision processing.
    - Multi-Matrix function.
    - Electronic soft focus.
    - Tru-eye processing.
    - Selectable gamma tables.
    - Triple Skin-Tone-Detail control.
    - Colour temperature control.

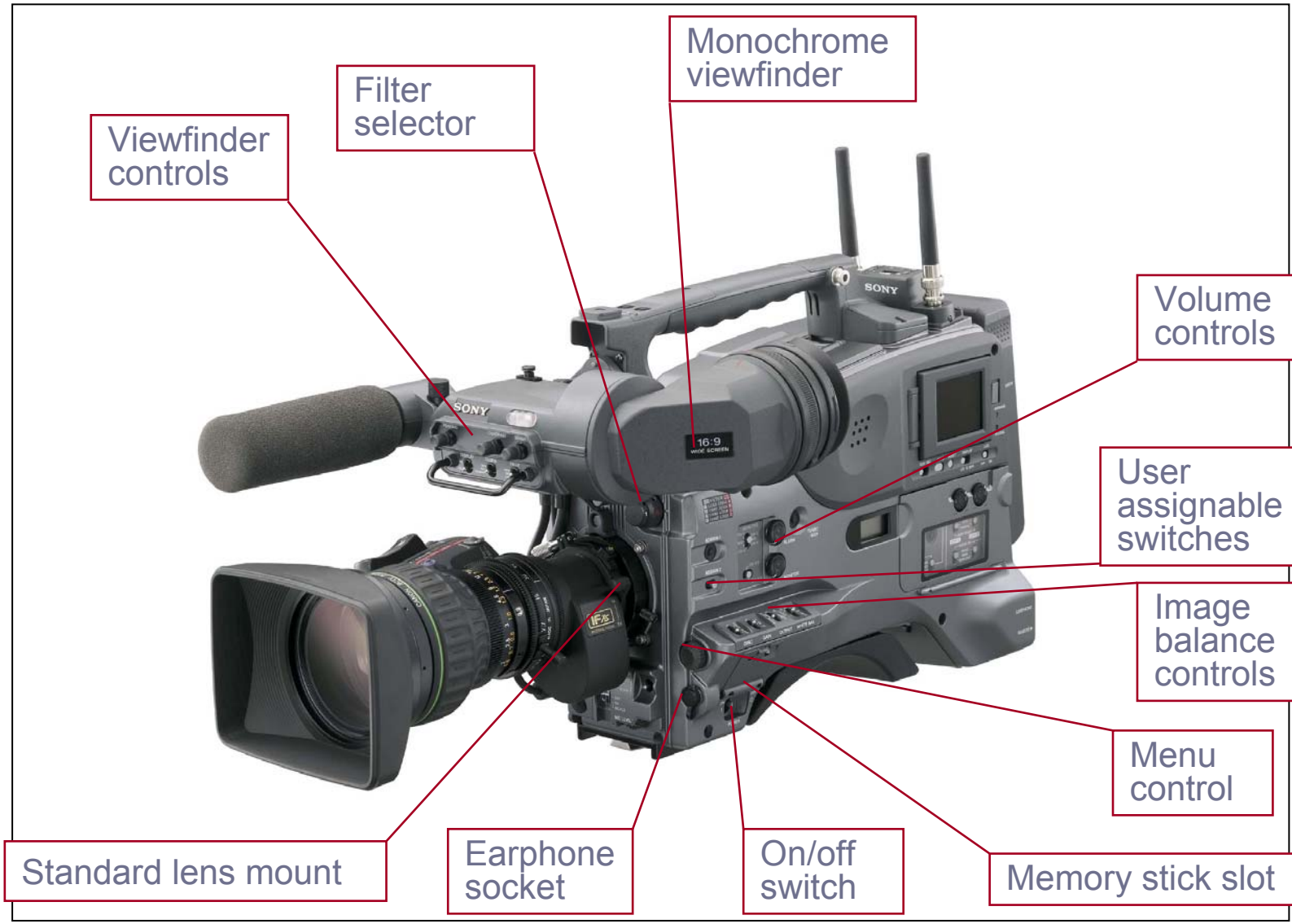
XDCAM product range - Camcorders

- PDW-510P
  - Built-in neutral density/colour compensating (ND/CC) filter.
  - Low light shooting capability.
    - Slow shutter for longer than frame rate recording.
    - Turbo Gain for +48dB gain boost.
  - Conventional broadcast cameraman operation.
  - Conventional lens, battery and power supply mounting.
  - Rotatable 2.5” colour LCD screen.
    - Useful as supplementary viewfinder …
    - … clip viewer and organiser …
    - … and camcorder setup & maintenance.

XDCAM product range - Camcorders

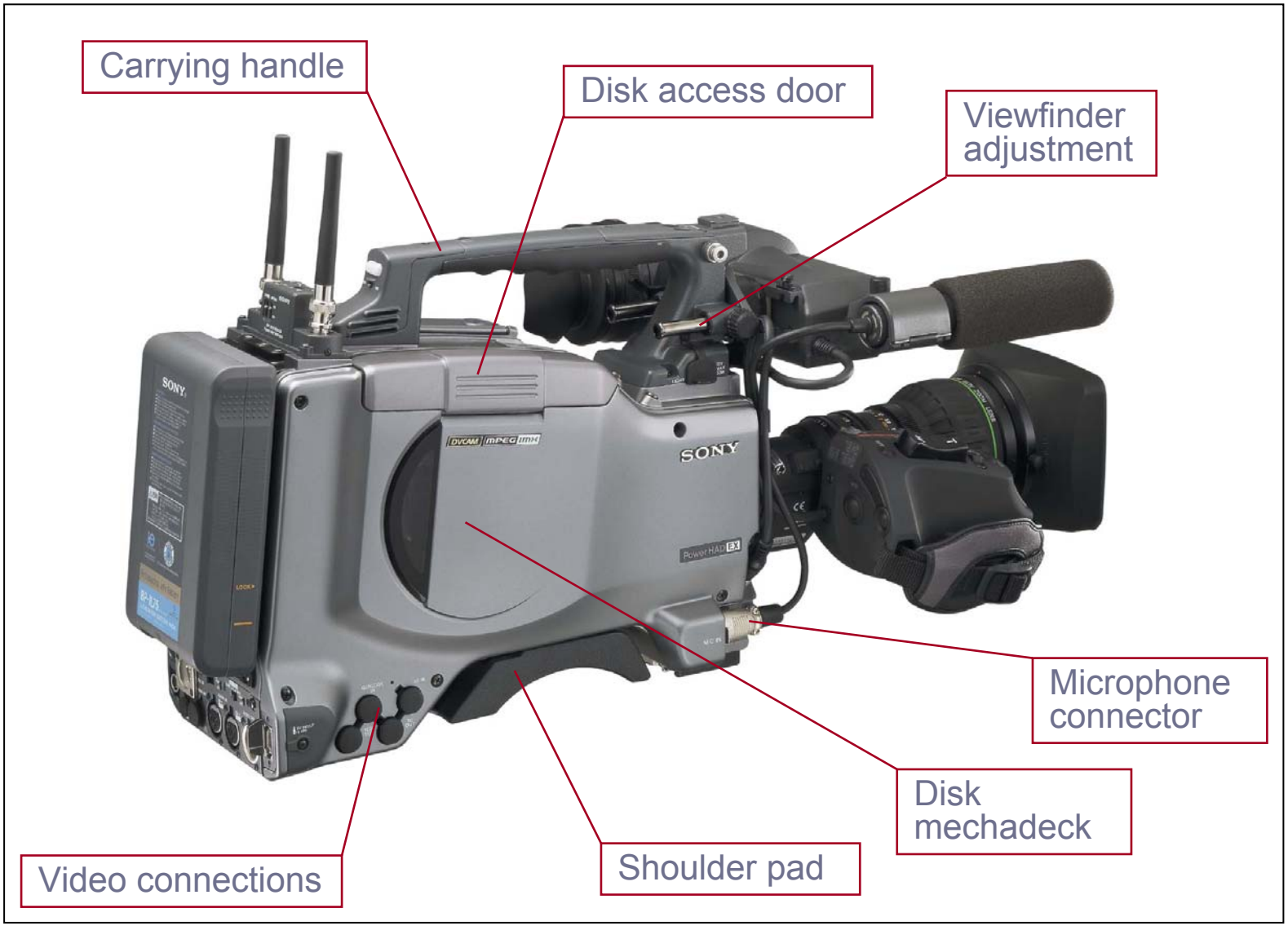
- PDW-510P
  - iLink connection for fast clip transfer.
    - Switchable AVC or FAM modes.
  - Added controls for clip management.
    - Thumbnail search.
    - Scene selection operation.
  - Optional wireless microphone module.
  - Optional ethernet module.

XDCAM Camcorders : PDW-510P



XDCAM Camcorders : PDW-510P

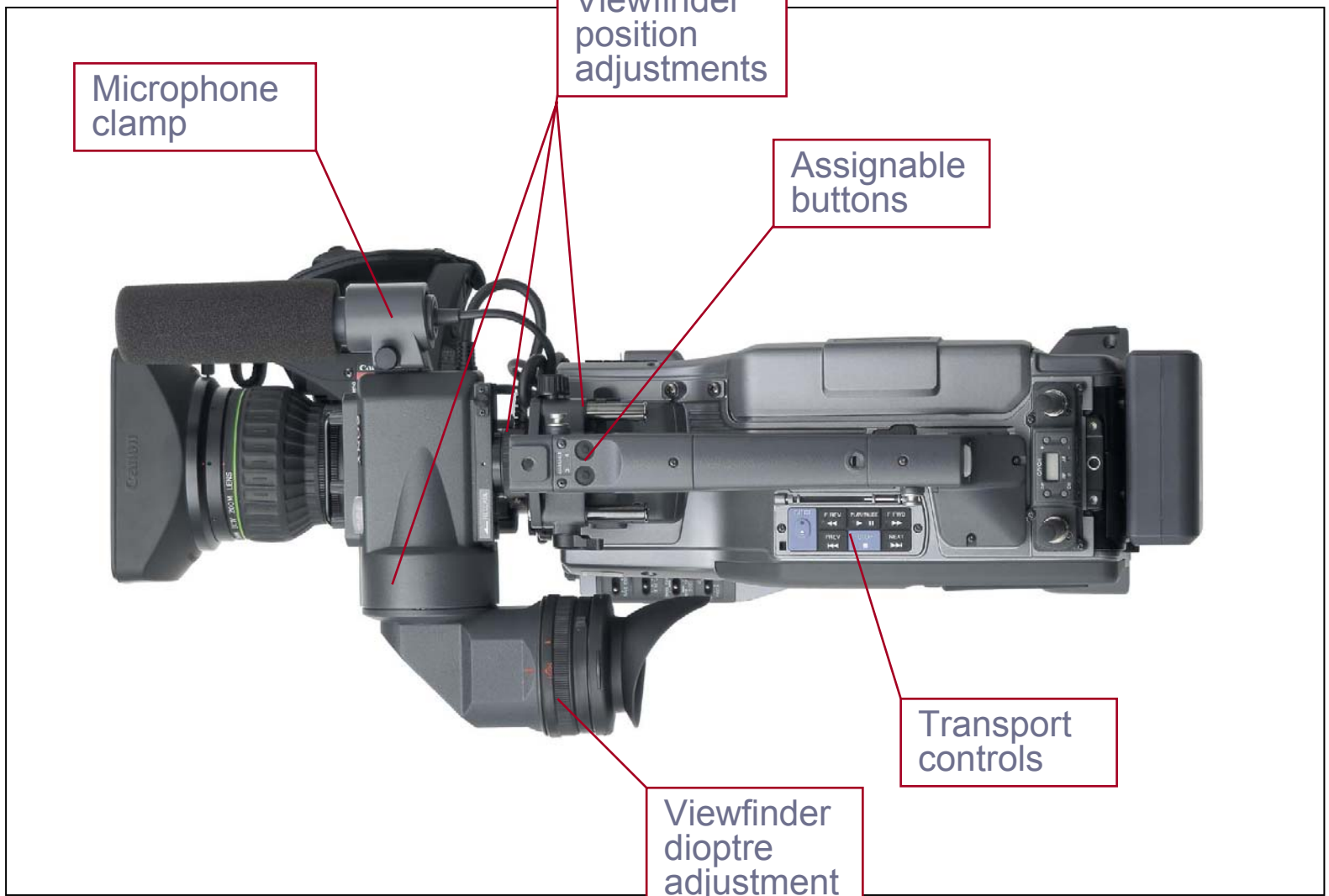
XDCAM Camcorders : PDW-510P



XDCAM Camcorders : PDW-510P

XDCAM Camcorders : PDW-510P

- PDW-510P



XDCAM product range - Camcorders

- PDW-510P

XDCAM product range - Camcorders

- PDW-530P
  - Identical to PDW-510P …
  - … with added IMX recording capability …
  - … and built-in dual optical filter.

Camcorders – Spot the difference

Format label

PDW-510 : DVCAM

PDW-530 : DVCAM & MPEG IMX

Filter wheels

PDW-510 : Single filter wheel

PDW-530 : Dual filter wheel

XDCAM product range - Camcorders

- What you get in the box.

XDCAM product range - Decks

- PDW-V1 Mobile Deck
  - Portable player.
  - Flip-up panel with colour image display and status display.
  - Standard studio VTR type controls with shuttle/jog dial.
  - DVCAM output capability from IMX material.
  - Full 8 channel audio monitoring.
  - Ethernet and iLink connectivity (recording, playback & control).
  - SDI digital, or analogue video and audio playback.
  - VGA output.
  - Battery or mains operation.

XDCAM product range - Decks

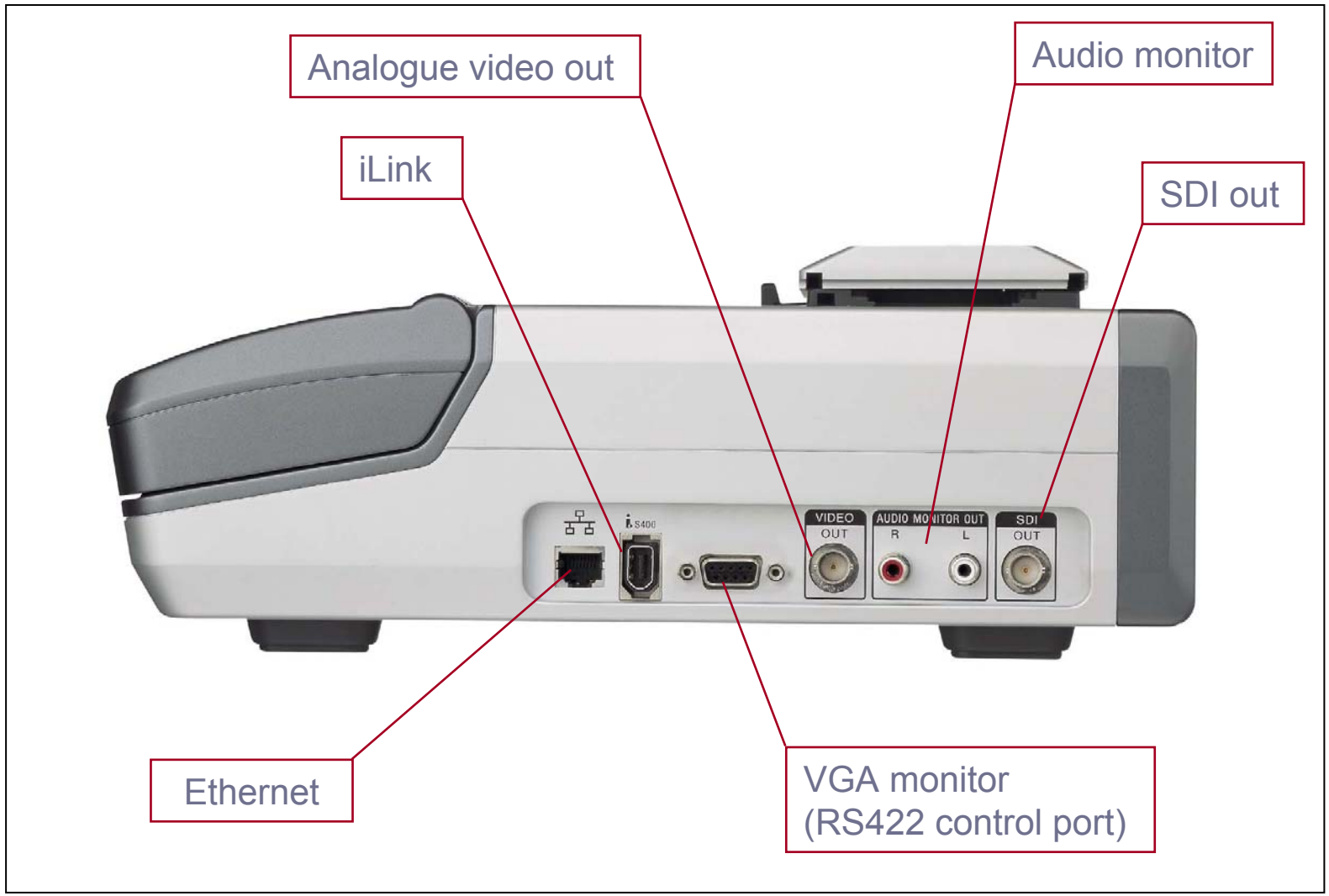
- PDW-V1 Mobile Deck

XDCAM product range - Decks

- PDW-V1 Mobile Deck

XDCAM product range - Decks

- PDW-V1 Mobile Deck



XDCAM product range - Camcorders

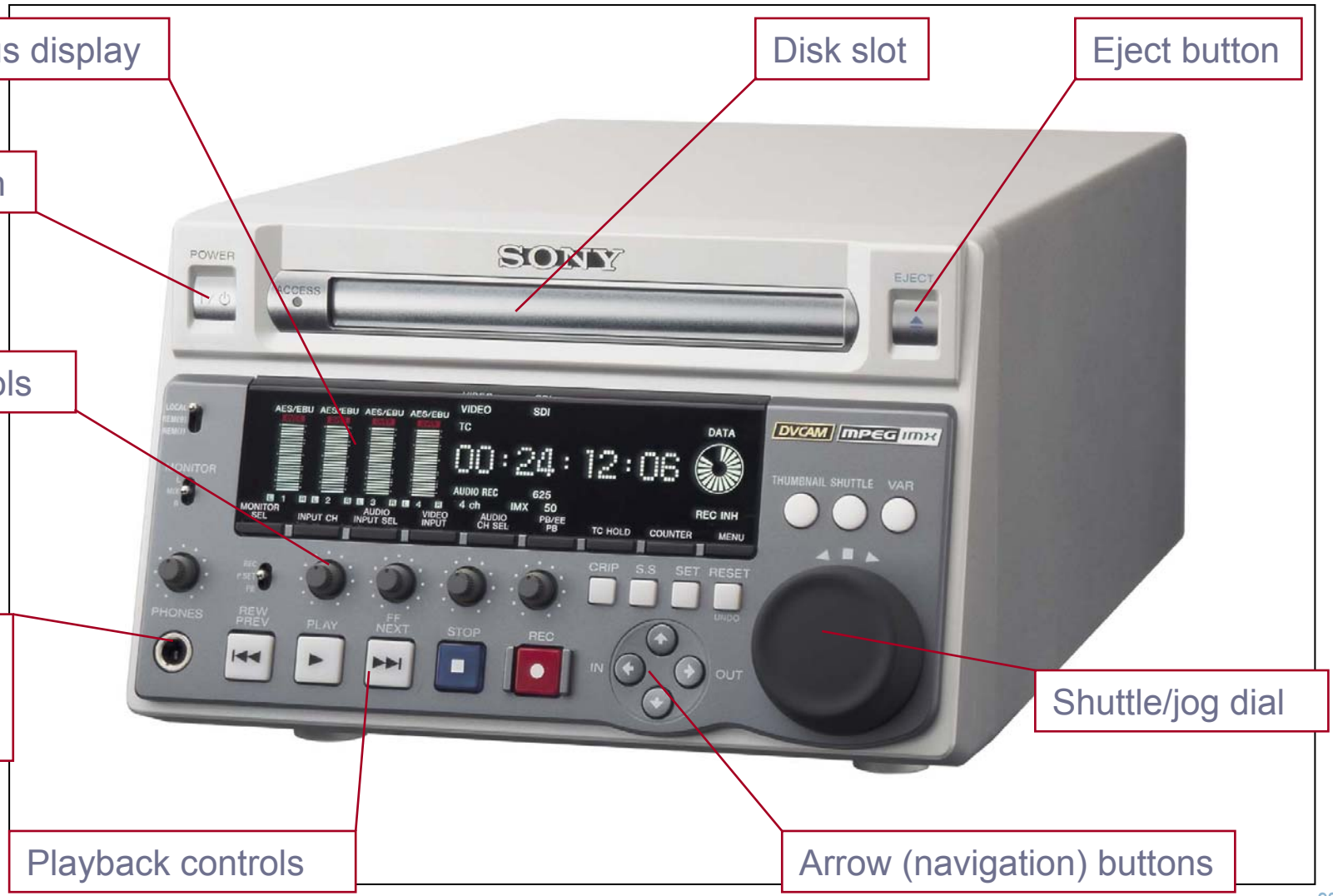
- What you get in the box.

XDCAM product range - Decks

- PDW-1500 Compact Deck
  - DVCAM, IMX and proxy recording / playback.
  - Dual optical head for 2.5x IMX & 5x DVCAM transfer speed.
  - Recording and transfer via iLink and Gigabit connection.
  - Metadata recording, handling, and transfer.
  - Voice-over recording.
  - Thumbnail search and scene selection.
  - Standard studio VTR type controls.
  - Standard video and audio connections.

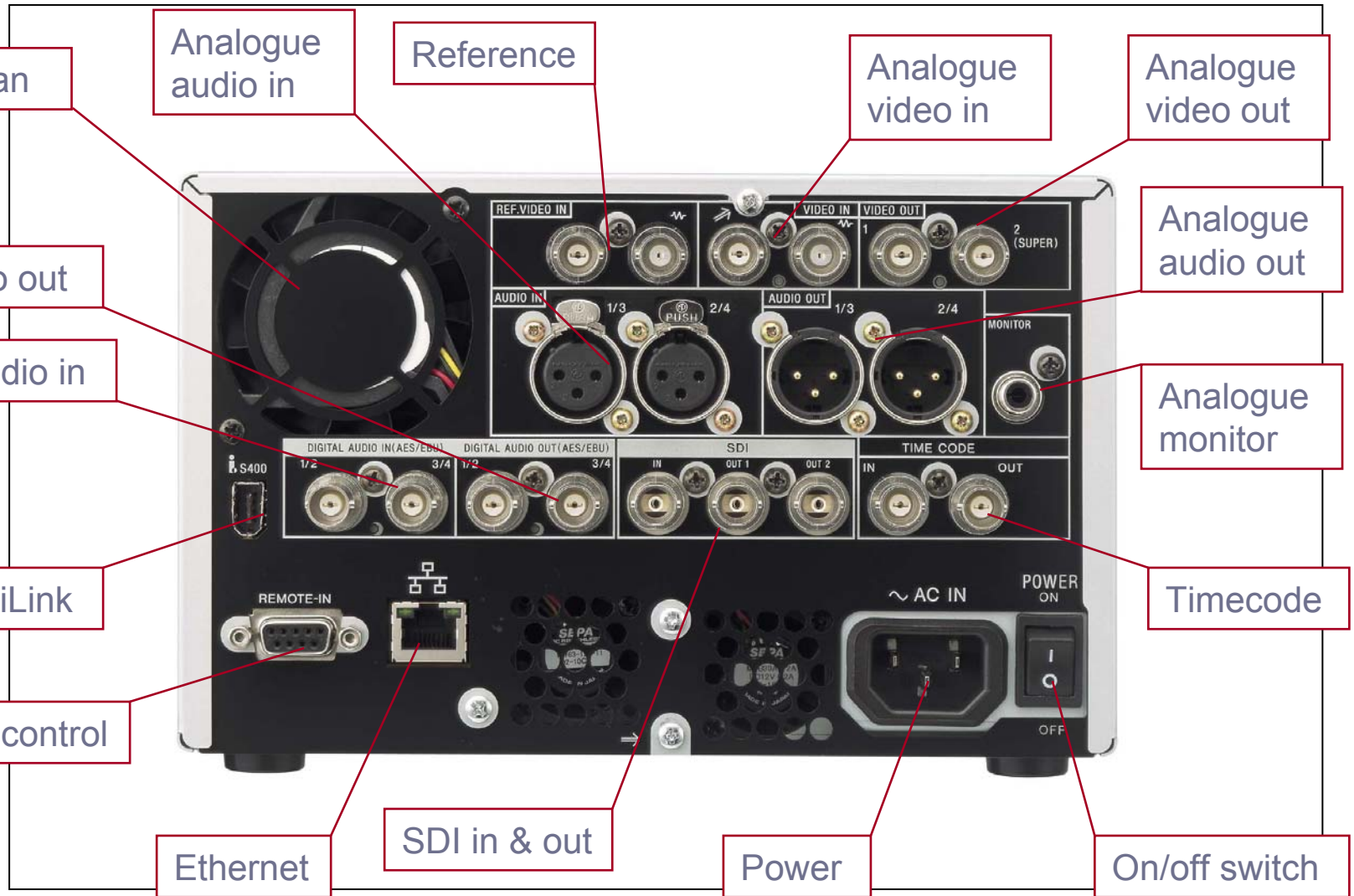
XDCAM product range - Decks

- PDW-1500 Compact Deck



XDCAM product range - Decks

- PDW-1500 Compact Deck



XDCAM product range - Camcorders

- What you get in the box.

XDCAM product range - Drives

- PDW-D1 

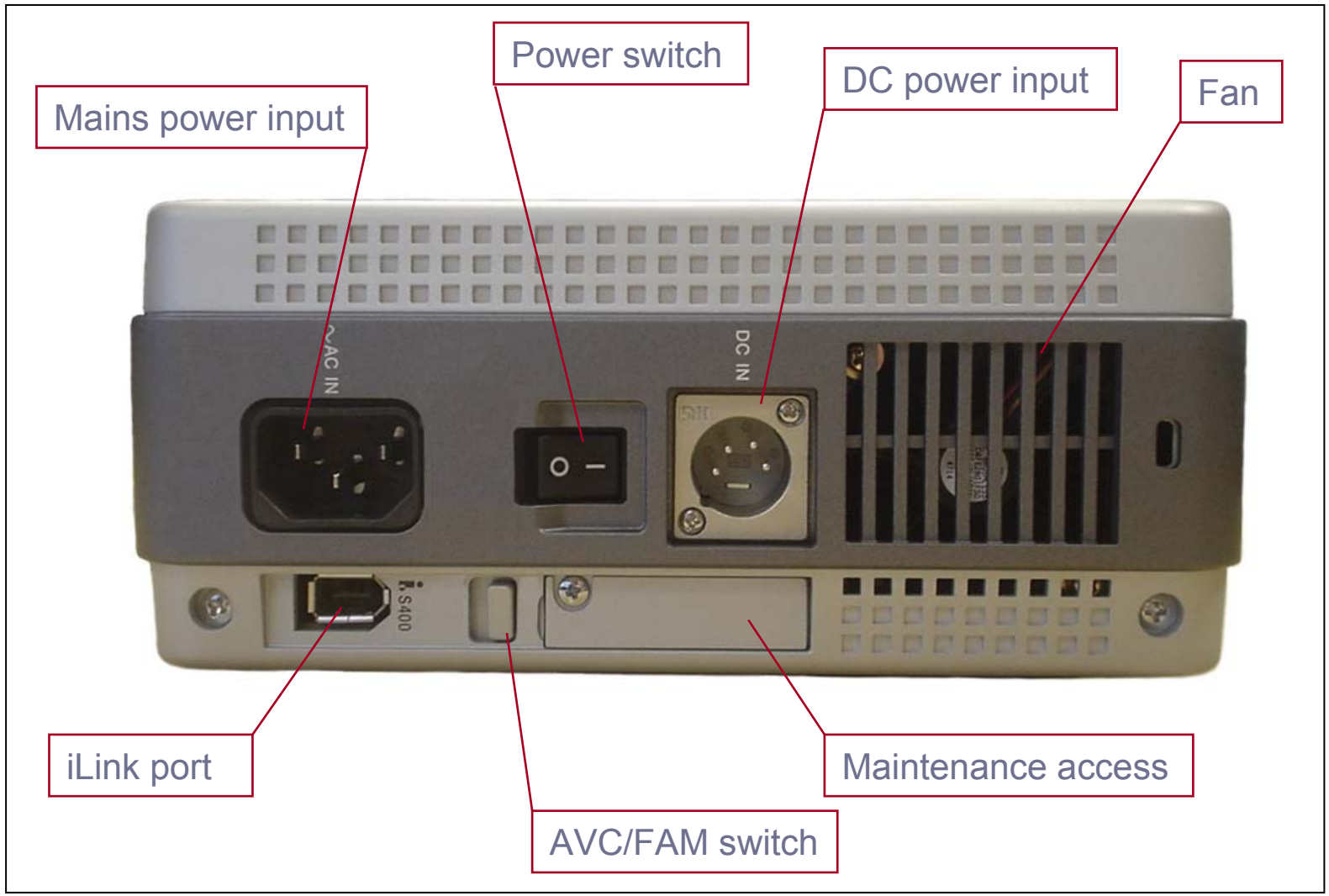
  - Basic portable desktop XDCAM drive.
  - Recording and playback through iLink port.
  - AVC or FAM access.
  - Powered by mains or standard camcorder power supply.

XDCAM product range - Drives

- PDW-D1

XDCAM product range - Drives

- PDW-D1



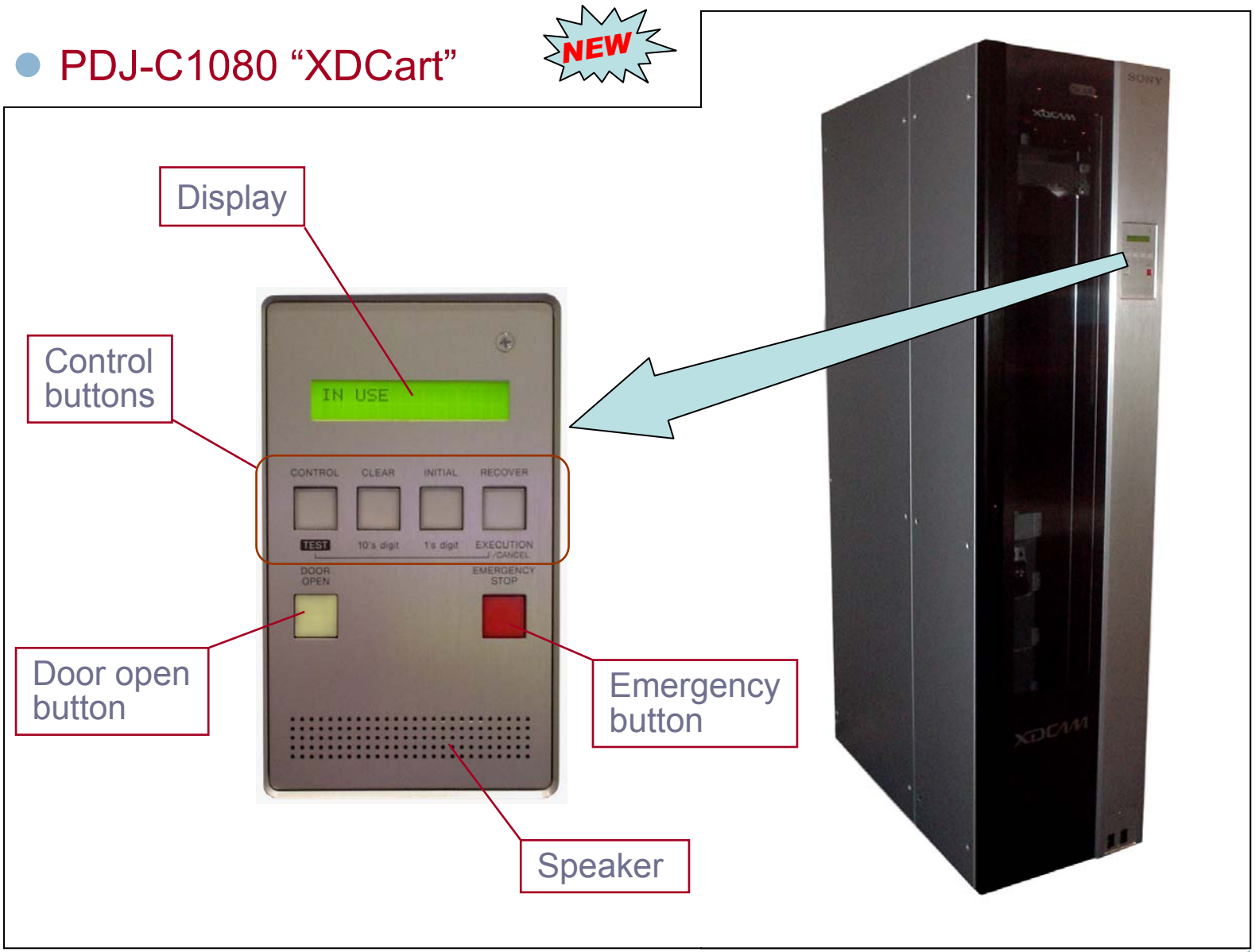
XDCAM product range – Cart machines

- PDJ-C1080 “XDCart”. NEW
  - XDCAM robotic disk storage.
  - 80 disc capacity.
  - Maximum 4 PDW-1500 decks.
  - Replacement for Flexicart.
  - All the advantages of XDCAM.
  - Same control protocol (VCC).
  - Industry standard support.
  - GPI control.
  - Router control.
  - Ethernet control.

XDCAM product range – Cart machines

- PDJ-C1080 “XDCart”

NEW



XDCAM product range – Cart machines

- PDJ-C1080 “XDCart”

NEW

RS422 port

XDCAM deck ports

RS232 port

Router port

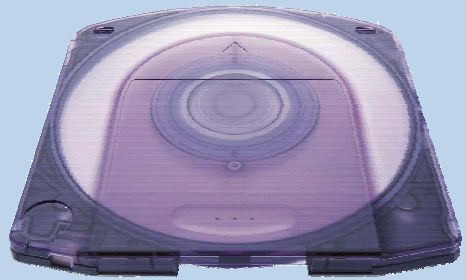
GPI port

Sub/main indicators

Ethernet ports

Reference ports & term

Supporting software



XDCAM product range - Software

- New for version 1.1. Three separate applications. NEW


PDZ-1


PDZ-1 DirectMode


MXFProxyViewer

  - PDZ-1 (similar to previous versions).
  - PDZ-1 Direct Mode – Direct access to disc material.
  - MXFProxyViewer – Simple viewer for MXF material.
- New FAM driver. NEW
  - File Access Mode driver for OEM applications.
  - Included on CDROM with PDZ-1 software package.

PDZ-1 application

- Reads lo-res proxy clips and metadata from XDCAM disk.
- Write Clip List files to XDCAM disk.
- Import and export EDLs.

PDZ-1 Direct Access application

- Operates in a similar way to PDZ-1 application.
- Works directly on disc.
- Disc appears as another drive on the PC.
- No Read or Write from ProDisc required.
- ClipLists saved directly to disc.
- Other files can be saved to the General folder.

Disc Information Window

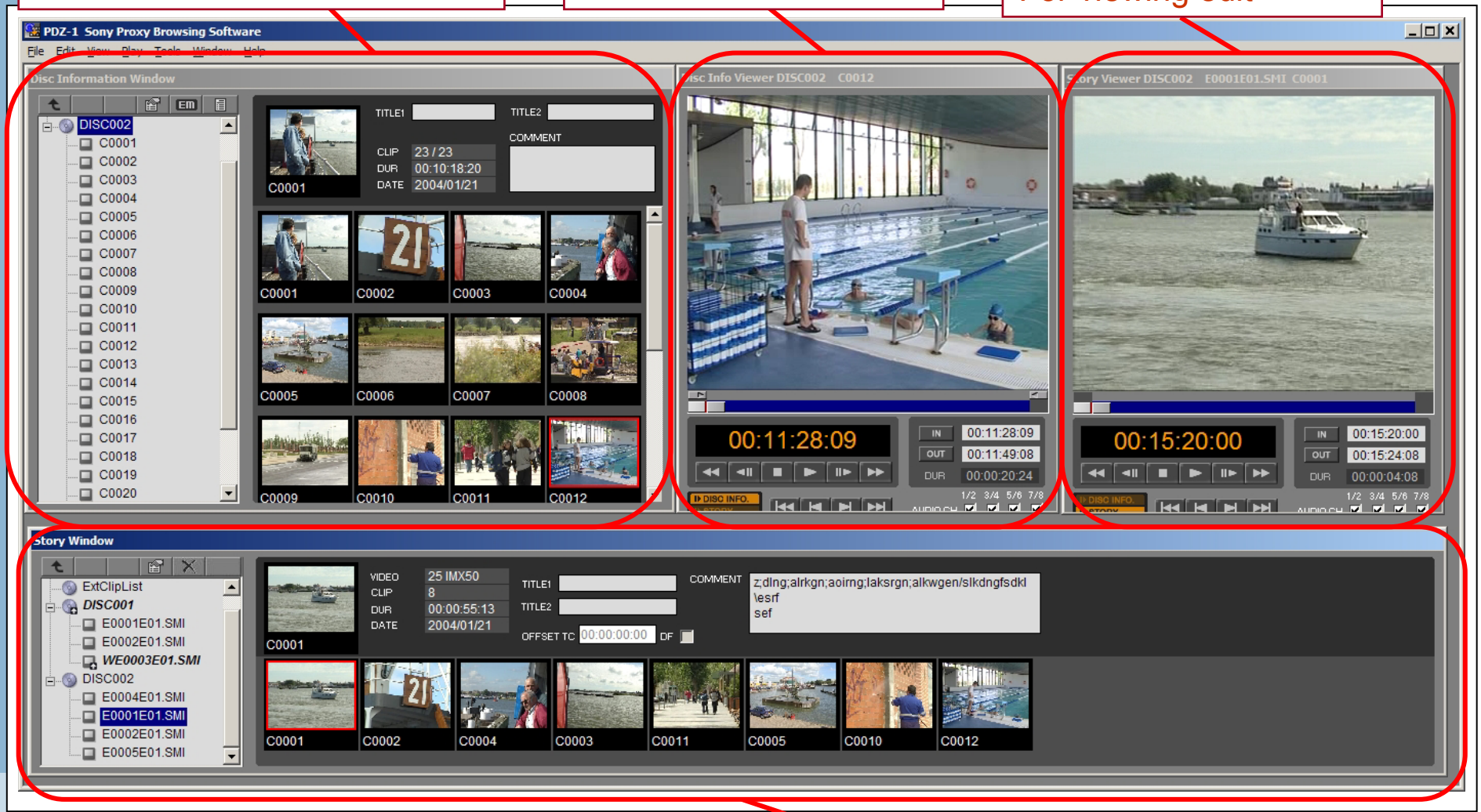
For studying the contents of the Professional Disc

Disc Info Viewer

For viewing the clips on the disk

Story Viewer

For viewing edit

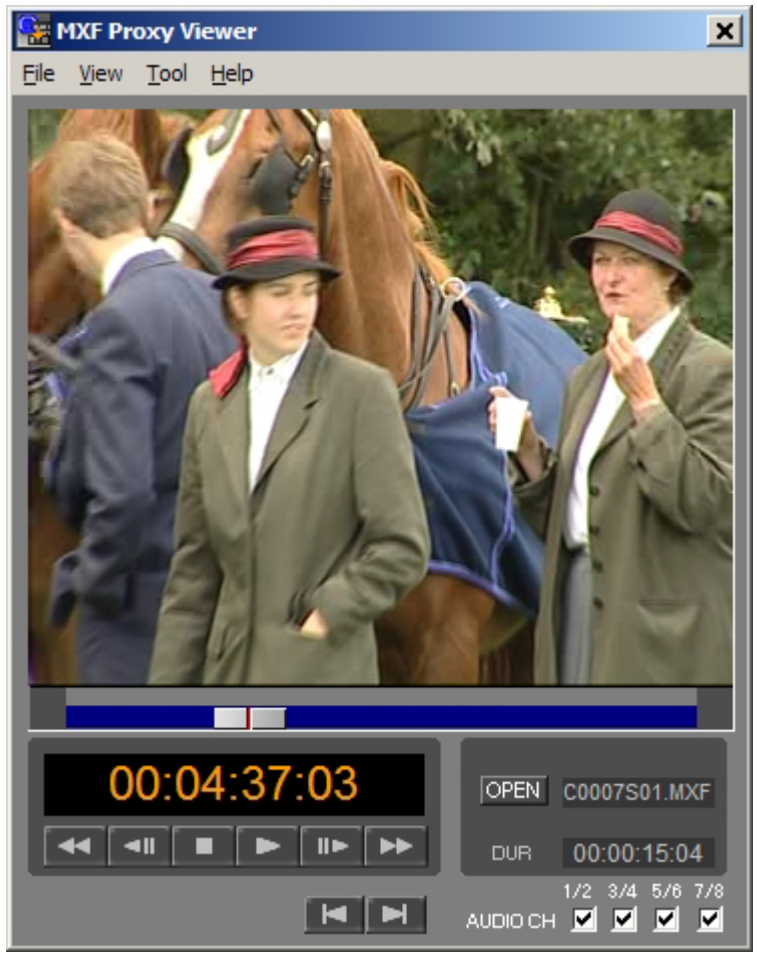


Story Window

Contains timeline for editing clips together.

MXF Proxy Viewer application

- Simple viewer for MXF material.
- All the controls from PDZ-1 viewers.



XDCAM product range - Software

- XPRI MetaStation
  - Designed for network setup with central store.
  - Editing of lo-res proxy or hi-res original material.
  - Full XDCAM metadata support.

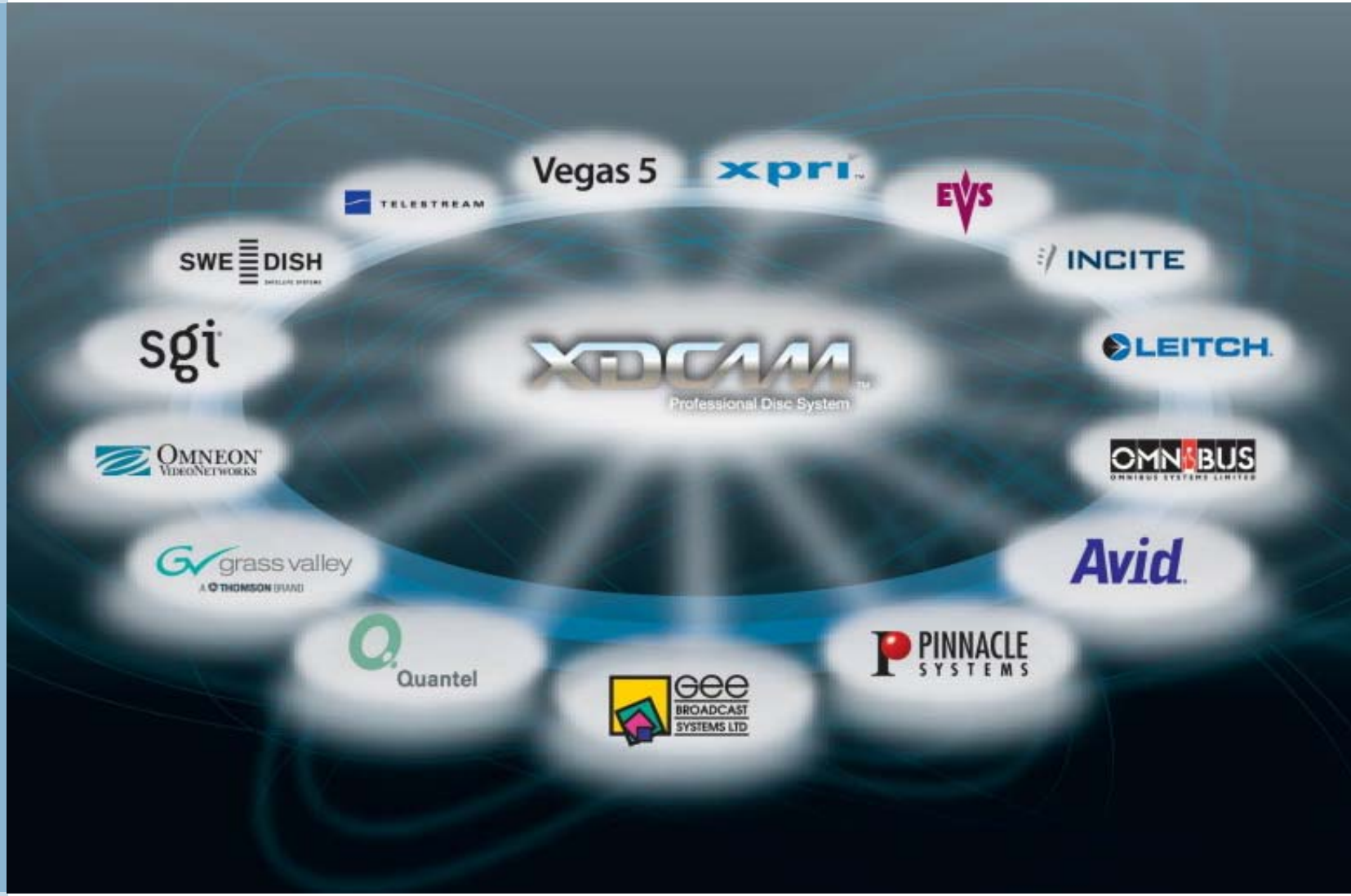
XDCAM product range - Software

- XPRI MobileStation
  - Designed for stand-alone use connected to XCAM deck.
  - Editing of lo-res proxy or hi-res original material.
  - Full XDCAM metadata support.

Picture

XDCAM 3rd party support

- XDCAM software development kit (SDK) provided.



Section 6 : Supporting software

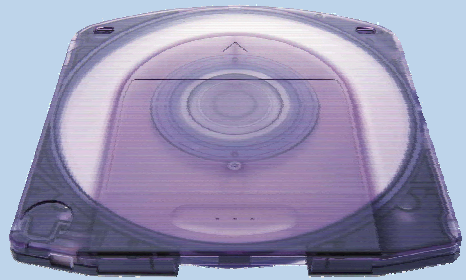
You make it a Sony

XDCAM 3rd party support

- XDCAM Interoperability Guide on www.sonybiz.net/xdcam.

You make it a Sony

Version 1.1 upgrade



Version 1.1 upgrade

- Version 1.0 released end February 2004.
- Version 1.1 released mid October 2004.
- Upgrade procedures can be done by local representatives.
- Upgrade software package obtained from Sony.
- Procedure can be performed using web interface.
- Camcorders can be updated via MemoryStick.

Version 1.1 highlights

- iLink File Access Mode (FAM).
  - Disc appears as a new drive on the PC.
  - Folder and file access and management from the PC.
  - Direct editing of the disc from the PC.
- Network adaptor for the XDCAM camcorders.
  - Allows XDCAM camcorders to be connected to a network.
  - Allows FTP access to and from XDCAM camcorders.

Version 1.1 highlights

- Picture cache recording.
  - Allows recording to start prior to pressing the record button.
- Improved recording capabilities for camcorders
  - Interval recording, record preview and retake.
- Improved alarm detection.
  - Dew sensor, fan rotation, disc load/eject time out, etc..
- Dolby E audio input and output for PDW-1500.
  - Via AES/EBU ports.
- Non-standard composite input for PDW-1500.

Version 1.1 highlights

- Full salvage.
  - Allows disks to be salvaged on another XDCAM machine.
- Thumbnail position change within XDCAM equipment.
- Better scene selection and Clip List playback.
- Alarm & error display for XDCAM camcorders.
- New essence marks for XDCAM camcorders.
  - Flash, filter change, shutter speed change, gain change, etc..
- Extra maintenance menus.
  - Further service capabilities for engineers and technicians.

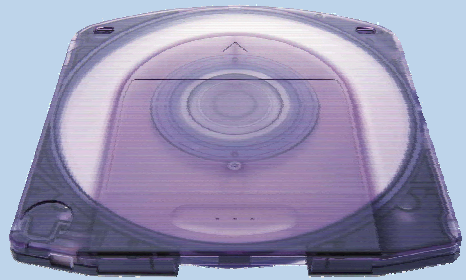
Version 1.1 further details

- Canon serial lenses may not allow manual iris control.
  - Only shows up on version 1.1 XDCAM camcorders.
  - This affects Canon J17 series lenses.
  - Can be fixed with simple Canon firmware update.
- SNMP network functionality after version 1.1.
- GPS functionality for camcorders after version 1.1.

PDZ-1 version 1.1 upgrade procedures

- Preliminary PDZ-1 version 1.1 Beta released.
- Version 1 to version 1.1 upgrade procedure.
  - Use PDZ-V1100ToV110UpdateModule.zip.
  - Simple upgrade procedure.
    - Upwrap .ZIP file and run Setup.EXE.
- Version 1.1 Beta to version 1.1 upgrade.
  - Remove ProDisk module in Add/Remove Programs.
  - Then perform same operations as v1 to v1.1 procedure.

Workflow



Conventional production workflow

- Material acquired from camcorders or archive.
- Tape used in most acquisitions.
  - Tape records an undefined stream.
- Material transferred via linear synchronous connections.
  - Video transferred via composite or component.
  - Audio transferred via analogue or AES/EBU.
  - SDI used to transfer video & audio in many environments.
- Linear editors used with tape.
  - 2 players, 1 recorder, edit controller and mixer.
- Final edit often recorded to conventional linear tape.

Changes in conventional workflow

- Steady change from linear to non-linear editing.
  - Still some conventional linear editing.
  - Most studios have installed computer based non-linear editing.
  - Non-linear editing is file based.

Changes in conventional workflow

- Increased requirement for metadata.
  - Clip information, thumbnails, time codes, etc. are more important.
  - Metadata is more easily supported with file based material.

Changes in conventional workflow

- Final edits are increasingly remaining as files.
  - Dropping to linear tape is becoming less popular.
  - Some final edits remain on hard disk as EDL + original material.
  - Tape is still being used, but to store file based material.

Problems with present workflows

- Mixture of technologies slows workflow.
- Reasons :-
  - Mix of linear & non-linear, synchronous & asynchronous.
  - Acquisition tapes (rushes) are converted to files (digitised).
  - Material transferred on tape and via IP.
  - Final programmes sometimes converted back to linear tape.

Problems with present workflows

- Organisation of material is often difficult.
- Clips and segments difficult to find on tape.
- Time wasted searching for material.
- A lot of important material may go unnoticed.
- Reasons :-
  - Inconsistent use of metadata.
  - Use of metadata not properly understood.
  - Islands of non-standard metadata.
  - Metadata transfer not always easy.

The XDCAM workflow features

- All XDCAM material is stored as files.
  - All XDCAM clips are recorded in the camcorder as files on disk.
  - Lo-res AV proxy is also recorded to disk automatically.
- Metadata added at source.
  - All XDCAM clips have metadata added automatically in camcorder.
  - Metadata includes dates, times, labels, markers, thumbnails, etc..

The XDCAM workflow features

- Metadata is consistent throughout production workflow.
  - Same metadata recorded in camcorder is used in editing.
  - Metadata is retained for all final edits as well.
- Scene selection data can reside on disk with material.
  - This data can be made to play only selected clips …
  - … in the order they were selected.

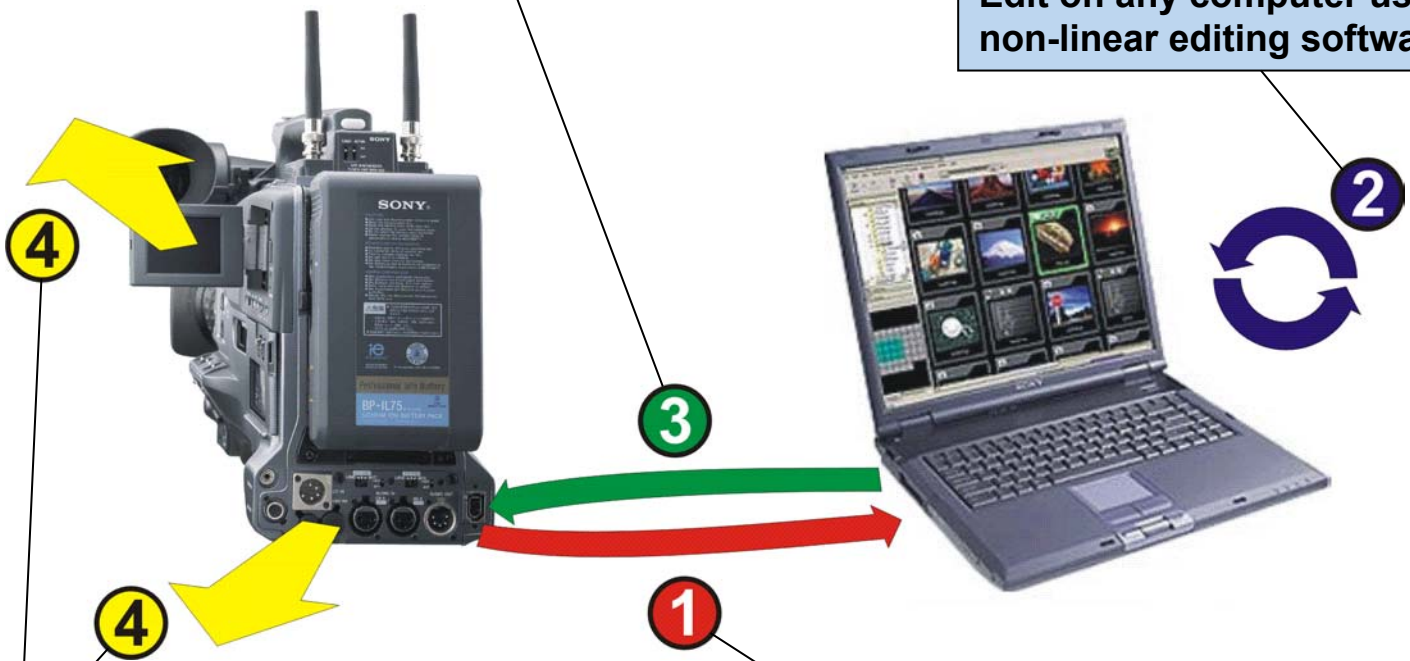
Advantages of XDCAM workflow

- Low media running costs.
  - Using Professional disk keeps media costs similar to tape.
  - Media can be lent, borrowed and stored with impunity.
  - A shoot can use extra disks without impacting costs.
- Fast operation.

Workflow scenario 1 – Simple DVCAM edit

- Camcorder connected to computer via iLink port.
- DVCAM clips played out to computer.
  - Hi-res clips are transferred
- Edits performed on hi-res clips using standard software.
- Final edited programme recorded back to Professional Disc.
- Final edited programme can be played back on camcorder.

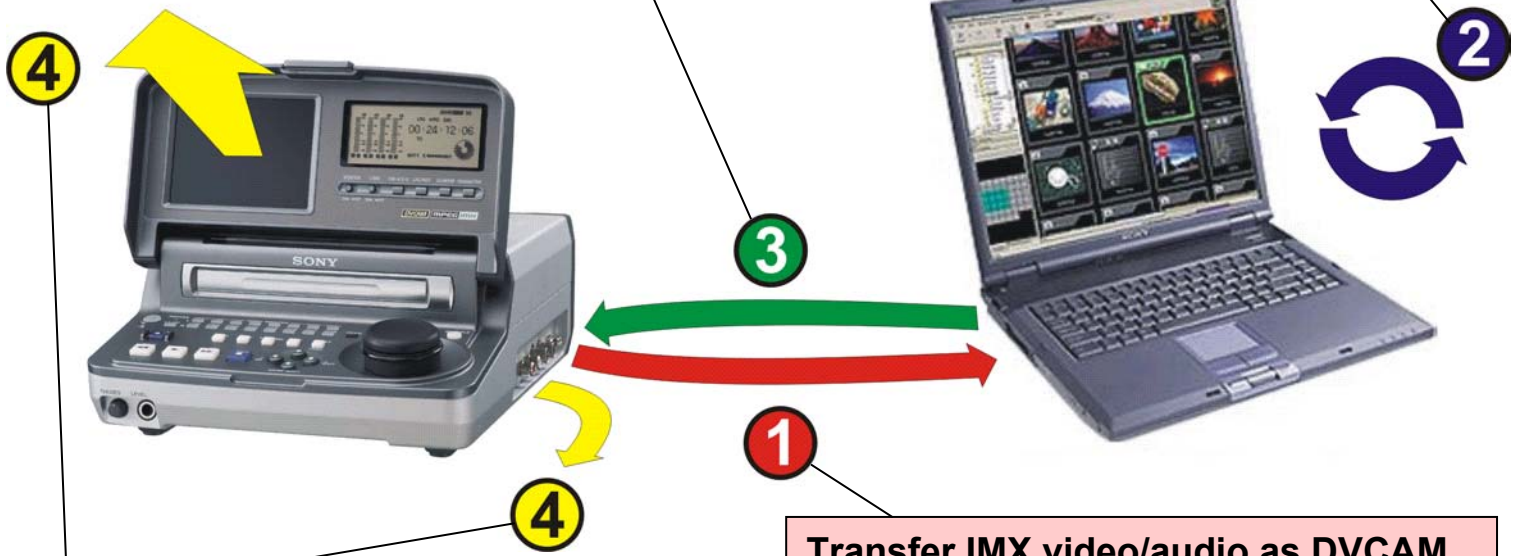
Workflow scenario 1 – Simple DVCAM edit



Workflow scenario 2 – Simple edit with IMX

- PDW-V1 plays IMX material as DVCAM through iLink AVC.
- This allows simple edits with IMX with existing NLE's.

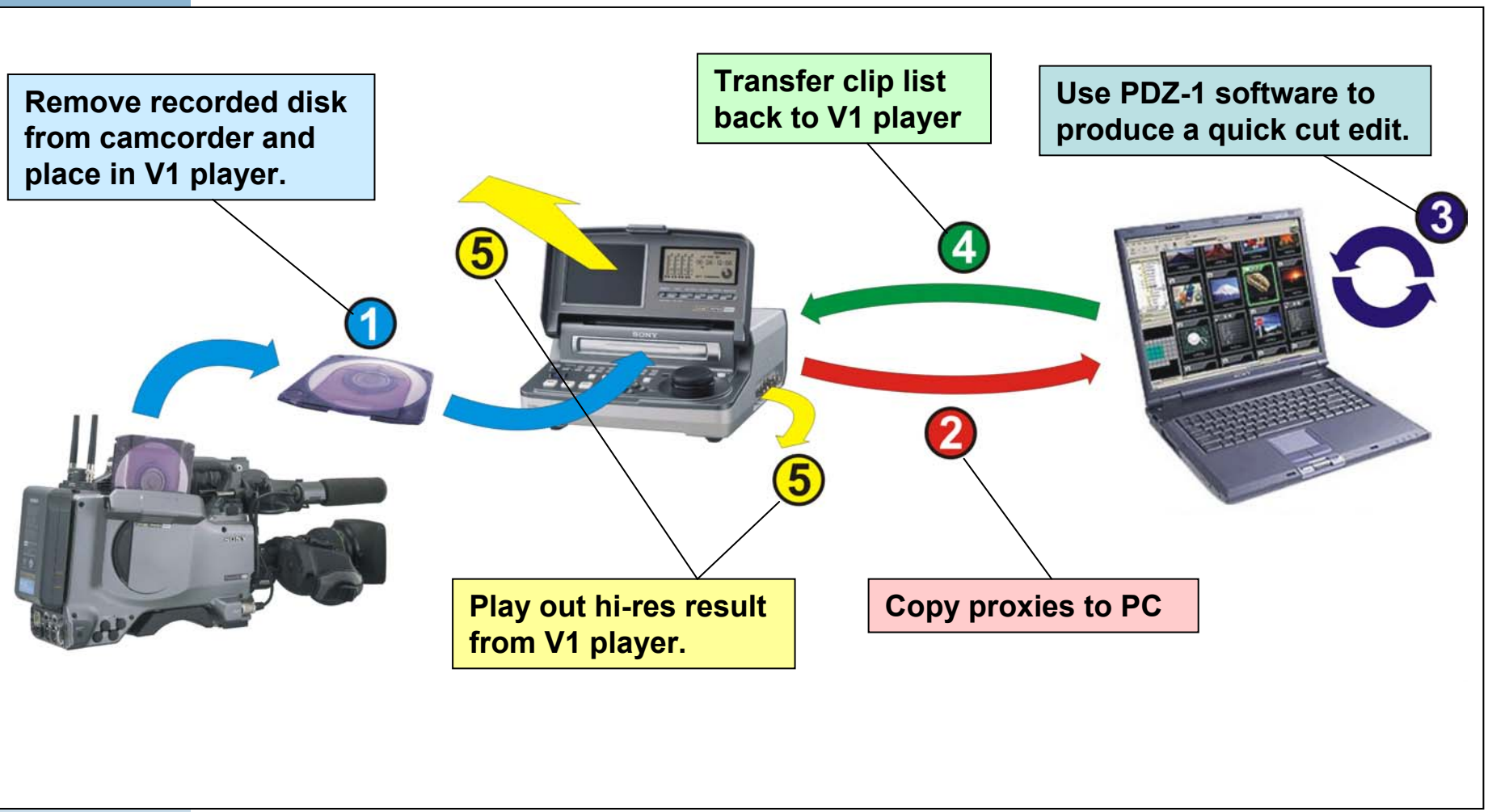
Workflow scenario 2 – Simple edit with IMX



Workflow scenario 3 – Edit using proxies

- Remove disk from camcorder and place in PDW-V1.
- Copy proxies fast to computer via using PDZ-1 software.
- Edit proxies quickly using PDZ-1 to provide Clip List.
- Transfer Clip List back to PDW-V1.
- Play out edit using Clip List on hi-res material.

Workflow scenario 3 – Edit using proxies



Workflow scenario 4 – Edit using non-MXF NLE's

- Time saving for logging/digitisation processes.
- Allows non MXF compliant NLE's to log individual XDCAM clips.

- Remove disk from camcorder and place in PDW-1500.
- Copy proxies fast to computer using PDZ-1 software.
- Build quick cut edit using PDZ-1 software.
- Export BVE or ALE edit description file.
- Use BVE or ALE file in non-linear editor to import hi-res clips.
- Complete edit in non-linear editor.
- Record final edit back to PDW-1500.
- Play out edit from PDW-1500.

Workflow scenario 4 – Edit using non-MXF NLE's

Move recorded disk from camcorder to 1500 player.

Play out final edit

Record final edit back to 1500 deck.

Use BVE or ALE file to import hi-res clips and complete edit in non-linear editor.

Copy proxies to PC

3 PDZ-1

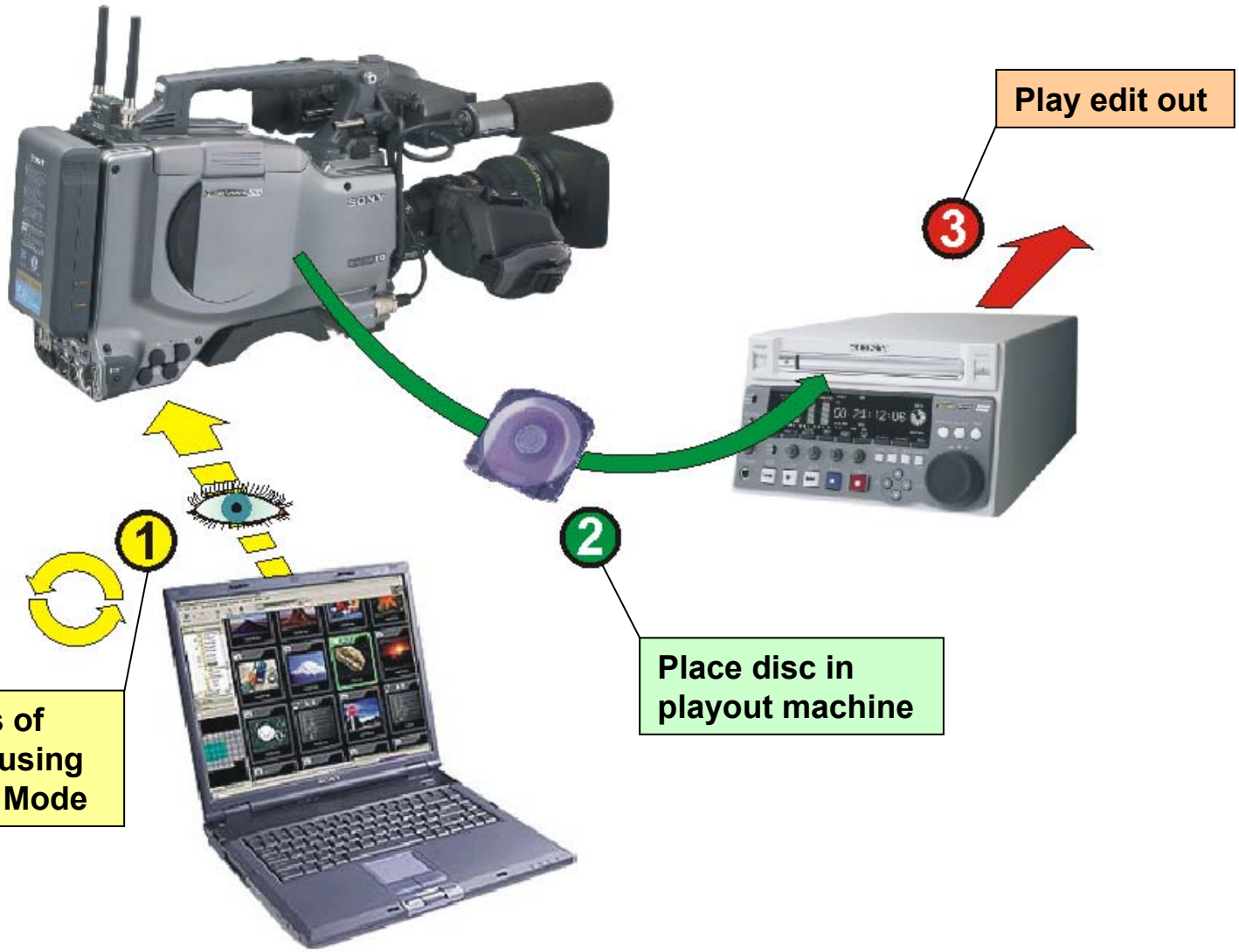
4 NLE

Use PDZ-1 software to produce cut edit and export as BVE or ALE file.

Workflow scenario 5 – Edit using FAM

- Edit contents of disc directly using PDZ-1 Direct Mode.
- Place disc in playout machine.
- Play edit out.

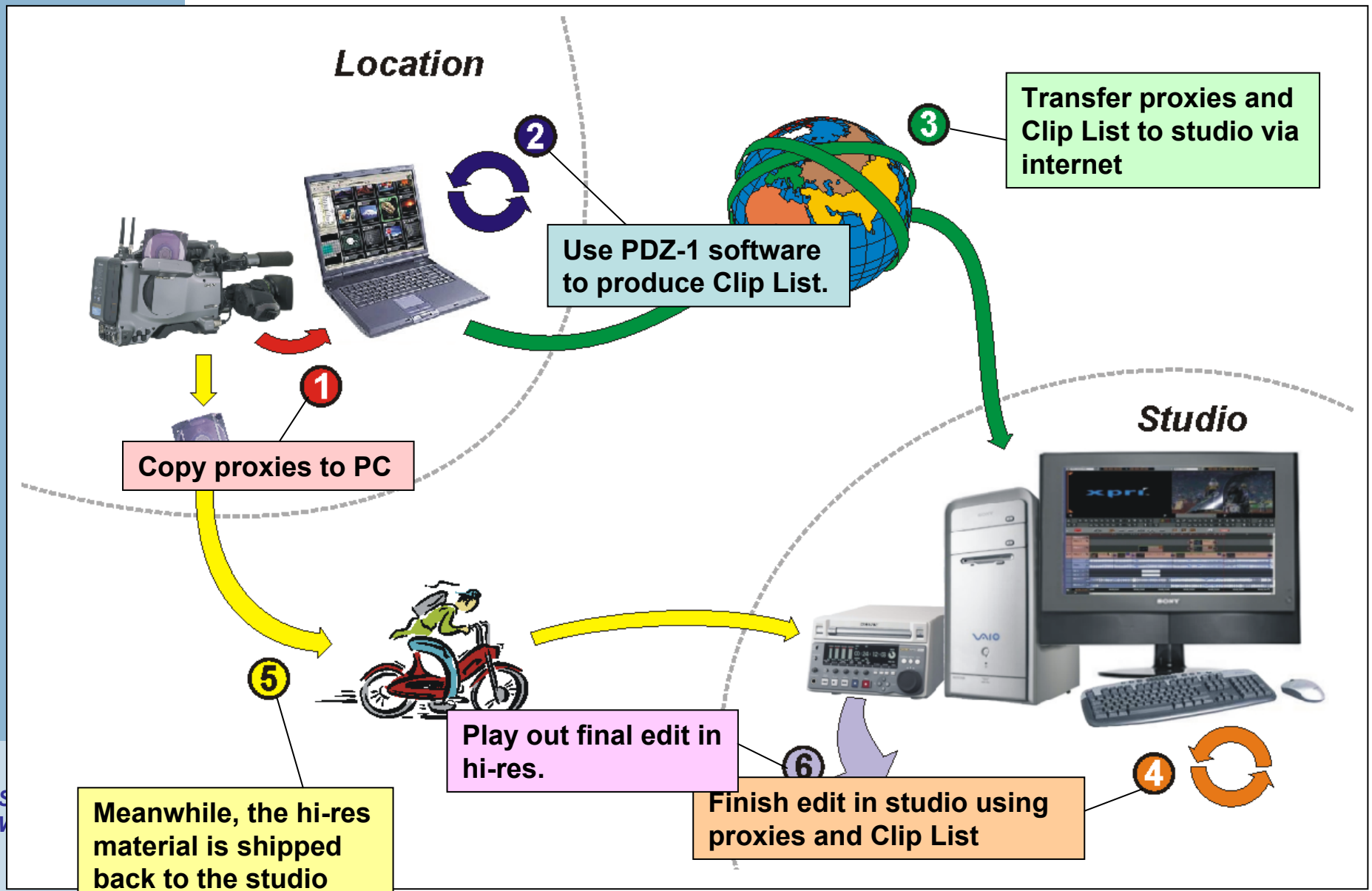
Workflow scenario 5 – Edit using FAM



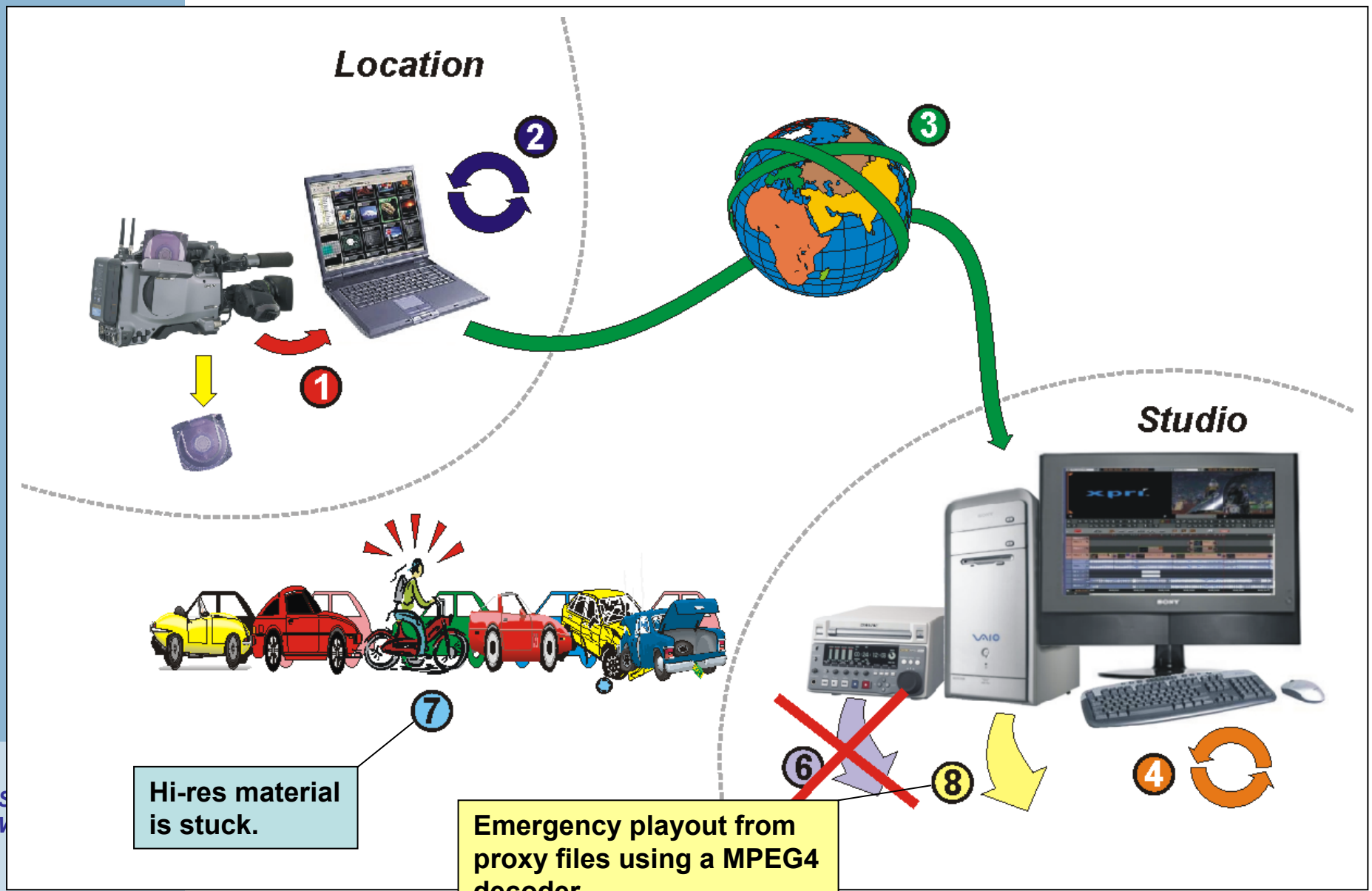
Workflow scenario 6 – Quick location edit

- Remove disk from camcorder and place in PDW-V1.
- Copy proxies to computer via using PDZ-1 software.
- Build quick cut edit on location using PDZ-1 software.
- Send proxies and Clip List back to studio using the internet.
- Perform further edits on proxies using XPRI editor.
- In the mean time hi-res material is shipped back to studio.
- Hi-res material played out using PGM file from XPRI.

Workflow scenario 6 – Quick location edit



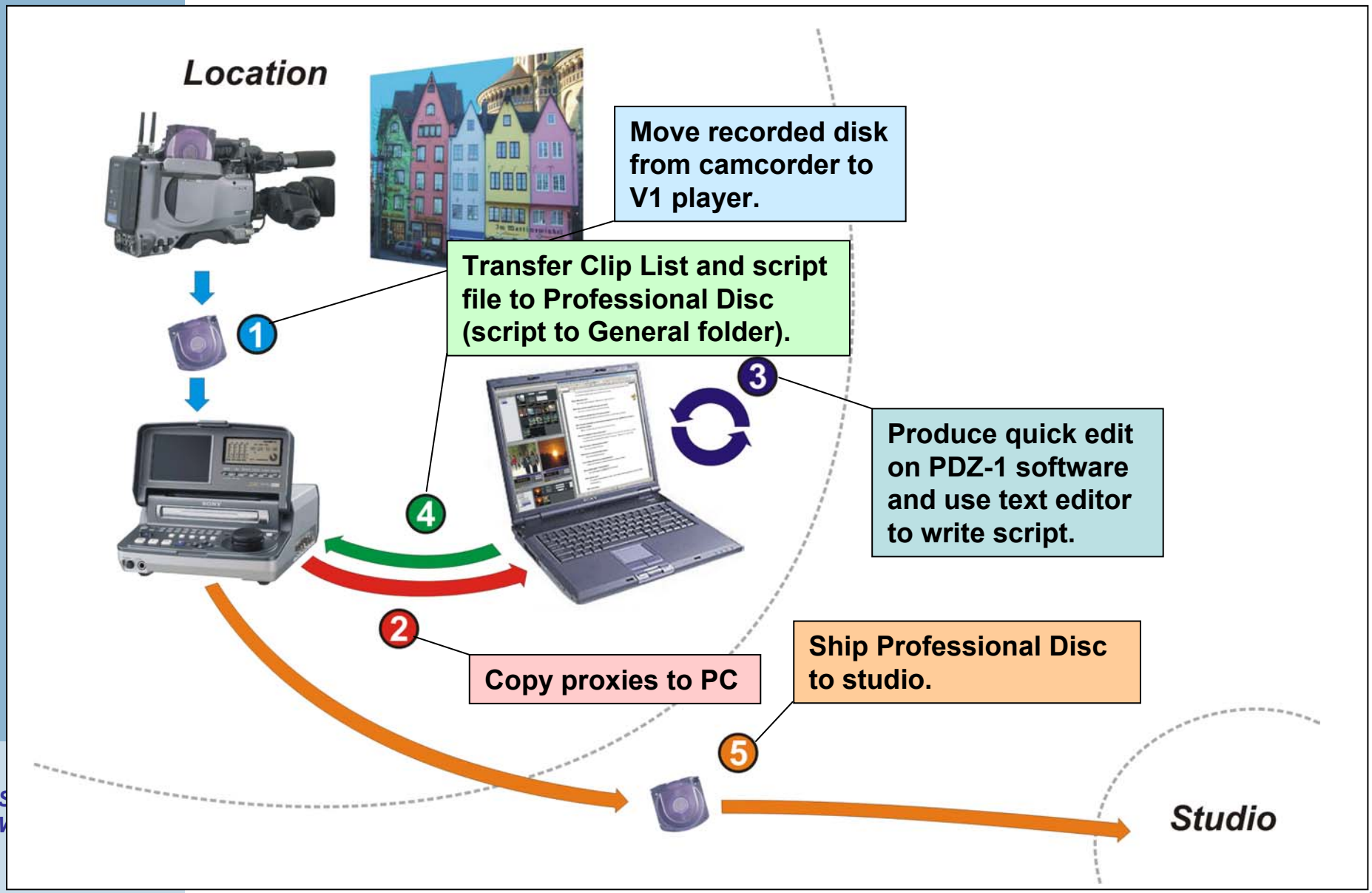
Workflow scenario 6 – Quick location edit



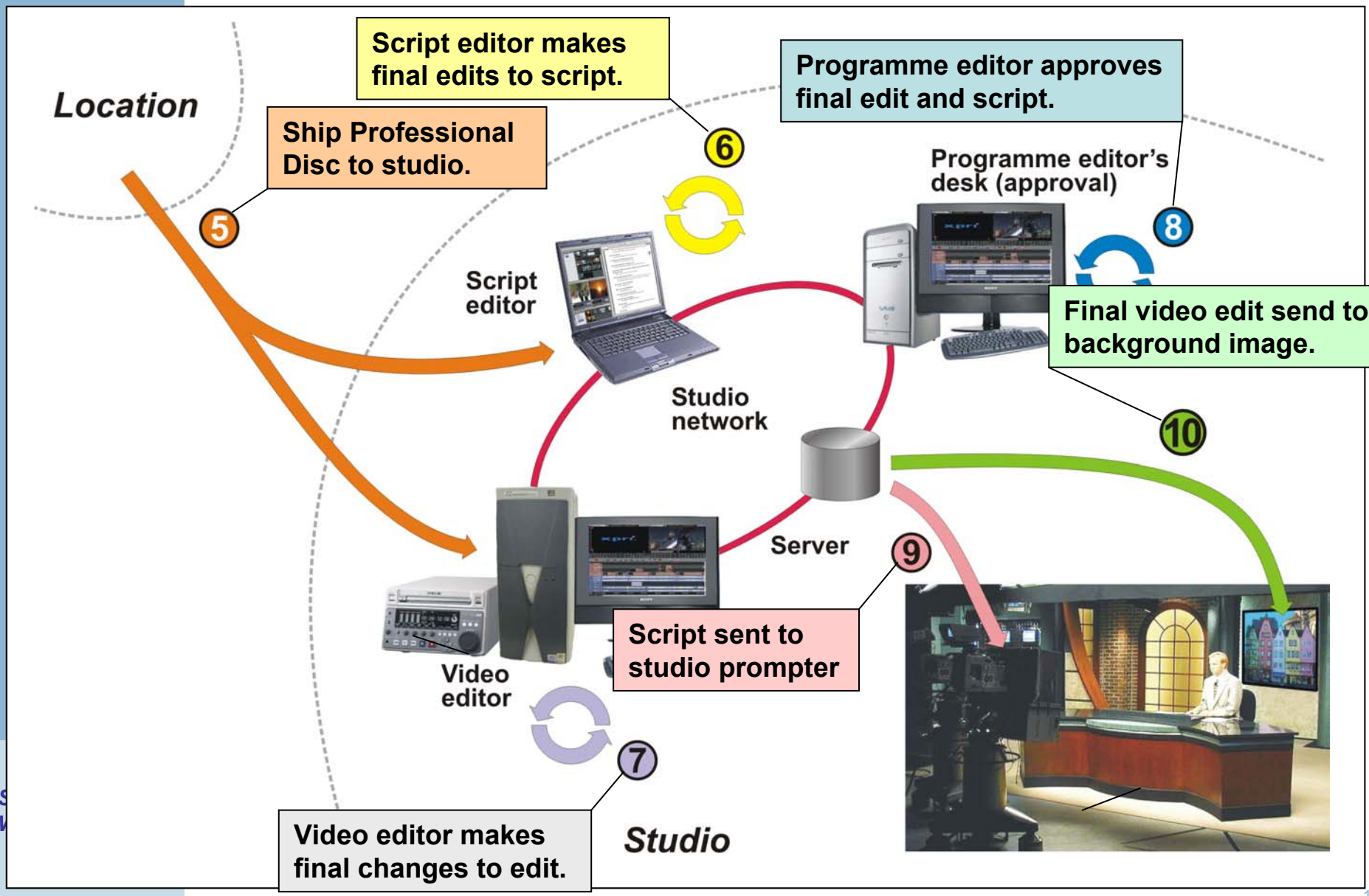
Workflow scenario 7 – Script integration

- Copy proxies to computer.
- Perform quick cut edit using PDZ-1 software.
- Use any word processor to write scripts for the edit.
  - On location journalist puts together script for the shoot.
- Write script file back to Professional Disk.
  - Script file placed in ‘General’ folder.
- Script follows material on Professional disk back to studio.
- Studio personnel can extract scripts in studio.
  - Scripts can be approved or further edited.
  - Scripts can be printed and/or sent to prompter.

Workflow scenario 7 – Script integration



Workflow scenario 7 – Script integration



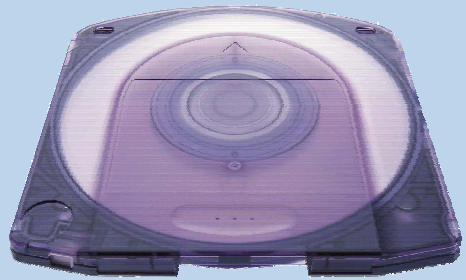
Advantages of XDCAM workflow

- XDCAM uses Professional Disc.
  - Professional Disc is robust and cost effective.
  - Professional Disc is removable, just like tape.
- All material starts in file form.
  - Every clip is recorded on camcorder disc as a file …
  - … with associated lo-res proxy copy and metadata.
- Files used throughout the production chain.
  - Transfer of material via Ethernet or iLink.
  - Editor can use lo-res proxy copies to produce EDL quickly …
  - … or edit using hi-res original directly.
  - No linear to non-linear transfer (digitisation).

Advantages of XDCAM workflow

- Playout can use edited hi-res or original hi-res + EDL.
- Final programme is in file form.
  - An edited single file with its metadata …
  - … that can be played out through appropriate decoder.
- Archive can hold everything as a series of files.
  - Hi-res and lo-res files, EDL's, final programme files and metadata.
  - Searching through the archive can be done via metadata.

Ownership

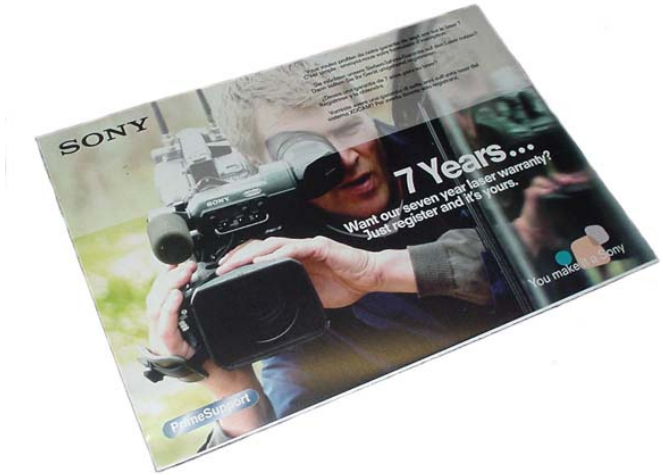


Ownership consideration

- Low cost media - 30 Euro per disk.
- Disks can be re-recorded at least 10000 times.
- Disk/data shelf life at least 50 years.
- 7 years warranty offered on all XDCAM products.
  - Worry free warranty on critical mechanical parts.
  - Cover free replacement of the optical drive.
    - Including the laser, seek motor and disk drive motor.
    - End-of-life and manufacturing defects.
  - Does not include breakage or accidental damage.
  - Optical block (camcorder) and PCB's not covered.

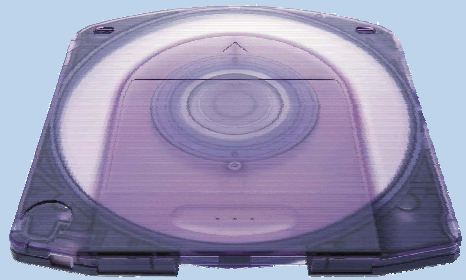
Support and service guidance

- 7 Year Warranty pack attached to every XDCAM product.



  - Pack includes registration form for 7 year warranty.
  - Web site for everything about XDCAM :-
  - ***www.sonybiz.net/xdcam***
  - Link to '*7-year warranty for XDCAM optical drive*'.
    - Information on 7 year warranty scope, terms and conditions.

XDCAM data



XDCAM folder structure

- Each disc has a unique number.
- XDCAM produces 5 folders on the disc.
  - Clip : Main media files (.MXF) & their metadata (.XML).
  - Edit : Clip Lists (.SMI) and their metadata (.XML).
  - General : Any files (text, images, etc.) 500Mb maximum.
  - SonyPM : No contents at present.
  - Sub : Proxy files (.MXF) & audio files (.WAV).

XDCAM media files

- Main video files (.MXF).
  - MXF is a wrapper for IMX30, IMX40, IMX50, or DVCAM data.
- Proxy video files (.MXF).
  - MXF is a wrapper for MPEG4 data.
- Audio files (.WAV).
  - WAV is a wrapper for uncompressed audio data.
  - 48kHz, 20 bit samples, 4 or 8 channels.
  - 48kHz, 16 bit samples, 4 channels (DV).

SONY

XDCAM main video metadata (.XML)

```
<?xml version="1.0" encoding="UTF-8"?>
<NonRealTimeMeta xmlns="urn:schemas-professionalDisc:nonRealTimeMeta" xmlns:sony="urn:schemas-sony-
    com:pro:nrtExtention:2003" xmlns:lib="urn:schemas-professionalDisc:lib" lastUpdate="2004-01-26T11:56:10+00:00">
    <TargetMaterial umidRef="060A2B340101010501010D43130000002D2210002530058008004602 0118F881" status=""/>
    <Duration value="532"/>
    <LtcChangeTable tcFps="25">
            <LtcChange frameCount="0" value="01061500" status="increment"/>
            <LtcChange frameCount="531" value="07271500" status="end"/>
    </LtcChangeTable>
    <CreationDate value="2004-01-21T11:44:53Z"/>
    <TypicalUbit value="0000000000000000"/>
    <BodyUmidBasicChangeTable>
            <BodyUmidBasicChange frameCount="0"
value="060A2B340101010501010D43330000002D2210002530058008004602 0118F881" status="start"/>
    </BodyUmidBasicChangeTable>
    <BodyUmidWhenChangeTable>
            <BodyUmidWhenChange frameCount="0" value="448B080425300580" status="increment"/>
            <BodyUmidWhenChange frameCount="531" value="0410090425300580" status="end"/>
    </BodyUmidWhenChangeTable>
    <BodyUmidWhereChangeTable>
            <BodyUmidWhereChange frameCount="0" value="00000000000000000000000000" status="start"/>
     </BodyUmidWhoChangeTable>
```

Frame rate

Unique Material Identifier (UMID) number

XDCAM main video metadata (.XML)

```
<VideoFormat>
        <VideoRecPort port="DIGITAL-COMPONENT"/>
        <VideoFrame videoCodec="IMX50" formatFps="50i" clipBegin="0"/>
        <VideoLayout pixel="720" numOfVerticalLine="608" aspectRatio="4:3"/>
</VideoFormat>
<AudioFormat numOfChannel="8">
        <AudioRecPort port="SDI" audioCodec="LPCM16" trackDst="CH1"/>
        <AudioRecPort port="SDI" audioCodec="LPCM16" trackDst="CH2"/>
        <AudioRecPort port="SDI" audioCodec="LPCM16" trackDst="CH3"/>
        <AudioRecPort port="SDI" audioCodec="LPCM16" trackDst="CH4"/>
        <AudioRecPort port="SDI" audioCodec="LPCM16" trackDst="CH5"/>
        <AudioRecPort port="SDI" audioCodec="LPCM16" trackDst="CH6"/>
        <AudioRecPort port="SDI" audioCodec="LPCM16" trackDst="CH7"/>
        <AudioRecPort port="SDI" audioCodec="LPCM16" trackDst="CH8"/>
</AudioFormat>
<SubStream codec="PD-SubStream" clipBegin="0"/>
```

Video format

Video format

XDCAM main video metadata (.XML)

<Device manufacturer="SONY" modelName="PDW-1500" serialNo="03177">
<Element hardware="Itron CPU" software="Version 0.620"/>
<Element hardware="Menu" software="Version 0.330"/>
<Element hardware="VIDEO DEC" software="Version 6.000"/>
<Element hardware="PROX DSP" software="Version 0.c00"/>
<Element hardware="PROX FPGA" software="Version 1.000"/>
<Element hardware="AU DSP 3" software="Version 0.240"/>
<Element hardware="AU DSP 2" software="Version 0.220"/>
<Element hardware="AU DSP 1" software="Version 0.210"/>
<Element hardware="AU DSP 0" software="Version 0.210"/>
<Element hardware="KY" software="Version 0.900"/>
<Element hardware="Drive" software="Version 0.200"/>
<Element hardware="Linux FS" software="Version 0.530"/>
<Element hardware="Linux KERN" software="Version 0.530"/>
<Element hardware="VAIN" software="Version 0.461"/>
<Element hardware="PIER" software="Version 0.710"/>
</Device>

XDCAM machines firmware versions

<KlvPacketTable><KlvPacket frameCount="0" status="spot" key="060E2B3401010105030102 0A02000000" lengthValue="095F5265635374617274"/></KlvPacketTable><Title usAscii="drydrydr"><lib:Alias>setset</lib:Alias></Title><Description>setsdg tfyfdydy setgsdgsdgf</Description><Creator name=""/></NonRealTimeMeta>

SONY

XDCAM Clip List description files (.SMI)

Clip List UMID number

```
<?xml version="1.0" encoding="UTF-8"?>
<smil umid="060A2B340101010501010D4313000000CE7C0000393005800800460201l8F868"
    xmlns="urn:schemas-professionalDisc:edl">
<body>
    <par>
        <ref src="urn:smpte:umid:060A2B340101010501010D43130000002D2210002530058008004602011 8F881“
          clipBegin="smpte-25=00:00:13:24" clipEnd="smpte-25=00:00:18:07" begin="smpte-25=00:00:00:00"/>
        <ref src="urn:smpte:umid:060A2B340101010501010D4313000000872C10002530058008004602011 8F881"
          clipBegin="smpte-25=00:00:03:18" clipEnd="smpte-25=00:00:10:22" begin="smpte-25=00:00:04:08"/>
        <ref src="urn:smpte:umid:060A2B340101010501010D43130000001B3E10002530058008004602011 8F881"
          clipBegin="smpte-25=00:00:07:04" clipEnd="smpte-25=00:00:15:18" begin="smpte-25=00:00:11:12"/>
        <ref src="urn:smpte:umid:060A2B340101010501010D4313000000DA33100025300580080046020118F881"
          clipBegin="smpte-25=00:00:04:05" clipEnd="smpte-25=00:00:15:18" begin="smpte-25=00:00:20:01"/>
</par>
</body>
</smil>
```

Individual clip UMID numbers, start & end times

SONY

XDCAM Clip List metadata files (.XML)

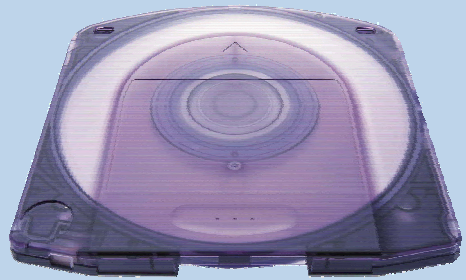

```
<?xml version="1.0" encoding="UTF-8"?>
<NonRealTimeMeta xmlns="urn:schemas-professionalDisc:nonRealTimeMeta" xmlns:sony="urn:schemas-sony-
    com:pro:nrtExtention:2003" xmlns:lib="urn:schemas-professionalDisc:lib" lastUpdate="2004-02-04T00:21:18Z">
    <TargetMaterial umidRef="060A2B340101010501010D4313000000CE7C0000393005800800460201 18F868"/>
    <Duration value="1388"/>
    <CreationDate value="2004-01-21T15:38:00Z"/>
    <Title usAscii=""><lib:Alias></lib:Alias></Title><Description>z;dlng;alrkgn;aoirng;laksrgn;alkwgen/slkdngfsdkl
\esrf sef \asf sef s\ f s f
sdgdsaf
gdaf
gas
dg</Description><Creator name="R Wallis"/><LtcChangeTable tcFps="25">
            <LtcChange frameCount="0" value="00000000" status="increment"/>
            <LtcChange frameCount="1387" value="12550000" status="end"/>
    </LtcChangeTable>
    <KlvPacketTable><KlvPacket frameCount="0" status="spot" key="060E2B34010101050301020A02000000"
    lengthValue="095F5265635374617274"/></KlvPacketTable></NonRealTimeMeta>
```


Journalist

Frame rate

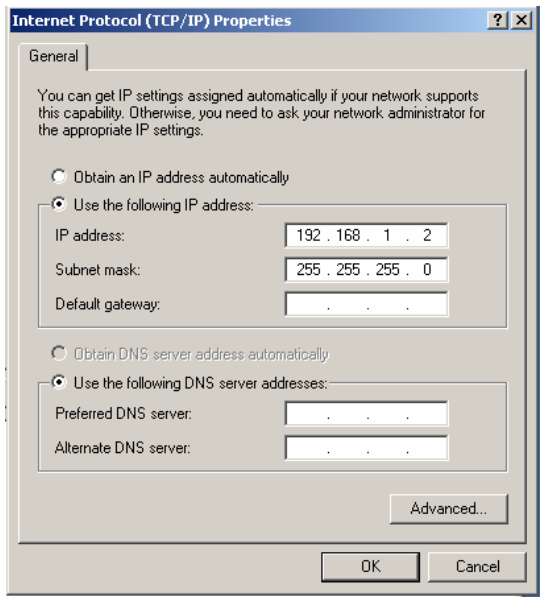
Clip list duration

Network setup guide



PDZ-1 & XDCAM deck network setup

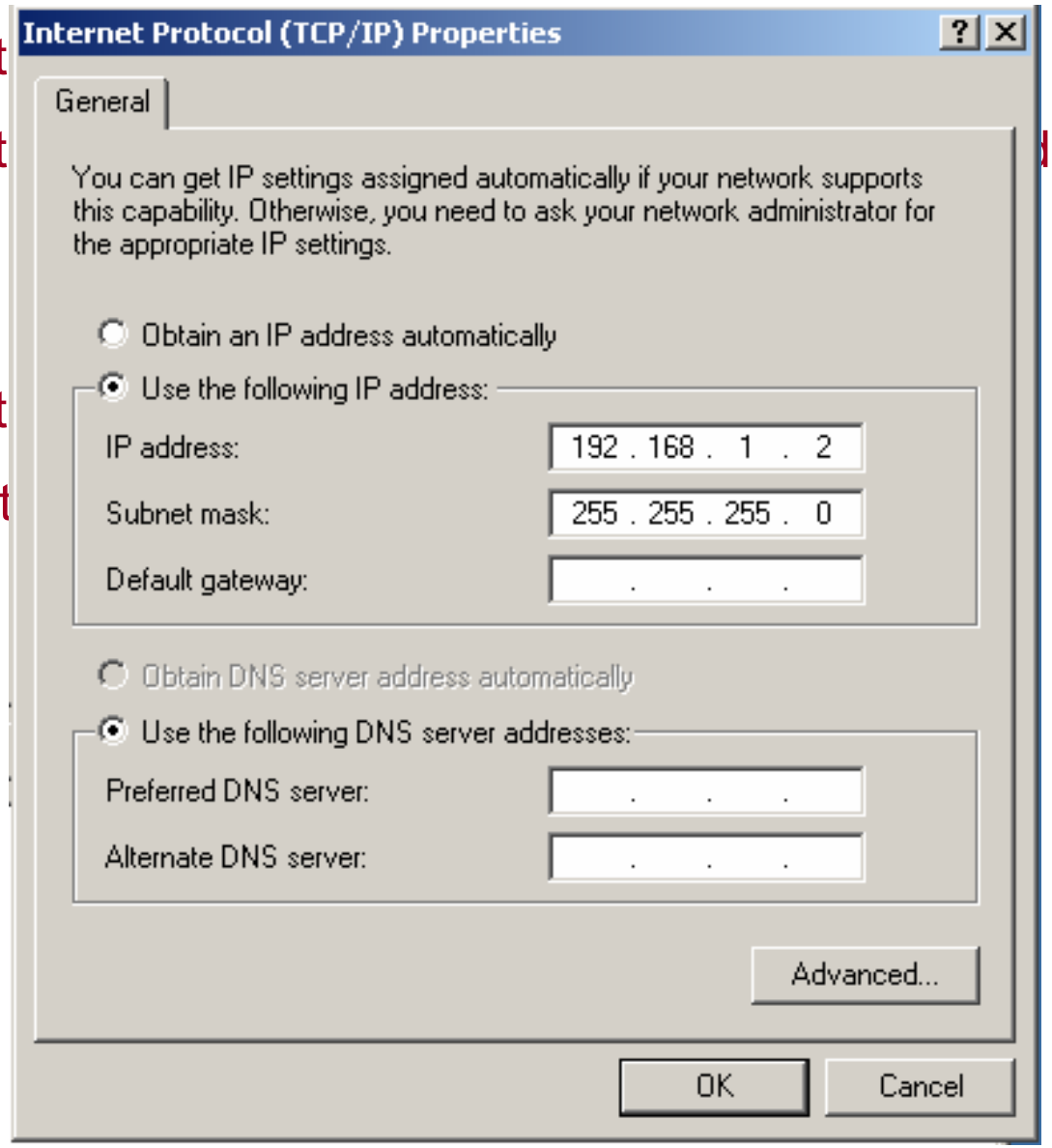
- Set PC to “Use the following IP address”.
- Set PC IP address to match XDCAM deck IP address .
  - For example 192.168.1.1 and 192.168.1.2 .
  - First three numbers should be the same.
- Set PC subnet mask to 255.255.255.0 .
- Gateway address should not be needed.



PDZ-1 & PDW deck network setup

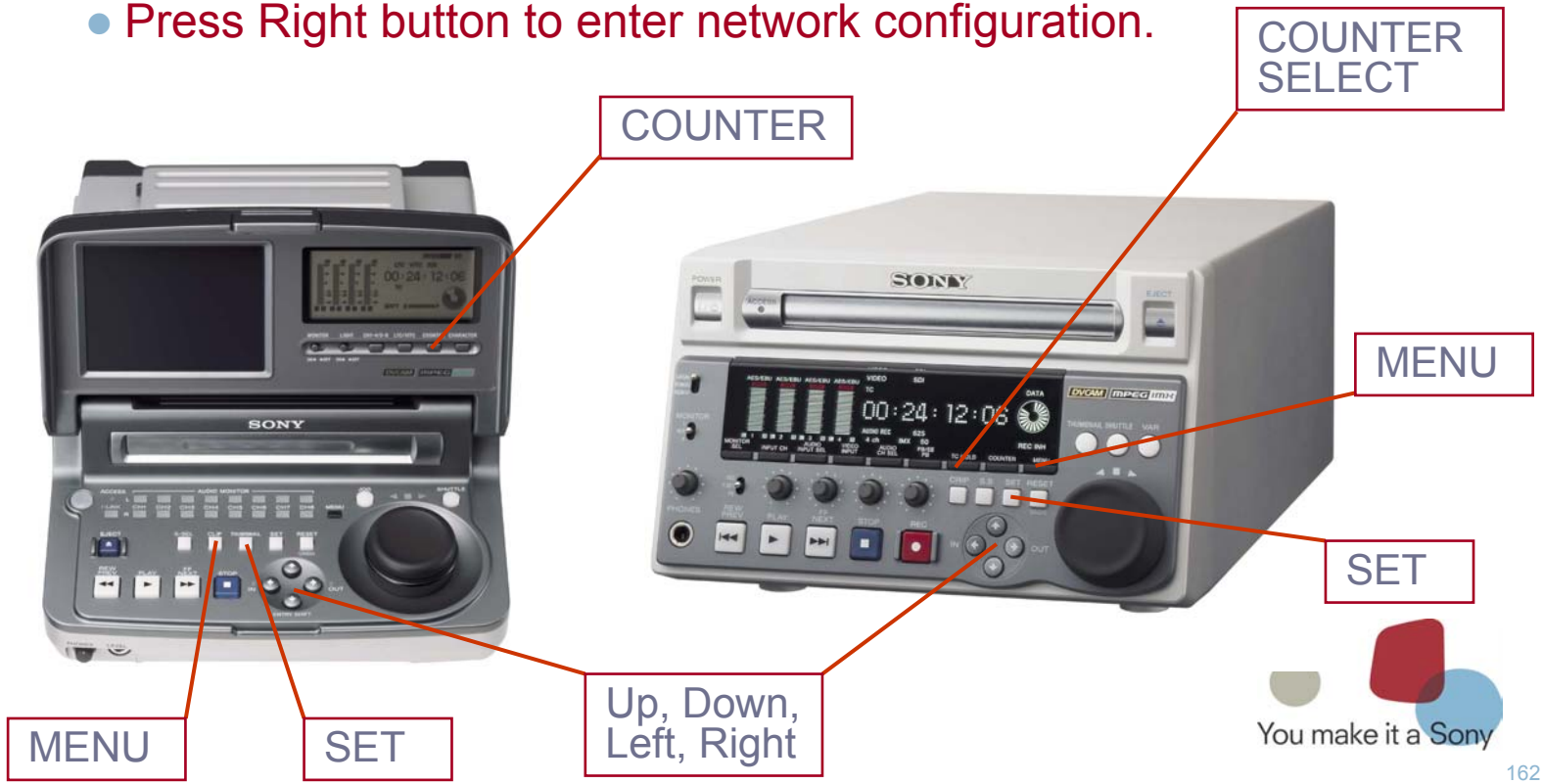
- Set
- Set
  -
  -
- Set
- Gat

dress .



PDZ-1 & PDW deck network setup

- Set IP address in XDCAM using Maintenance Menu.
  - MENU then COUNTER SELECT + SET (PDW-1500).
  - MENU then COUNTER + SET (PDW-V1).
  - Press Down button to NETWORK CONFIG.
  - Press Right button to enter network configuration.

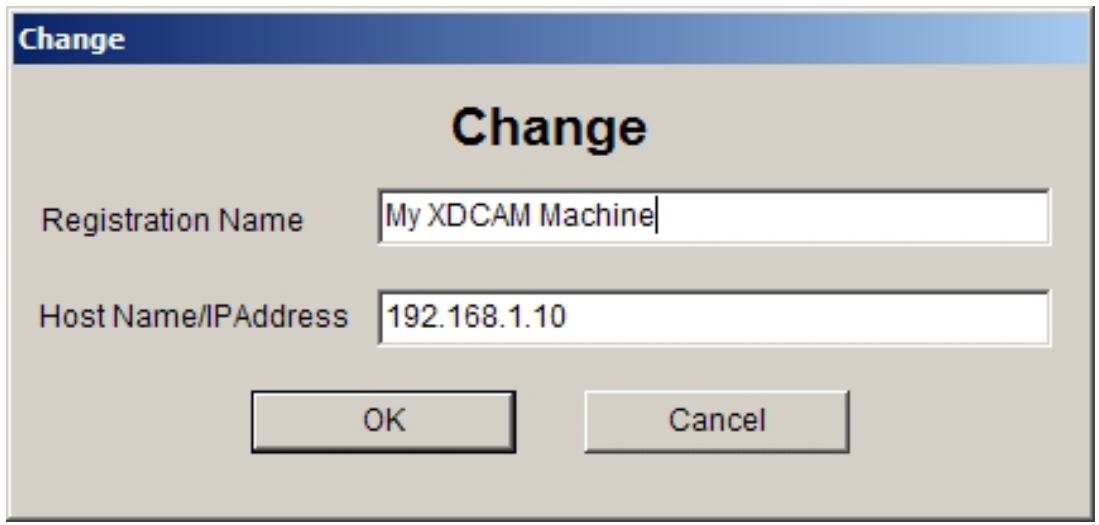


PDZ-1 & PDW deck network setup

- Set DHCP to “disable”.
- Set machine IP address to match PC IP address.
  - For example 192.168.1.1 and 192.168.1.2 .
  - First three numbers should be the same.
- Set machine subnet mask to 255.255.255.0 .
- Gateway address should not be needed.
- Set Link Speed to “auto”.
- Set Dulplex to “auto” (if present).

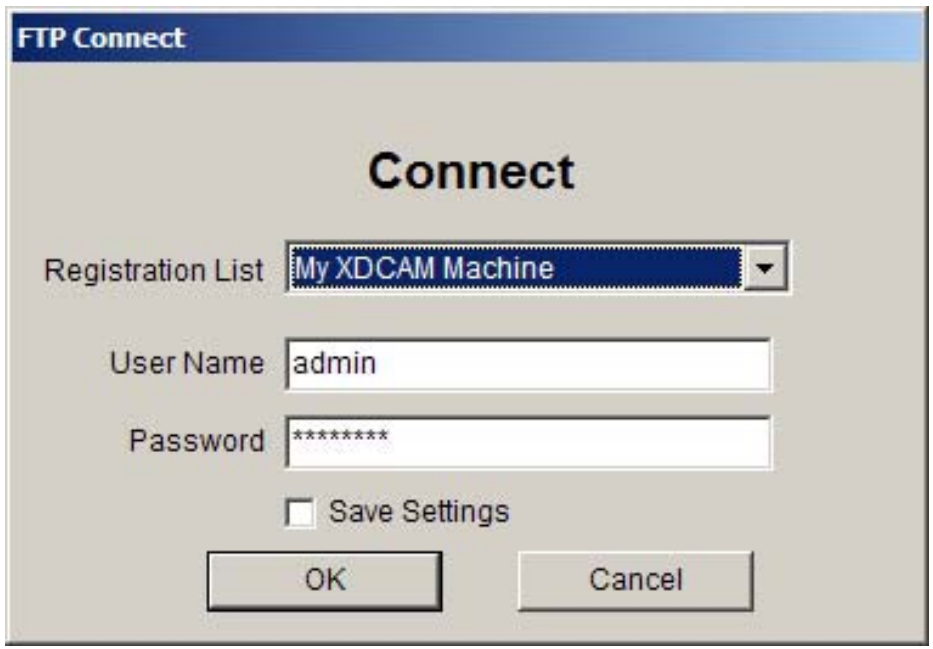
PDZ-1 network setup

- Enter Registration Name and IP Address into PDZ-1.
  - Registration Name can be any name.
  - IP Address must be the machine IP address.
  - From now on the Registration Name will be used only.



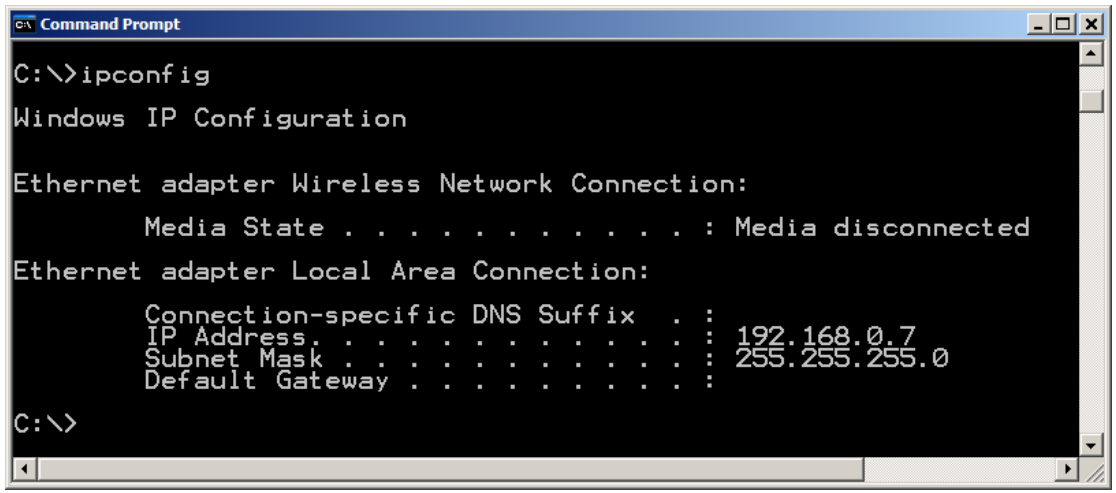
PDZ-1 network setup

- Connect using Registration Name from drop-down list.
- Default User Name : admin.
- Default Password : pdw-v1 or pdw-1500



PDZ-1 network fault finding

- Check IP addresses.
  - If the subnet mask is 255.255.255.0, the first three number must be the same and the last number must be different.
  - Be careful of IP addresses like 194.168.100.010 . “100” may be actually be “4”, and “010” may actually be “2”, because they are taken as binary.
  - Check the actual PC IP address by using ‘ipconfig’ from the Command Prompt.



PDZ-1 network fault finding

- Check the subnet mask is 255.255.255.0 .
  - This is the most common subnet mask.
  - This is true for the PC and the XDCAM deck.
- DHCP should be disabled.
  - Both on the PC and the XDCAM deck.
- Gateway addresses should be empty.
  - Both on the PC and the XDCAM deck.
- XDCAM deck link speed and duplex must be “auto”.
- If you change the XDCAM network settings switch off/on.
  - The XDCAM deck may need a power cycle.

PDZ-1 network fault finding

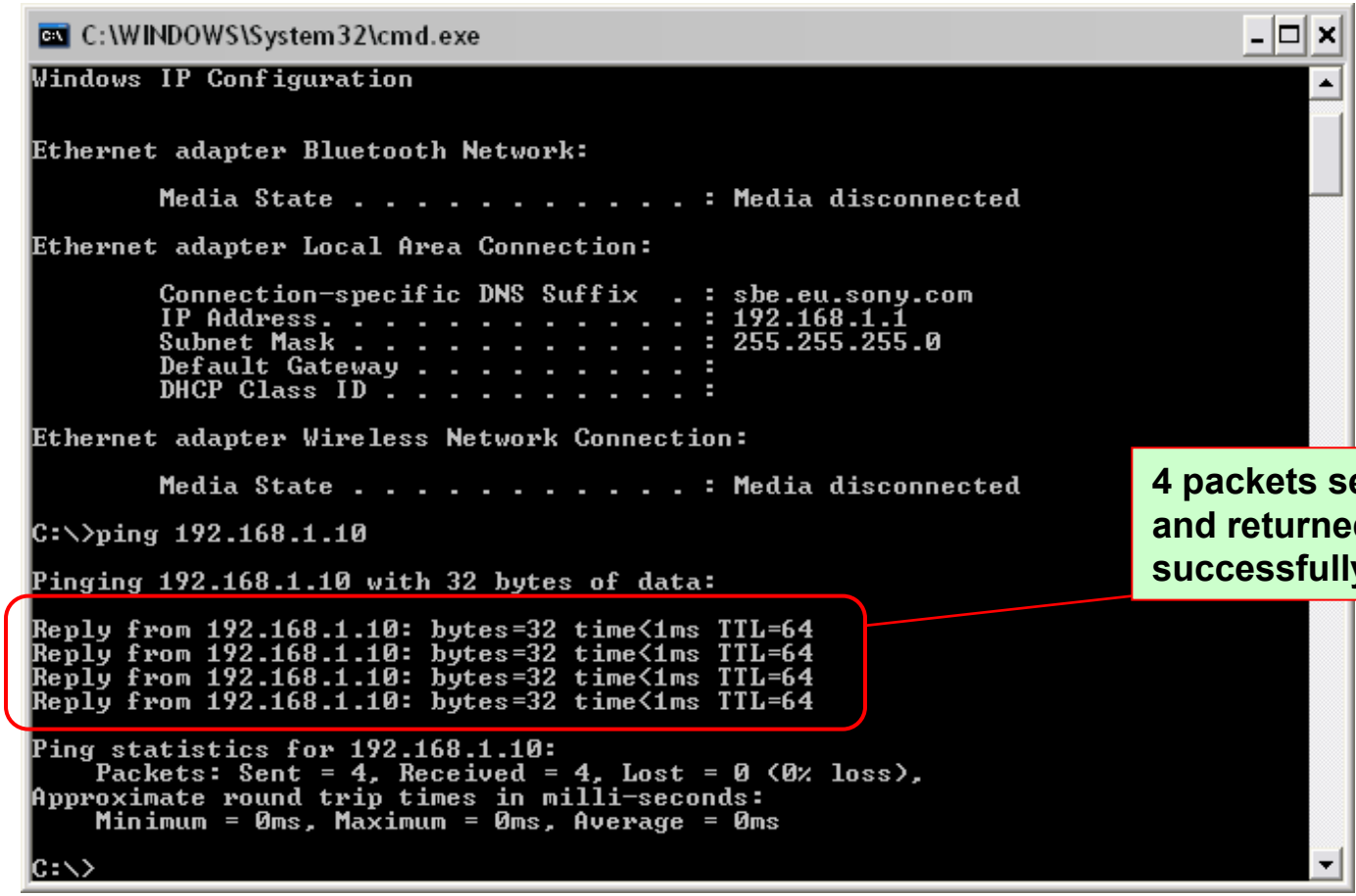
- Can you see any link lights?
  - All network ports have indicators for network activity. These should be flashing in an irregular fashion.
- Is there a switch or router between the PC and deck?
  - Anything between the XDCAM deck and the PC may cause the connection to fail.
  - Keep things as simple as possible. Remove potential problems.
- Try a direct connection.
  - The simplest and connection is to connect an ethernet cable directly between the XDCAM deck and the PC.
  - The camcorders and PDW-V1 must have an crossed Ethernet cable. The PDW-1500 may use a straight Ethernet cable.

PDZ-1 network fault finding

- Try ‘ping’ from the Command Prompt.
  - Ping is a utility for checking the network link to an IP address.
  - If the XDCAM deck IP address is 192.168.1.10 type …
  - ping 192.168.1.10
  - Ping will try the link 4 times.
    - Packets of data sent. Response expected.

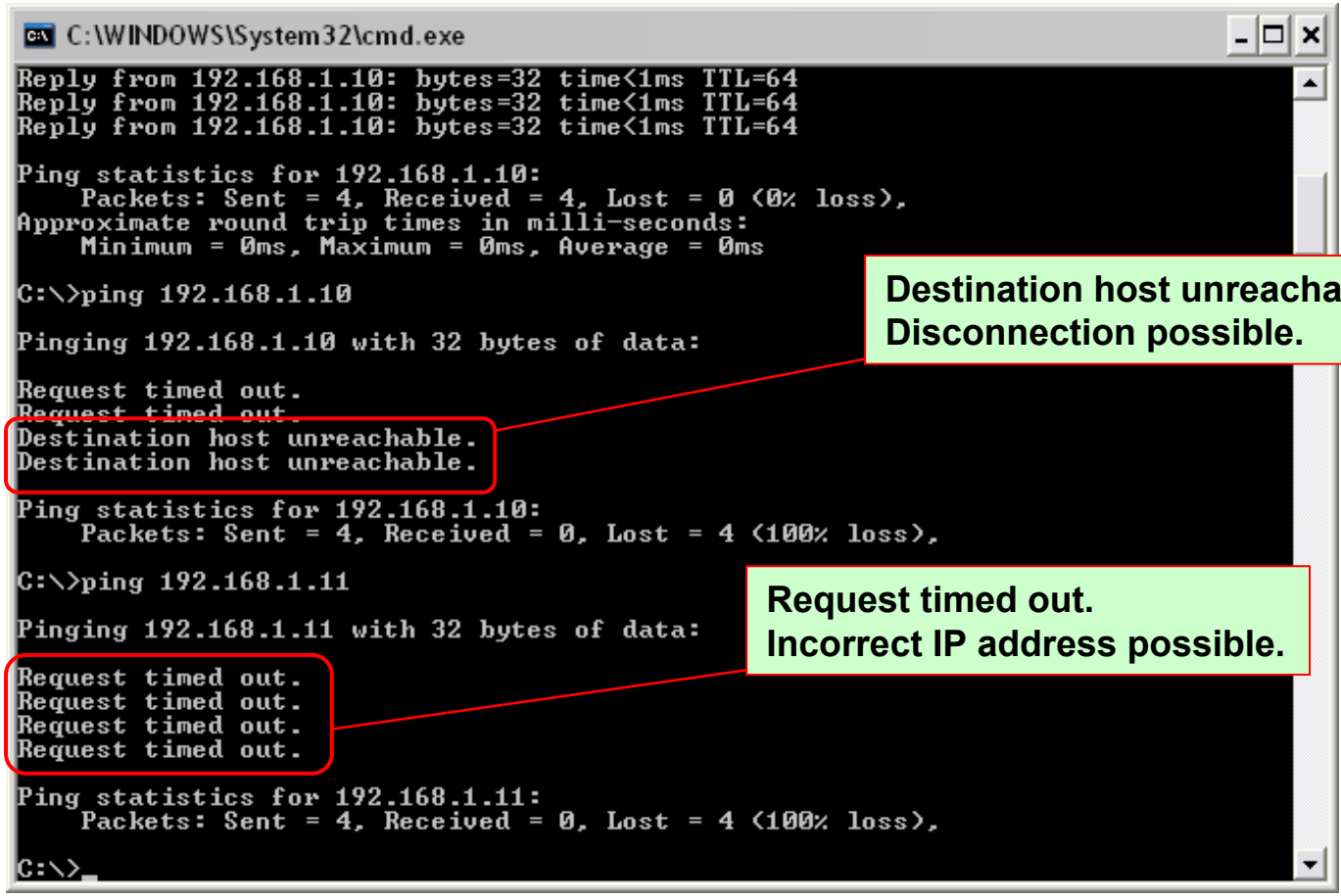
PDZ-1 network fault finding

- Good ping

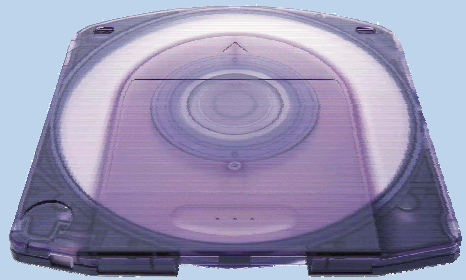


PDZ-1 network fault finding

- Bad pings



Some final thoughts



Some final thoughts

- Will Sony carry on supporting tape.
  - Sony have no plans to cease professional tape production.
  - More than 200 million tapes over 20 years.
  - Tape is still a very popular.
  - Tape is still an important part of the broadcast workflow.
  - Professional Disc complements tape, not replaces it.

Some final thoughts

- Can I turn a PDW-510P into a PDW-530P?
  - Difficult to accomplish, but not impossible.
  - Main signal processing board must be changed.
  - Optical block and filter system needs to be exchanged.
  - Casing needs to be replaced.
  - Cost would be greater than the difference in original price!

Some final thoughts

- Will there ever be multi-layer or HD XDCAM discs?
  - All present XDCAM equipment is single layer, single speed.
  - All XDCAM discs (and Bluray disks) are single layer.
  - Dual layer disks are technically possible.
  - Dual layer disks will not be exact doubling in capacity …
  - … but slightly less.
  - HD possible at single speed but required high compression.
  - Better HD required multi-speed and/or multi-head drives.
  - Research under way. Standardisation required.
  - **What this space!**

Some final thoughts

- Do I need to format Professional Disc before I can use it?
  - No. The disk are pre-formatted.
  - However, wait for the disc to initialise properly!!