



THE BLOODLESS REVOLUTION

A GUIDE TO SMOOTHER DIGITAL
WORKFLOWS IN TELEVISION

dpp

digital production partnership

mediasmiths

PREFACE

In our industry we take huge creative risks all the time: that is what makes British television punch well above its weight. When it comes to technical change, however, we are more cautious. The adoption of new tools and workflows tends to happen slowly – unless the community can see an instant benefit. Self-operated file-based HD cameras are a good example: even though the move to file-based HD has created a number of challenges in the production workflow, these cameras have been rapidly adopted as the only means of making quality HD content within constrained budgets.

In other words, single technologies which deliver immediate creative benefits are adopted more easily and quickly than end-to-end workflows – even if their impact on workflows is disruptive!

In reality, the introduction of end-to-end workflow changes could generate creative benefits which are just as dramatic as those that come from single technologies – for example by improving image quality, enabling greater use of new creative software tools, and releasing more budget to spend on screen. But ‘end-to-end workflow changes’ sound and feel unglamorous – and require a degree of collaboration across the industry and its suppliers that can seem daunting.

We see this document as the starting point for such collaboration – and an attempt both to provide it with an agenda, and to make it feel more achievable.

Why now? Over the course of half a century television production processes became mature, well understood, and subject to limited variation. But the world of file-based production has changed all that. Programme makers are now faced with the biggest change to workflow in decades: the replacement of video tape by computer file. And it’s coming at a time when the demand from broadcasters is also for the highest quality images ever, at the lowest ever prices.

At times like this, even the most experienced and intrepid creative explorer may find themselves in need of a map. And that’s what the Digital Production Partnership seeks here to provide: a guide to the file-based production journey. But we don’t want merely to offer a map – we want to suggest some routes. There are many ways to get from A to B in the file-based world; so it’s little wonder some producers are feeling a bit lost – or are clinging to the one route they know, even though it may be tortuous and expensive.

Our focus is upon helping to identify the smoothest, simplest, shortest production journeys – while still providing sufficient background information to help people maintain a view of the wider landscape. We appreciate that sometimes creative ambition, budget or time-scale may mean that a production team may consciously opt to take a route that may not be the smoothest – because the benefits make the bumps worthwhile. But we’d like to think we can help you ensure you spend no longer on the dirt roads than you have to: innovation should not have to mean irritation; and lost clips, crashing edit systems, or expensive back ups shouldn’t be the price paid for digital off-roading.

The workflows we suggest may not suit everyone, and even if they do, they are sure to change with time. They may seem too high level for some, and too detailed for others. But our prime motive here is to provide a mechanism to get the industry – the entire industry – to focus its efforts around the same goal: to enable streamlined, efficient and effective workflows that will put the technology in the background, put creativity at the fore, and keep UK production at the cutting edge.

INTRODUCTION

In our previous report *The Reluctant Revolution*, the Digital Production Partnership (DPP) highlighted how the use of file-based cameras was forcing new workflows on the television industry. In the past, tape was not just the medium of exchange but acted as the security blanket for production: it was a robust medium for shooting; it could be easily carried and stored; it was always there as back up when non-linear editing platforms or electronic storage systems crashed; and it also acted as the archive format both for rushes and completed programmes at the end of production.

The continuation of tape cameras in television, long after the consumer market began to go tapeless, is evidence of how resilient tape has been as a format. Even when the production process began to make greater and greater use of computers and IT, tape was still retained because it could always be returned to when things went wrong. And in an industry that lives by the priceless moments it captures, that characteristic had enormous value.

But the advent of file-based cameras has changed all of that. The computer file has always seemed mercurial and mysterious by comparison with physical media. And what's more, this transformation in the capture format of the cameras which give birth to our precious rushes has coincided with a quality/cost paradox: High Definition has become standard, while programme budgets in some areas have declined.

Whether the advent of newer and smaller HD file-based cameras facilitated or was the product of this paradox is a moot point. Put together one thing is clear: we are now acquiring more, but in many cases less confidently and for less money. And there is no way back: the manufacture of tape-cameras is discontinuing.

So, like it or not, the adoption of file-based cameras has brought with it a world of new workflows. From

the outset, production companies now need to deal with codecs (the audio-video file formats associated with file-based shooting) and the staggering lack of compatibility between different vendors' kit, codecs and editing platforms.

New phrases such as "metadata" and "data wranglers" have emerged. These terms emphasise the fact that in a file-based world it is vital to mark up and describe video footage. Content no longer physically exists on a shelf or desk. As a result, if the content is not described, it will probably never be found. Is it any surprise that in the move from tape to tapeless the first thing Production has had to do is ensure the security of its priceless moments?

It was against this backdrop that the DPP wanted to provide some clarity on how to adapt to end-to-end file-based workflows. We began by turning to our own members, and in a series of public forums and workshops in the latter part of 2011 and early 2012, we tried to distil effective working practices from the very practitioners at the forefront of production. We have stopped short of generating 'best practice' workflows as there is too much heterogeneity in the core production process for that concept to be truly valid. We have set out instead to provide some guidelines that highlight the challenges in file-based production and identify and share the different means currently used to address them.

We see three potential outcomes from the publication of this report:

- 1 In a world of transient production teams, with many freelancers, the industry will be given a set of common reference points. We hope these will help to generate a commonly agreed language and framework within which to approach the planning and execution of a file-based production.
- 2 Broadcast technology vendors and service providers will be given an oversight of the entire production process, together with an insight into the requirements and concerns of the producer when operating in a file-based world. We would hope this will lead to a clearer, and perhaps more open, dialogue – and a better mutual understanding of the benefits and drivers in the process.
- 3 Vendors, the production community and service providers may also use the workflows to identify opportunities to create and deliver new services that will help to streamline or enhance the production process.

The DPP encourages debate and feedback and our regular forum provides one such outlet for the industry to come together and share experiences. If you would like to receive information on our forum events, or if you want to provide feedback on this document, please email us on info@digitalproductionpartnership.co.uk.

For any press enquiries regarding this report, please contact mary@marycollins-pr.com.

In setting out the workflows, we were faced with a challenge on the level of detail. Too high level, and the workflows would be of little practical use, but too great a level of detail would deter any serious adoption. We hope that we have found a middle ground, which is sufficiently easy to follow and will allow production companies to provide their own greater level of detail on specific aspects of the workflow.

DPP RECOMMENDS

To help clarify the points we feel are particularly important to achieving smoother workflows, we have added the icon **DPP Recommends** at key moments.

We have striven to focus on one core workflow as much as possible. The overall process has been broken into four steps: **Planning, Rushes Management, Post-Production and Delivery.**

THE WORKFLOW



It's a cliché that planning is everything – and equally a cliché that creative brilliance and meticulous planning are uneasy bedfellows.

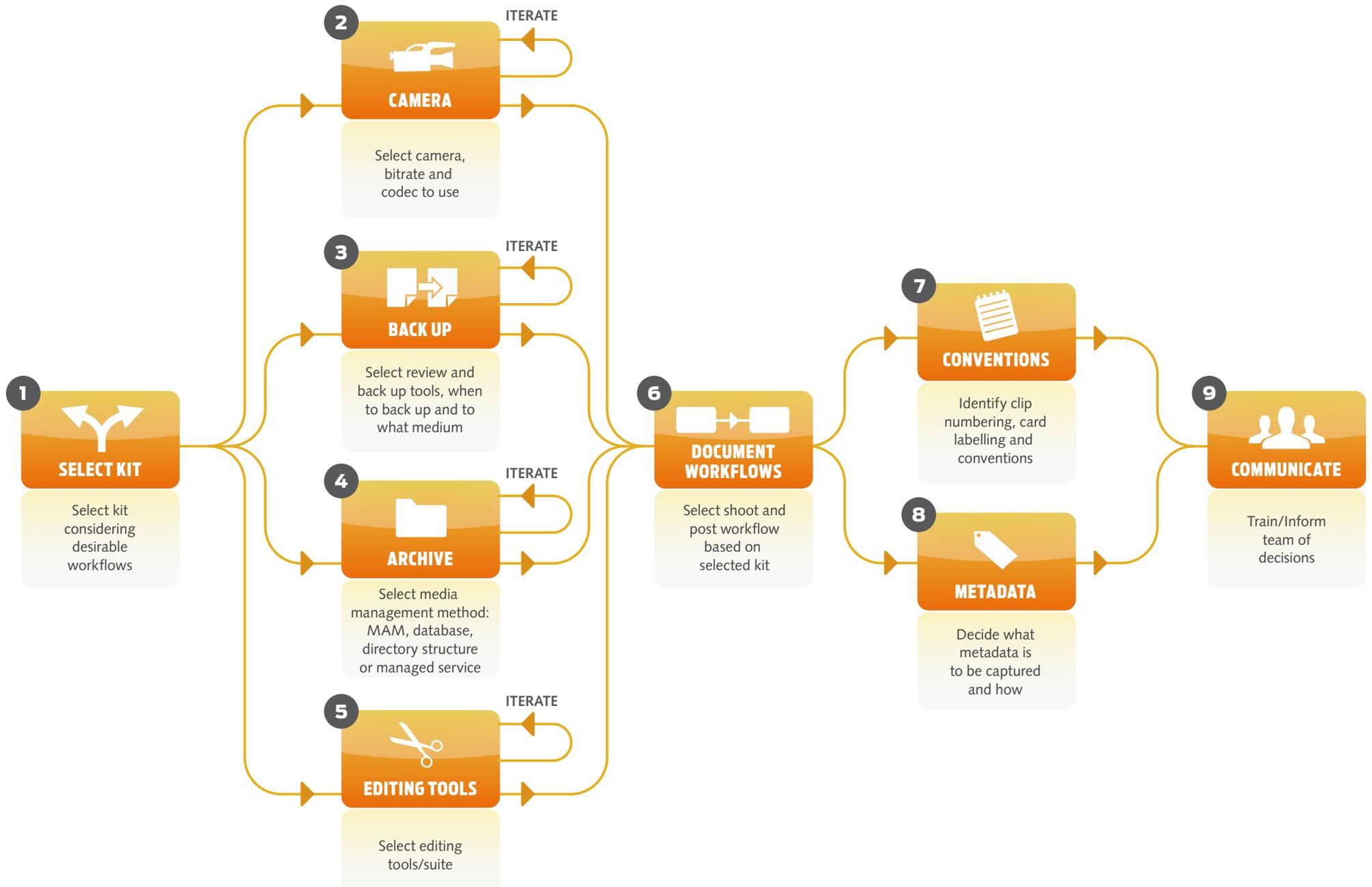
But in end-to-end file-based workflows the planning stage becomes more important than ever – and without it creativity may be seriously compromised. Whoever found computer systems that don't talk to each other creatively liberating?

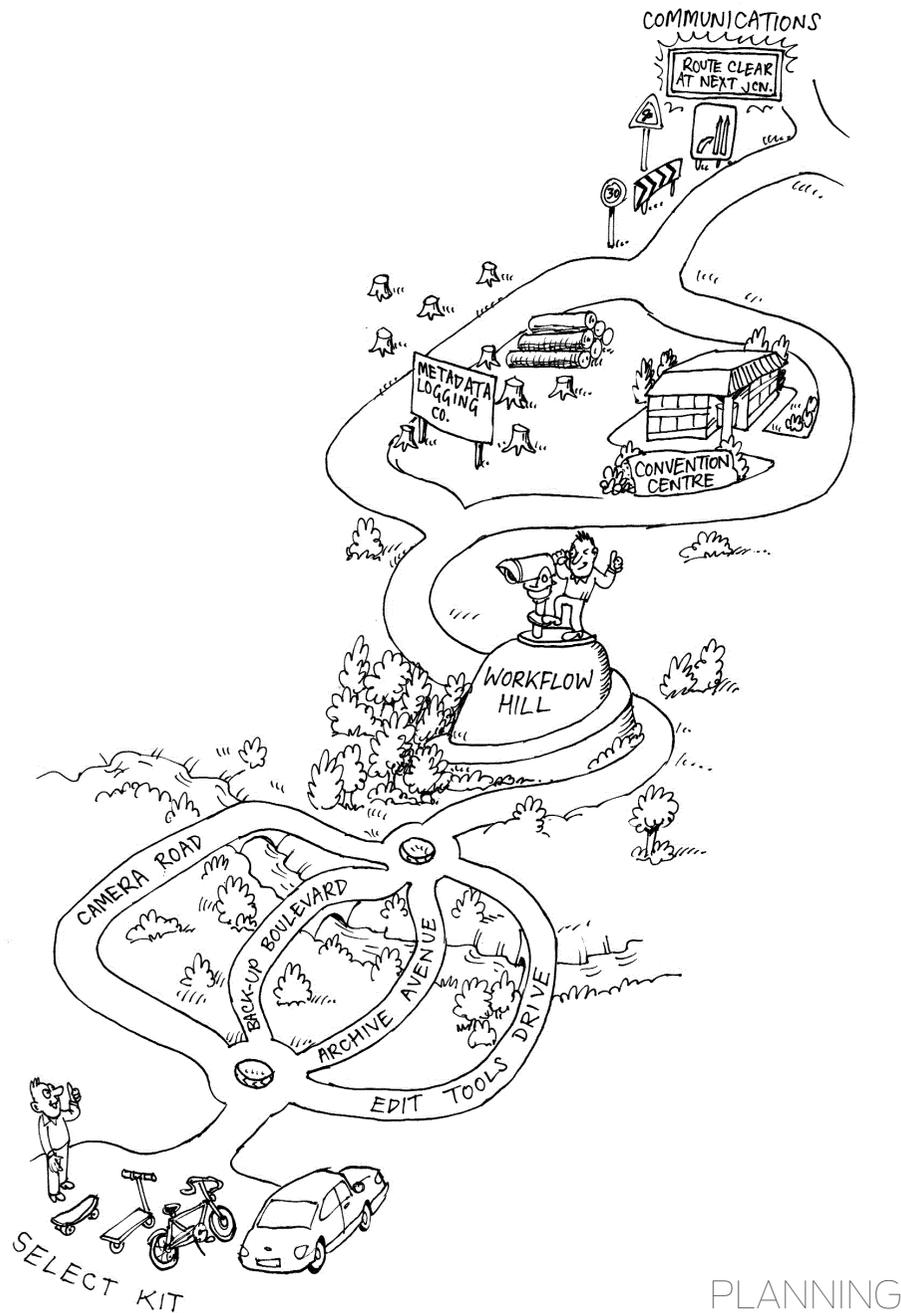
Not only is it the case that better planning upfront will make the process easier for production, but broadcasters, studio facilities, and even insurers, are increasingly now insisting on production companies providing a workflow description upfront. It all comes back to the need to rediscover the security apparently sacrificed in the move from tape.

Planning has two main elements to it: the first is the selection of the kit to be used, and the second is decision making on actual workflows, conventions and documentation of what is going to be shot.

PART 1

PLANNING





1

SELECT KIT

The production community tend to think of kit rather than codecs or processes, and very often a production may implicitly define a workflow based on the choice of camera. There are four main technology aspects that need to either be defined or considered right at the start of the process: choice of camera is seen as the most important, followed by the method of archiving rushes, backing up of material on shoots, and the editing tools to be used in post-production.

When and how to review your rushes should also be taken into consideration. The decision as to when is normally determined by the value of the rushes as well as the intensity of the shooting schedule and the length and location of the shoot.

The significance of camera kit selection is one of the unforeseen consequences of the move to file-based production. The decision between tape and film notwithstanding, the precise choice of camera has never before had such

implications for everything that follows and for the quality of the final product.

As will become evident from this guide, the choice of a particular camera may create such issues further down the workflow (depending on the requirements of the production) that the initial creative or operational benefits of the choice are negated.

DPP RECOMMENDS

There is merit, in our view, in using the planning process to look first at the smoothest possible workflow for the requirements of the production – and then to ask which cameras (and which camera settings) will ensure this smoothness can be maintained while still achieving the desired creative look.

Of course the conclusion might be that for creative reasons, a team will still prefer to sacrifice some smoothness, but at least that decision will be made knowingly, and additional thought and planning can be put into the friction that may result.

2

CAMERA

WHICH CAMERA?

The nature of the commission of course will be a key deciding factor in camera choice, as certain types of production will require different types of camera e.g. handheld or shoulder mounted, self-op or professional. Some types of production, such as drama, may also prefer large sensor cameras, which give a great look by enabling a shallower depth of field. All of this should be considered alongside the list of broadcaster accepted cameras.

WHICH RECORDING FORMAT?

Increasingly cost is the key component – and this means not just the cost of the camera but also the cost of the media it uses to capture the image.

For example, P2 (by Panasonic) and SxS (commonly referred to as 'S by S') cards are relatively expensive, and must therefore be cleared and re-used. This in turn requires production teams to create multiple copies whilst on the shoot in order to be able to clear and re-use the cards.

This will mean the addition of further kit, such as specialist external hard-drives. However, this has the benefit of forcing productions to make on-site back ups, which not only provides security but may well be essential for insurance.

Cameras such as the Canon XF305 and Canon EOS C300, on the other hand, use more consumer oriented Compact Flash (CF) storage cards that are sometimes treated almost like consumable tapes for the duration of the shooting period (the fact that they are relatively low cost means that you can carry additional cards as you would with tape in order to reduce the frequency with which you need to clear and re-use cards).

The Sony XDCAM disc cameras meanwhile have relatively cheap media (XDCAM discs) which also happen to be almost identical to a tape based operation, at least at the shooting stage. Some production companies have found these cameras useful in their transition to a

file-based workflow, since content can be shot, delivered and archived on XDCAM disc – much as it was with tape, using a similar workflow.

WHICH CAMERA SETTINGS?

When setting up the camera, the obvious choice may seem to be to select the highest bitrate for the highest quality video. However this decision may have enormous implications for your budget and workflow.

The higher the bitrate, the more memory is required to store the information – and that means the less you can store on the card. As a result, this may require additional cards and generate more work on location. More frequent card re-use will mean more regular duplication and extra back up storage. Similarly, your post-production costs will increase, as you will need more storage in your edit suite.

The choice of codec is also an important consideration in your workflow, as the

codec will need to be compatible with both the needs of the production and the downstream editing platform and delivery specification.

It is worth noting that the European Broadcasting Union (EBU) has produced a tiering of HD cameras, referenced in the DPP Delivery Specifications, which can be found at tech.ebu.ch/camtest. This tiering may help with the decision making process, however many will find it too technical to assist in camera selection so it is important to check that the camera and the settings you select meet the required technical standards of your commissioning broadcaster.

DPP RECOMMENDS

The remaining technology choices are also critical components of the workflow, and the final choice of camera and capture format should not be confirmed until they have also been considered.

3

BACK UP

It is important to decide when and how to back up. In file-based workflows this is often to a removable drive, but in larger organisations it may be a more robust rack-mounted disc storage array. It is likely that the method of backing up rushes on location will be different from the method of backing up your final master at base. If media needs to be couriered to your editor it could affect the workflow and even the type of drive you use.

Another important consideration is who has access to your rushes, particularly if the content is sensitive. File-based media means having multiple digital copies that are much easier to duplicate. You may wish to create multiple full resolution back ups on separate security-protected storage devices, and then delete the original copy. (See Rushes Management section below for further detail.)

4

ARCHIVE

Early decision making about the method of longer term archiving is important because the metadata, directory structure or format of the archive can affect, or be affected by, the choice of other technologies used for shooting. Content that will be ingested into a media asset management system, for example, will require more structured metadata if it is to be of use. Tapes archived on a shelf used to require little more than a few notes on a label but productions are starting to realise the benefits of capturing a more detailed description of their assets. (See the Rushes Management section for further detail.)

5

EDITING TOOLS

The editing tools (Non Linear Editor, or NLE) may be already determined when using in-house post-production, however the choice of camera and codec compatibility with the NLE should be considered if you want to achieve a smooth workflow. Certain codecs appear to work better with different edit platforms, and aligning the choice of camera and editing tool will make the production and post-production process more efficient. (See page 23, below.) This alignment of camera codec with the NLE's supported codec will prevent the need for a transcode between the two, and this will save time and storage.

In addition, productions requiring a fast turnaround such as news and sports will need to be planned very differently. All of the tools will need to be selected for seamless integration of editing, graphics and playout.

DPP RECOMMENDS

In general, it is best to avoid the need to transcode entirely. However if transcode is unavoidable, then we recommend you transcode only once, for reasons of quality, convenience and cost.

6

DOCUMENT WORKFLOWS

Given the choice of technologies, a critical new step for many will be the documentation of the workflow to be deployed during production. It is possible that this report may help: it could act as a template for production to make explicit their plans and decisions and communicate them to their team.

In addition to the process steps and the order they are to be completed in, the workflow has 3 main elements:

- 1 the documentation on what and how to shoot
- 2 the metadata to be captured
- 3 the naming conventions to be supported

7

NAMING CONVENTIONS

As we observed at the beginning of this report, there are few things more important in a world of file-based media than having the ability to find your material. If decisions on the naming of material are taken on the hoof out on location, they will almost certainly create problems further down the line. Far better to decide as part of the planning process what naming conventions are required by the production's workflow and delivery requirements.

The term naming convention actually has three sub-elements: card labelling, clip naming and numbering. While shooters may prefer to simply use numbers (e.g. Mov_0001, etc) this will be useless on a long shoot when people need to find specific clips. Equally it is impractical to expect shooters to input overly long or complicated file names.

For example, the Canon XF305 allows you to configure clip naming settings in the camera in an AA/0000 format. Sony cameras also allow the configuration of clip naming settings but allow much longer free text; and the Nano-Flash has a two-letter format, similar to the Canon. It is essential however to liaise with the post house/production team, especially the editor, before the shoot and agree on naming conventions and media management workflow.

DPP RECOMMENDS

The answer appears to lie in setting up the cards and cameras to apply as much useful technical metadata as possible, and then having the ability to relate clip names to a shooting diary, report or logging sheet or similar.

METADATA

We can see this area getting more complex as crews may need to populate *metadata schemas* or templates that are set up before the shoot. This may require new specialist metadata expert roles to identify, create and possibly enforce adherence to metadata conventions. This role may also include the definition of back up procedures, archive procedures and rights management, covering both release forms and defining how to apply restrictions through naming conventions.

The logging of metadata will become an increasingly important area, as described, right.

LOGGING

Logging can be a confusing term, as it means different things to different people and at different stages of the production process. It may be helpful to think in terms of four types of logging.

PRODUCTION LOGGING

(may also be referred to as footage, rushes or shot logging) relates to descriptive metadata produced about rushes to assist in the post-production process. For example, shot descriptions, transcriptions, and qualitative comments which help the director and editor select shots more quickly for inclusion in the edit. We see this as the bulk of the requirement for production companies.

ARCHIVE LOGGING

relates to logging your archive to identify clips and rushes that could be of use at a later point, e.g. for compliance or sale. The main function here is to label content so that it can be found easily through searching. This is rare in production companies but more common in broadcasters who log against a managed list of keywords. It can also apply to rushes or completed programming.

CATALOGUING

relates to the provision of technical, contextual and subjective metadata that helps the distribution of completed programmes e.g. programme synopsis for EPGs or cast lists. The emphasis is on the needs of end consumers or distribution companies rather than production staff.

9 ►

RIGHTS LOGGING

Each one of these logging stages can be supported by a rights logging activity. The production logging stage will typically be associated with contributor rights i.e. what rights were used to make a programme. Archive logging is linked to access rights, i.e. what are the internal restrictions on use and re-use of content. Distribution rights are intimately linked to Cataloguing as both are focused on end usage.



COMMUNICATE

This planning work is only worthwhile if it is adhered to, and shared with all parties throughout the production process. This may be conveyed in a variety of ways, through morning briefs, structured documentation and even training to ensure your team understands your planning decisions and why it's important to adhere to them.

Increasingly some aspects of this communication may be formalised, for example through the use of industry standards for file exchange. It is also likely that broadcasters or facilities will begin to demand to see planned workflows before they sign key stages, a move that some facilities companies have taken to protect against potential loss of content with file-based cameras. In the following section we set out some potential ways of presenting and documenting production workflows.

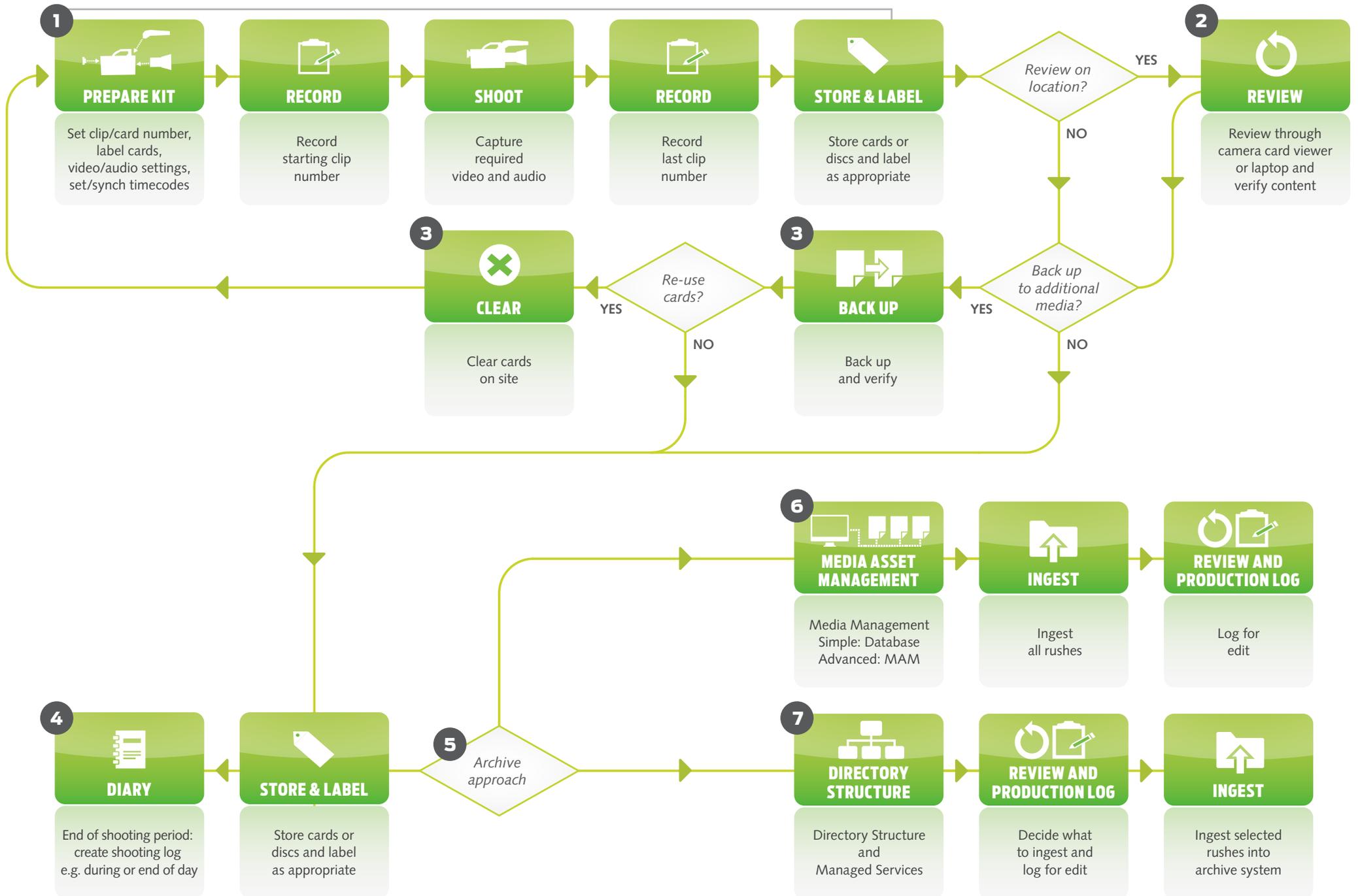
The shooting workflow is primarily about rushes management. Production companies are probably most comfortable with this area and as a result it is likely that they will already have their own *de facto* workflows.

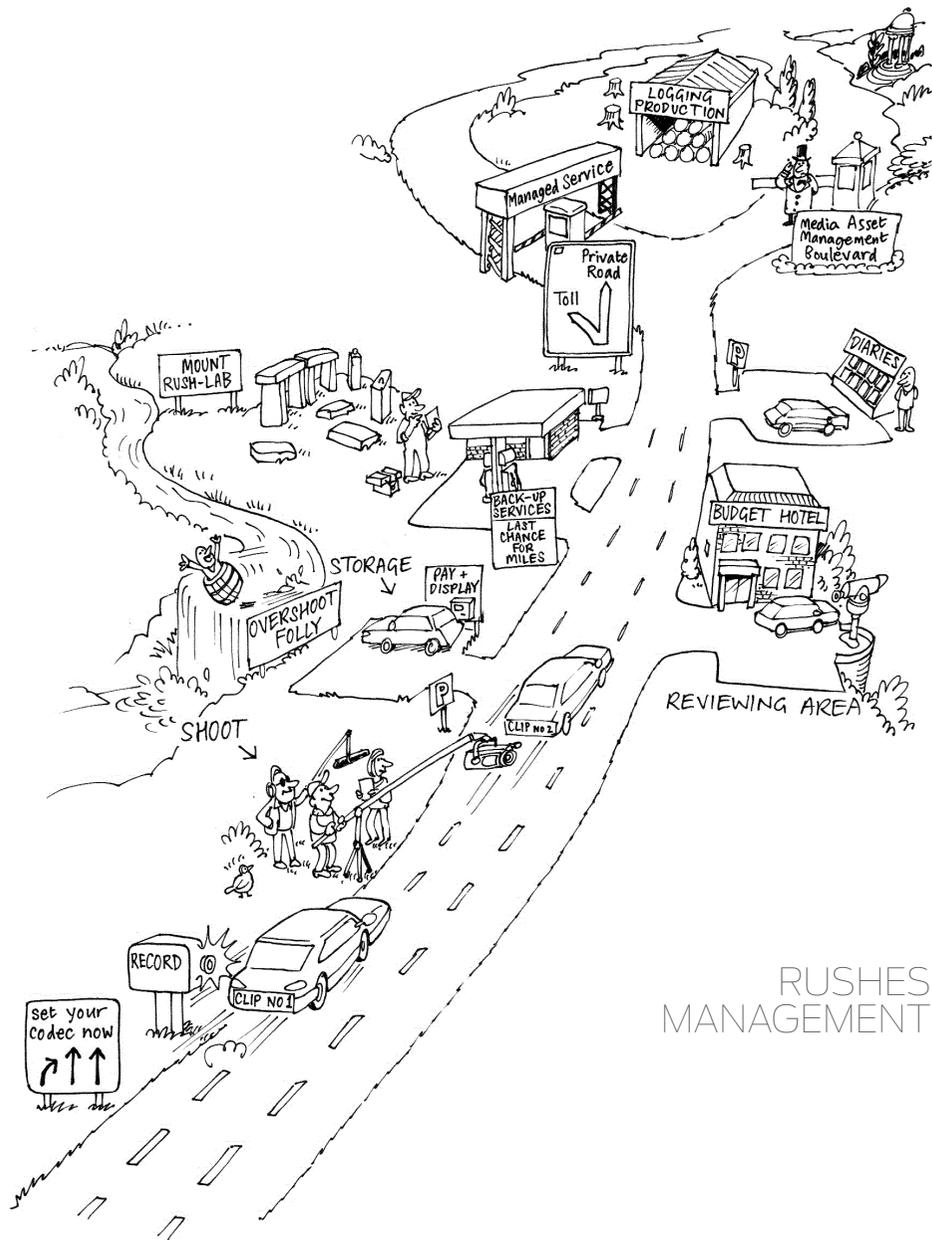
The workflow has three elements. The first is the shooting of content. Depending on the kit used, the next main element is whether and how to back up, and also whether to re-use cards on location. The last element is how to archive the rushes, and this is also a factor of the archiving technology in place.

Archiving as a term is increasingly anachronistic, as it suggests that the material will be put on a dusty shelf and not accessed. Nothing could be further from the truth: in reality, archiving is an essential production library function that provides a safe destination for shot material, and underpins post-production.

PART 2

RUSHES MANAGEMENT





1

THE SHOOT

During the shoot, the team should follow the naming conventions set in the planning stage, and follow the checklist below as they prepare and set up their kit in line with the agreed plans:

- Set clip/card number
- Label and number cards according to specified conventions
- Ensure there are enough cards, using a newly formatted card each day to avoid timecode conflicts
- Prepare camera and audio settings, including video codecs, wrapper/container, progressive/interlaced, audio codec, bitrate/sampling rate
- Set timecode and synch timecodes between cameras

DPP RECOMMENDS

A filming log or diary of what has been shot should accompany the cards, and should ideally capture information such as the producer, date, location, card number, clip start and end number, and a brief description of the content. Assigning this job to someone on the shoot allows the production team to keep track of everything that has been shot.

2

WHAT TO SHOOT

The *What to Shoot* concept has not really changed – production companies already know what material they plan to acquire. File-based cameras have added a new element however: in the tape world, the amount of stock on location was limited; but in the file-based world shooting is limited only by the available on-site back up storage – which may be considerable. This can result in over-shooting – particularly for a relatively inexperienced crew. It's easy to think that over-shooting doesn't carry a cost (since storage may be cheap). But in reality it can impose considerable costs later in the process, with more time required to review content, and more storage required for post-production.

REVIEW

At this stage comes one of the most significant variations in production workflow: namely whether to review on location or not. In theory location may seem the ideal place to review footage since if there are any issues material can be immediately re-shot, and it is required by many insurers. In practice however this is not necessarily the case. Unscripted documentaries, for example, cannot be reshot and even on scripted shoots the crew may not have the time either to review the material or to reshoot.

If the decision is taken to review on location, however, there can be multiple ways of achieving this. The most popular is to ingest either the source material or the proxies (if proxies have been generated in the course of shooting) into a laptop. The material can then be played on the laptop either through edit software or through a video client.

Alternatively, the rushes could be viewed directly from the capture medium. This

could be done on the camera; on a card reader with a screen; on a laptop; or on a monitor attached to the camera or storage system.

In any case, be sure to make the card handling process clear to protect the content. In addition to ensuring the cards are safely stored, some cards offer the ability to also lock the content to prevent additional editing which could be one of the first steps after removing a card from a camera. It would be devastating to have a crew member accidentally delete the footage on their laptop whilst attempting to review it! Similarly, a security procedure may need to be enforced to prevent the copying of valuable or sensitive material, as digital files are much easier to duplicate and distribute than tape.

Many vendors offer free software tools to review footage generated by their camera. If the shooting period is short or if it is possible to get footage back to base it may also be possible to review footage in your

Media Asset Management tool. Some of these products allow companies to upload content to the web as proxies for production logging, review and shot selection/proxy editing, before exporting an EDL for conform and finishing in a high resolution editing system.

More generally, the review stage is becoming more important, particularly on high shooting ratio programmes to reduce the amount of footage to edit and archive. While MAM tools have browse capability built in, there are also non-MAM based alternatives in the cloud. Our first report highlighted that broadband connectivity is not good enough yet for most companies to upload high bitrate content from many locations; however as broadband connectivity is improving, the ability to share and review in cloud or web-based services is becoming easier, especially when proxies are used, providing additional alternatives to the traditional local review methods.

3

BACK UP AND CLEAR

In a file-based environment, it is always recommended to make a back up of any important files. Whether to do so on location is often also dictated by how far the production is from base, how long the shoot is and how valuable the rushes are.

In practice, back ups are sometimes required simply due to camera choice. Some higher-end solid state cameras shoot on expensive media, so fewer cards can be afforded on the shoot.

For example, P2 cards (amongst others such as SxS cards) are both expensive and don't hold much content; therefore making a second copy (and also an additional back up copy) and re-using cards is the only practical workflow.

These two back ups will have now become the masters of course, once the cards are wiped. It is hard to overemphasise the care that needs to go into this process – and the importance of having two independent copies, not just one.

Backing up to removable Hard Disc Drives (HDDs), meanwhile is not always as secure as people imagine. Discs fail all the time, and even backing up on a device that mirrors the content on two discs offers no protection if that device is, say, dropped on the road. If backing up to HDD, it is therefore necessary to make two separate copies on separate HDDs. Alternatively, Solid State Discs (SSDs) can be used to back up the content, which are much more reliable although are significantly more expensive than HDDs.

Other cameras use lower cost cards that are often treated similarly to digibeta or HDCAM tapes: production teams can be provided with enough of them to complete the shoot without needing to re-use the cards. This means duplication may not need to take place until back at base – unless it is a particularly long shoot.

Irrespective of location, duplicated card content should always be verified before the cards are cleared. Ideally this would involve running a checksum on the copied files (i.e. file comparison at the byte level) in addition to a spot check and comparing file sizes. This can be time consuming so should be properly scheduled into the shooting period.

One key factor here is the human element. The DPP workshops identified that crews can be heavily overworked and stressed – with the first day of shooting having particular strains as the team find their feet. Tired and stressed crews are not always the right people to be forced to make decisions on what to clear off cards, and a workflow that forces them to do this at the end of every day's shooting may result in permanently lost footage or a large bill for memory cards if not properly managed.

DPP RECOMMENDS

The best procedure should be to follow a clearly defined, constantly enforced and trusted back up process for all content. Backing up should be assigned to a named team member who is well trained and confident in the task. They should be given properly scheduled slots in the shooting period to undertake this important job. Only once they're satisfied that back up has been successfully completed, should the content on the cards be cleared.

Again, it is important to check insurers' terms as to when a back up is acceptable (and the number of copies required). Some vendors have an insurance approved location back up system with card verification.

4

DIARY

The shooting log remains just as important in the file-based workflow – except now the log needs to be able to reference file clips or cards rather than video tapes.

5

ARCHIVE APPROACH

Once rushes have been acquired and backed up, they can be archived in a variety of different ways. Although broadcasters would at this stage ingest the content into a Media Asset Management (MAM) system, production companies and post-production companies typically cannot afford these systems.

While this is changing a little, and very cost effective systems are now becoming available, the price points need to be extremely low (i.e. under £10,000) to be considered by the majority of production companies. Online services may change this by providing more of a pay-as-you-go service that can be incorporated into programme budgets rather than being seen as an overhead, although

such solutions may be too expensive to be used as a long-term archive system, as historically production companies have archived on shelf space, where the perceived cost was zero and they may therefore not wish to pay for ongoing long-term archiving.

Despite the importance of metadata in a file-based environment, the implication is that unless mandated by broadcasters, the additional or more advanced archive and logging processes are less likely to be adopted unless there is a serious business case for making better use of that archived and logged content. Feedback from the DPP workshops suggested that while there was some potential value in clip sales, this is restricted to certain

genres and for the most part was not sufficient to justify any significant incremental investment in MAM or logging services or products at present.

The alternative to a MAM, or MAM-like approach, is to use a folder structure using removable drives, disc arrays or formats such as LTO for digital tape storage. Media locations could be deduced literally by the folder structure, or alternatively a database or spreadsheet could be used to track where files are stored and can be found in the future.

6

MEDIA ASSET MANAGEMENT

The workflow for content archived in a MAM system is different from the simpler folder structure approach. Typically all content is ingested first and then reviewed within the MAM system. In a MAM system, the content being reviewed will be a proxy, generated by the camera or by the MAM on ingest. This allows for desktop review of content, with any shots deleted having the option of also deleting the high-resolution source material. The MAM approach is particularly suitable for archive logging and where content is likely to be re-used frequently.

7

DIRECTORY STRUCTURE

The directory structure approach involves archiving onto a set of structured folders using a file system. For many production companies this will be adequate but does require some forethought into structure and as a longer term archive, it is unlikely that content will be found easily or at all. Some production companies are using LTO for longer term archiving and use spreadsheets or very simple databases for keeping records of content on LTO digital tape.

RUSHES MANAGEMENT ACTIVITIES

ACQUISITION LOCATION/STUDIO				EDIT PREP			
CAMERA/CARD FORMAT	CODEC	FIELD/STUDIO BACK UP	METADATA ON CARD	BASE BACK UP	RUSHES WIPING	TRANSCODE TO EDIT CODEC	LOGGING/ DESKTOP EDIT
 VIDEO <p>Choice of file-based camera</p>	Codec on camera	Choice of back up device if required	Minimum technical metadata on original card format	Longer term back up, possibly on a MAM system	Protocol for wiping original cards (may happen before Base Back Up)	If necessary, transcode original codec to edit codec. Ideal is to edit in acquisition codec. However may also be for generating lower resolution for Offline.	Lower resolution possibly remote or cloud-based editing
 AUDIO <p>Integrated or separate audio recorder</p>	Audio codec	Integrated or separate audio recorder	Likely to be technical metadata	Longer term back up, ideally associated with video if not integrated	N/A	Ideally keep audio in high resolution format	

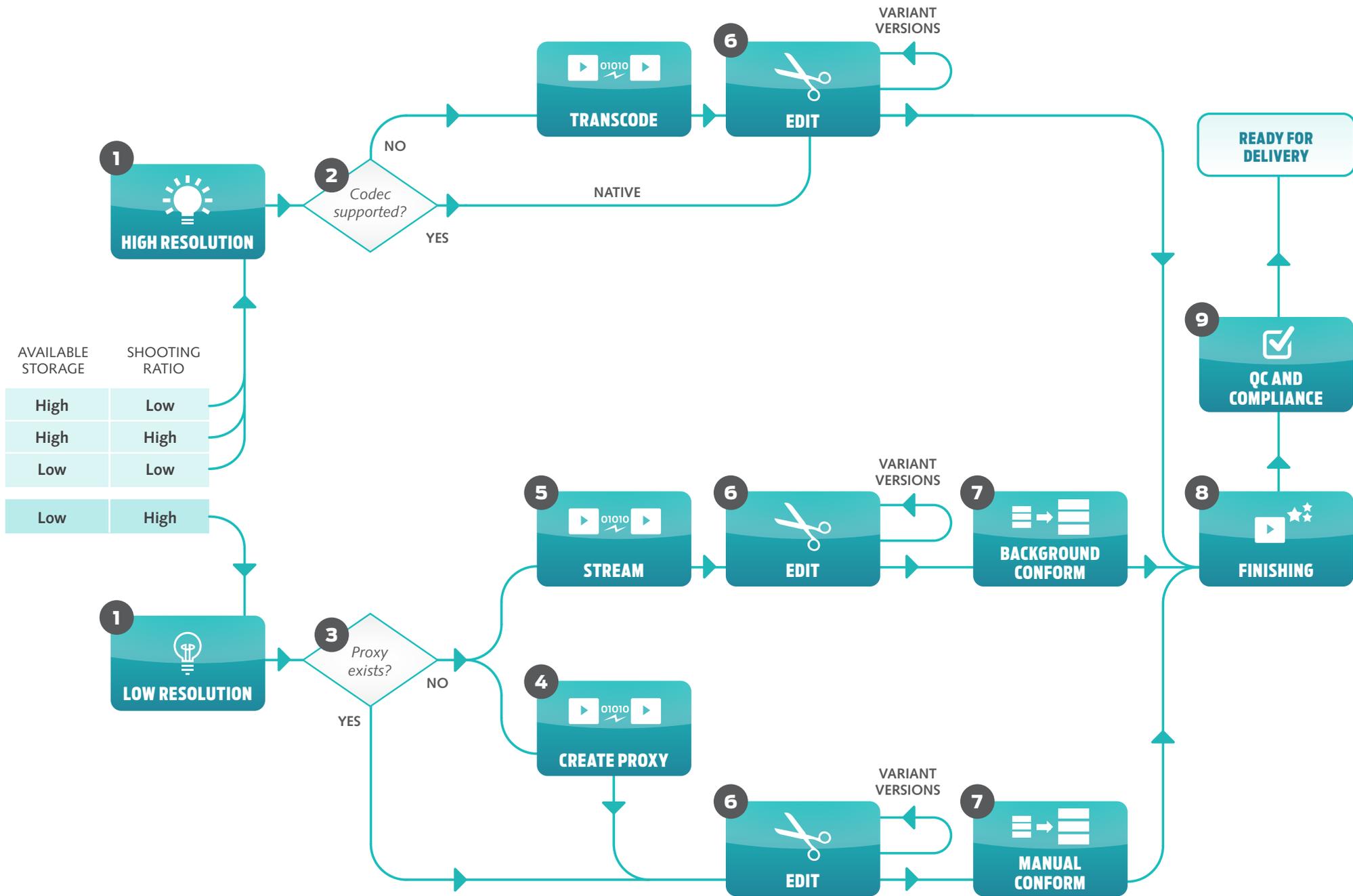
While the Post-Production stage may not appear at first glance to have changed with file-based production, it is in fact heavily impacted – particularly by the choice of camera and codec selected in the Planning stage. Non Linear Edit vendors claim to support the full range of codecs provided by the leading camera vendors. In practice, however, unless you are working in a format that is natively supported, it may be necessary to transcode to another format for the ease of handling your material in the edit.

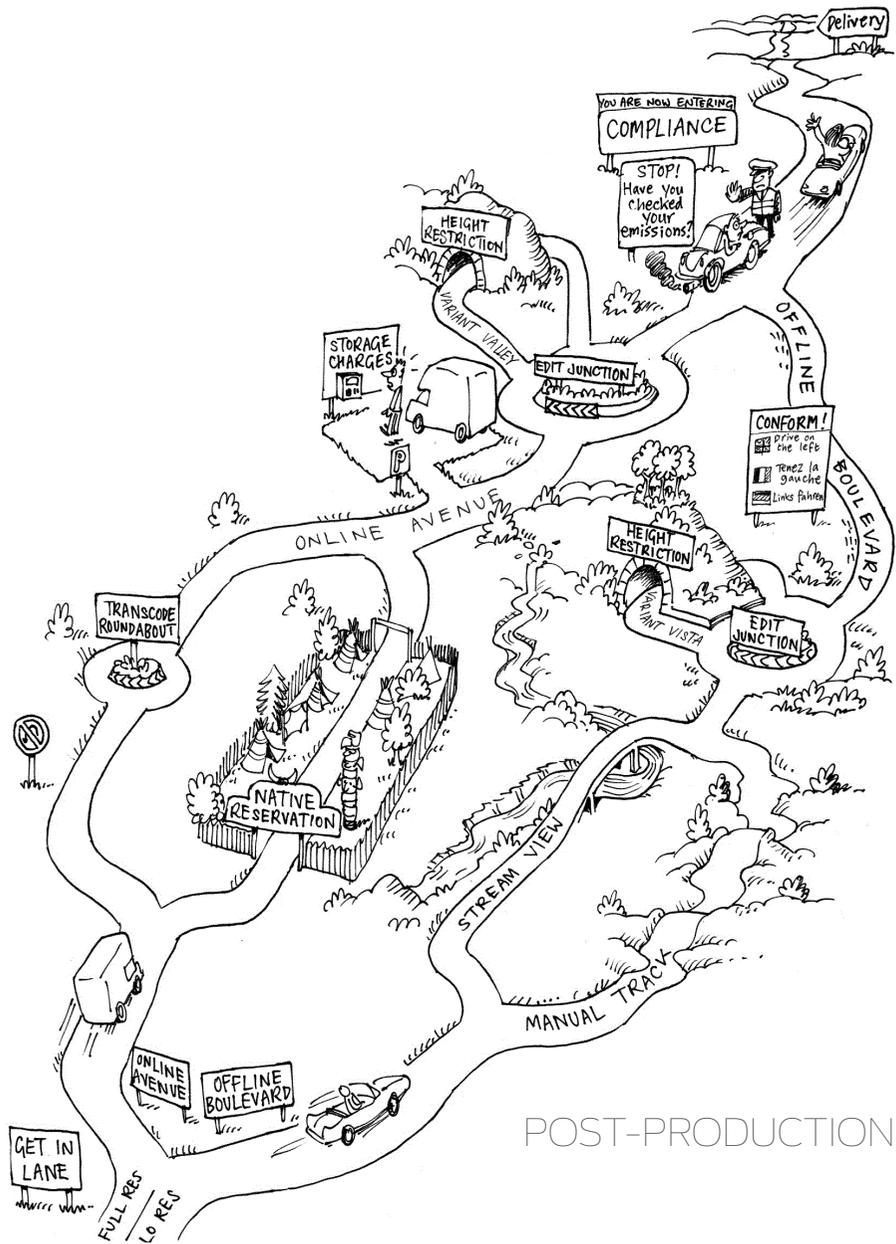
Put simply, we advise that for the smoothest workflow, you should aim to shoot in a codec that your NLE supports natively.

The choice as to whether to perform a high resolution or low resolution edit is typically determined by the amount of footage and the availability of storage for editing. If you have the storage in house or the budget to rent storage in a post house, then you will likely edit the high resolution material. If however, you have a high shooting ratio and a low budget you will transcode to a lower resolution format and edit a low resolution proxy version, conforming and re-linking to the master assets upon completion. This is an area to keep an eye on, as developing technology is likely to have an impact on this decision. If editing storage becomes cheaper it could favour high resolution editing whereas the development of remote proxy editing could also sway the balance.

PART 3

POST-PRODUCTION





1

HIGH / LOW RESOLUTION EDITING

Traditionally the two terms always associated with editing have been 'offline' and 'online'. The term offline emerged from film TV production where source rushes were copied to a lower cost format that was then used to create a rough assembly or a full off-line edit, that would then be conformed and finished using the source material. With NLEs the term has been used to refer to the use of a lower resolution proxy version to create a rough cut, and then using the NLE project or an Edit Decision List to conform and relink the high resolution master assets to 'finish' the edit and export.

This made a lot of sense in the early days of NLEs as storage was scarce and expensive. However some people, notably storage vendors, believe that with falling storage costs, offline as a concept should disappear, as it should be possible to work in full bitrate resolution from the beginning. Others however point out that HD (and beyond, with 4K and 8K emerging) is increasing storage requirements – especially as file-based HD cameras also tend to bring over-shooting. This, they insist, will ensure that offline is still retained as an approach. Still others argue, meanwhile, that different delivery platforms require different resolutions – and that what is considered 'offline' quality for broadcast TV may be considered 'online' quality for the web or mobile.

One thing is clear: the terms online and offline are becoming blurred and seem increasingly anachronistic. There are now new edit systems emerging which allow you to stream directly from high resolution material, enabling you to edit in a lower proxy resolution while the material is being automatically conformed at full resolution in the background: in short, to perform offline and online editing simultaneously. As a result, it is more accurate to talk in terms of working with the high resolution or low resolution or bitrate media.

DPP members confirmed that typically the choice of whether to edit with the high or low resolution and bitrate was based on the amount of storage available on their post-production systems and how high or low the shooting ratio was on their shoot. Occasionally, turnaround time would also become a factor as fast turnarounds favour a high resolution edit,

saving the time needed to conform and re-link the material. Alternatively, some hugely complex edits with a lot of material in a variety of codecs may struggle with the full quality media, unless the editing facilities have been set up and tuned for supporting these types of complex jobs.

In summary we would use the matrix below to guide the offline/online decision.

The type of edit will also help to inform whether to use the high or low resolution and bitrate media. Grading, for example, will require the high resolution media and is therefore more likely to require a more powerful machine. Whilst you can perform a shot selection on the high resolution material, it is probably easier to work with a low resolution and bitrate copy on a cheaper editing system. Similarly, the

editing kit being used would also inform the type of edit. If performing a shot selection or simple rough cut in the field on a laptop it's unlikely it would have the power or storage capacity to handle the high resolution media. Production companies are using low resolution and bitrate media to perform shot selections and rough cuts to reduce the amount of rushes they take into the high resolution edit.

OFFLINE/ONLINE
DECISION MATRIX

		SHOOTING RATIO	
		LOW	HIGH
VOLUME OF AVAILABLE STORAGE	HIGH	Online	Offline Bias
	LOW	Online Bias	Offline

2

HIGH RESOLUTION EDIT

Many of the main broadcast cameras write video in codecs that use complex algorithms to compress the highest quality possible into the lowest bitrate possible. While this feature is useful as a means of maintaining a high quality in a low card storage space, it can create difficulty in the edit because of the processing power required to decode the material.

As a result, editors often prefer to transcode into a format that is much easier to handle. This is not without issue however, as transcoding takes time, additional storage and results in a small 'generational-loss of quality', meaning that it's often best to avoid the need for a transcode altogether.

For fast turnaround productions such as for news and sports, working end-to-end in a codec that is supported natively throughout the process will make for the smoothest and fastest workflow. The 'native' format is the source format the camera encodes the video to, so an NLE that can handle these easily without the need to transcode can ensure a smoother workflow. Non fast turnaround productions can also benefit by selecting compatible kit in the planning stages or otherwise accepting the consequences of these decisions, perhaps for other benefits, planning for the additional time and storage that will be required in post-production.

Each editing platform has its preferred codec to work in. Avid Media Composer prefers DNxHD whilst Apple's FCP prefers ProRes, for example. Panasonic P2 cameras, meanwhile, can shoot in DVCPRO 100, which uses a compression technology that is easier for editing systems to handle making it possible to edit natively, while some other cameras can shoot directly in the NLE's preferred codec.

3

PROXY BASED EDIT

Depending on your Media Asset Management solution, proxies may have already been generated on ingest for browsing, shot selection and low resolution editing.

Alternatively, some cameras can automatically generate these proxies; however we found in the workshops that it was rare for production companies to use them. One reason for this is that they often work with multiple camera brands on the shoot where some may and others may not generate them, making it simpler to not use them at all and to re-generate all the proxies later in the workflow instead. Furthermore they found that managing the proxies – as well as the rushes – just added another level of complexity to the shoot.

4

LOW RESOLUTION PROXY GENERATION

If performing a low resolution edit, lower resolution/bitrate proxies need to be generated. In the edit for example, editors working on Avid tend to transcode all footage to Avid 10:1, while those working on FCP will transcode to ProRes 422 (Proxy). It is possible to edit with lower quality proxies than these, however it isn't recommended as the loss of quality may make it difficult to see issues from the shoot, such as soft focus.

5

LOW RESOLUTION STREAMING

Emerging stream-based remote editing such as Avid's Sphere, Quantel's Qtube and new products from Adobe automatically generate and stream video to a remote edit station. These technologies blur the line between online and offline editing, streaming a version sufficient enough for most offline editing, while reducing the need for a large local store by editing via proxy and automatically conforming as though you were editing the high resolution media.

If variant versions are required, such as for pre and post-watershed, they can be cut after the main version has been created.

6

EDIT

After choosing to edit with the high or low resolution media, the craft editing process has not significantly changed. The main difference is that some productions are now performing more detailed shot selections and even rough cuts in order to narrow down the volume of rushes and reduce the amount of storage required. This means the editor only works with the better material. Although some craft editors are now comfortable with also finishing the programme (see 8), many prefer to leave this more technical final stage to specialists – much like the old offline/online editor distinction.

7

CONFORMING

Once the various edit versions are complete, the low resolution media can then be re-linked to the high resolution master media. This is much like the conform that used to be done in an offline edit with tape masters, however the technical process is clearly different, and less manual. Gradually, this is becoming simpler as the conform process is automated and with low resolution streaming, can be done in the background without the user even being aware of it. At present, grading, graphics and audio mastering teams typically take over after the conform, working with the high resolution media. However as the quality of the proxies improves it may be possible for this step to be performed prior to the conform.

8

FINISHING

Once the edit is complete, for all but the smallest productions the video is likely to go through at least some basic grading. Some craft editors 'grade-as-they-go' throughout the editing process however colorists may add to this or change it to achieve the look the director is going for after the edit.

Similarly, whilst the craft editor may have already added some titles/graphics into the timeline, any additional required graphics and effects will be added to finish the product. Again, whilst the craft editor may have made some decisions about the audio mix, more advanced audio dubbing and mastering will also take place after the craft edit.

Finishing is also now the term used to describe the final 'legalising' stage of the edit process in which checks are made to ensure the programme conforms to various broadcast technical guidelines. This is a specialist skill and is still often performed by a different editor from the one who performed the craft edit. It also requires some specialist equipment, and may be performed in a separate edit suite.

9

QC AND COMPLIANCE

This step is to ensure that the video and audio of the final programme – together with its various versions – are of appropriate quality for the intended platform, and that they conform to the rules and values of the broadcaster. It's important to realise that if technical or editorial changes are required at this stage, it is actually far more complex and slow to achieve than on tape, where a simple 'insert edit' could be made. With file-based programming, the whole file will need to be played out or 'published' again. This should be considered when editing to a tight deadline.

Quality control of file-based media can be very different from tapes. The DPP has not yet produced any guidance around this, but we are working with the EBU, who are developing common guidelines for QC tools. This will enable production teams and facilities companies to choose automated QC solutions which suit their workflows whilst ensuring they meet broadcasters' delivery standards.

QC and compliance procedures may vary depending on the final destination of the media, and this means it is not possible to detail them all here.

Of course, compliance with the DPP AS 11 file and metadata standards will become part of the technical checks applied by UK broadcasters.

DPP RECOMMENDS

The DPP is committed to creating greater standardisation in technical delivery standards among UK broadcasters. We are pleased to have taken the first step by publishing agreed common standards for tape and file based delivery of finished programmes, and these can be found here:

www.digitalproductionpartnership.co.uk/outputs.html

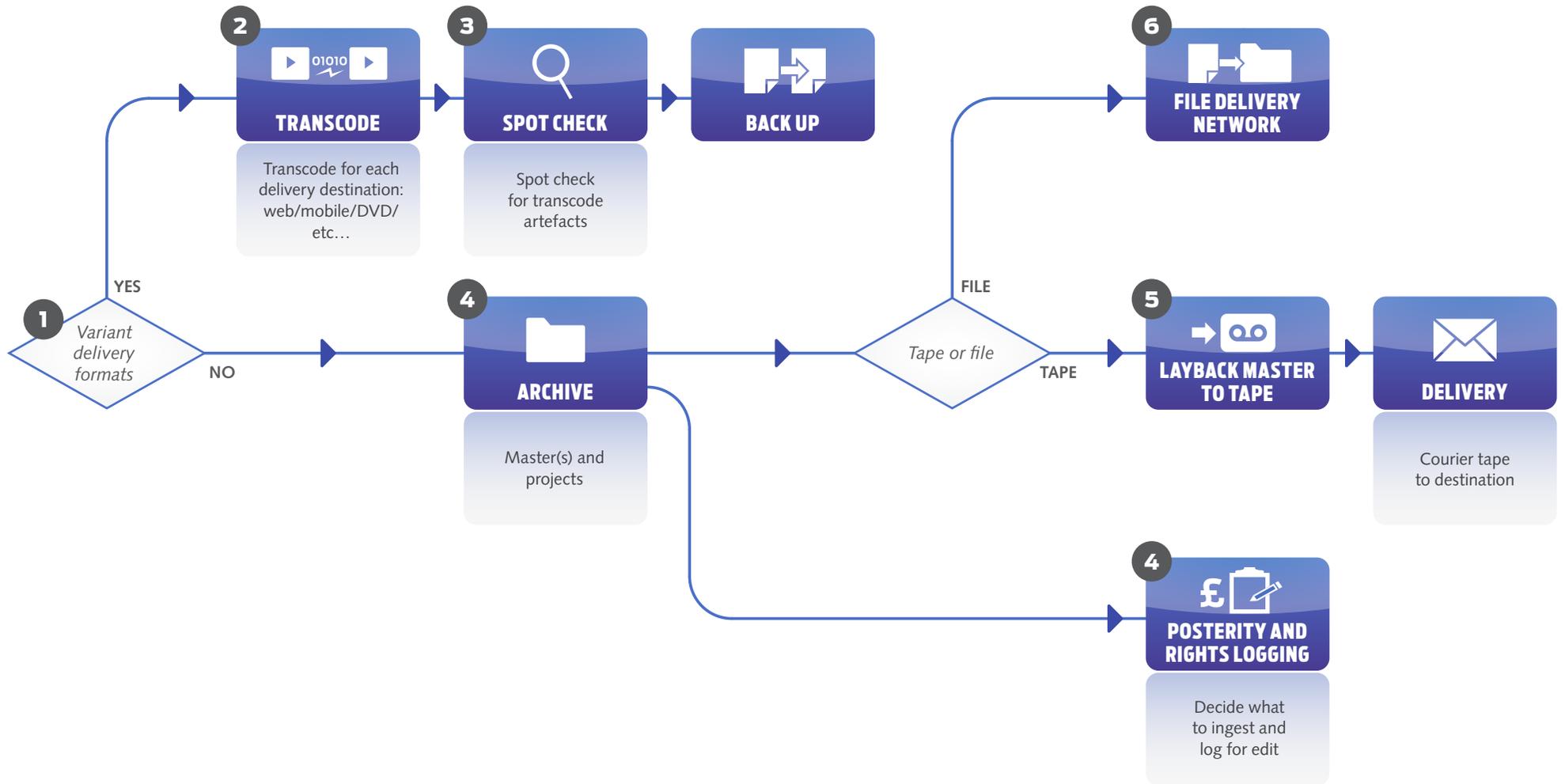
EDIT AND FINISHING ACTIVITIES

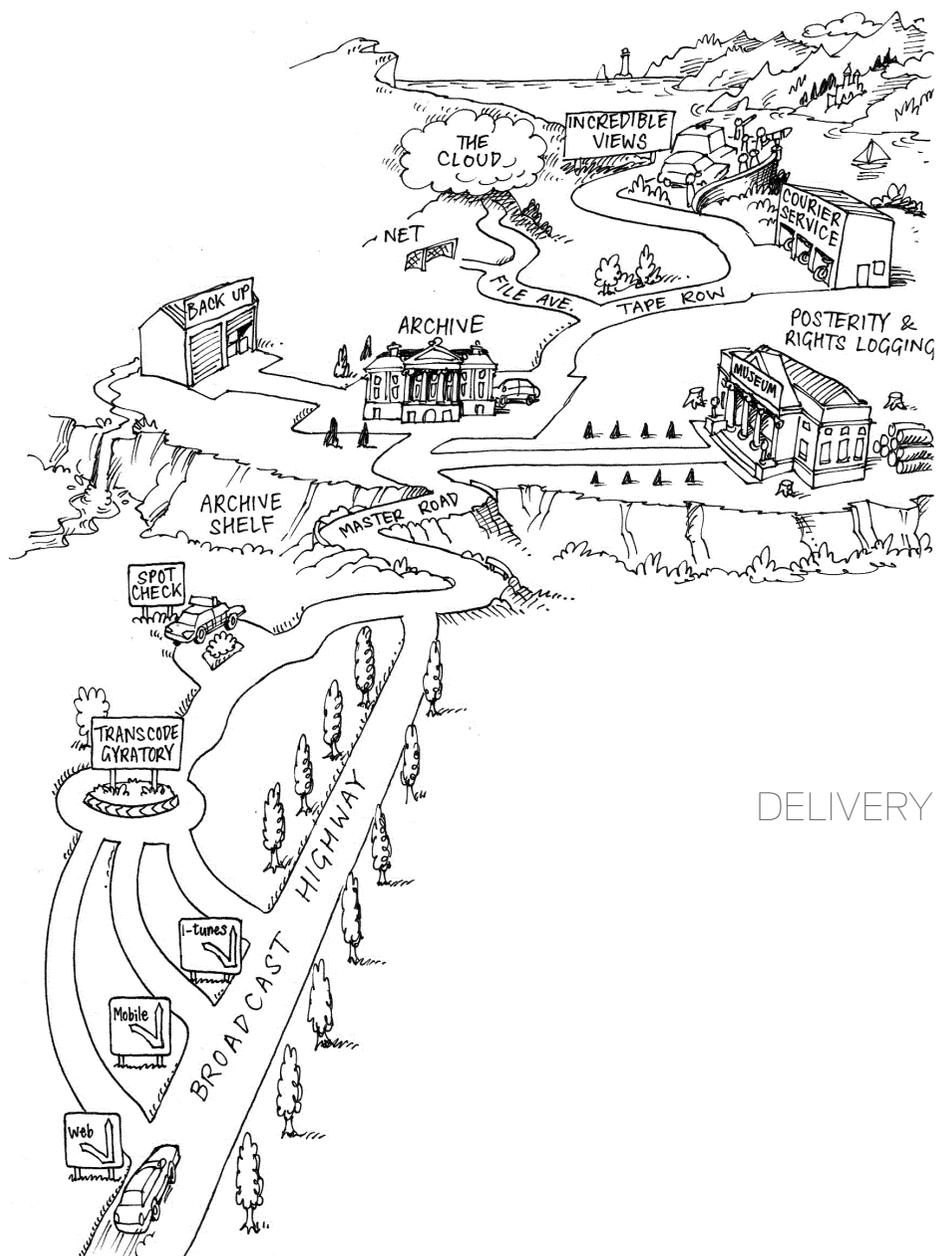
CRAFT EDIT - VIDEO			FINISH			
CRAFT VIDEO EDIT SYSTEM	CODEC	CONFORM/ RELINK	AUDIO TRACKLAY	DUB	GRADE	FINISH & LEGALISE
 <p>VIDEO</p> <p>Choice of craft edit</p>	Acquisition format if NLE allows, or native editor codec	Relink to nearline if editing in lower resolution		Video taken from Craft	Grading systems if required	Legalise refers to ensuring the final version is technically compliant
 <p>AUDIO</p> <p>N/A</p>	PCM	Audio also conformed at same time as relink	Create embedded AAF	Audio processing device	Audio exported as .wav file	

The final delivery of content from production companies is the start of the broadcaster's own internal processes, and for many, their own file-based processes. The growth in distribution across other platforms has also spawned new and complex workflows for generating versions of content for different smart phones, tablets and connected TVs.

For production companies, this part of the workflow has remained largely unchanged, primarily because tape remains the standard delivery format. File-based delivery is on the increase however, and, through the DPP, UK broadcasters have committed to it being the preferred means of delivery by 2014.

PART 4 **DELIVERY**





1

VARIANT DELIVERY FORMATS

Most production companies are required to make Tx masters for their UK and International broadcast customers. However, some may be required to produce variant delivery forms (e.g. for iTunes) either because of the specific nature of the deal and the rights sold, or because they are dealing with overseas commissioners who are acquiring several different masters. Note that 'variant' means different formats – if the material was being edited simply for duration or content, then it would just flow through the post-production process again.

2

TRANSCODING

For those that are required to produce variants for online, mobile or catch up services, files require transcoding into destination formats. Typically this would involve taking the transmission master and generating different lower bitrate versions based on the profiles established by each platform provider.

Transcoding is now a much more common and lower cost process than in the past. FCP users have historically had the Compressor transcode capability as an inherent part of the product, and some companies are now selling software transcoding products for less than £500. There are also open source transcoders, such as FFmpeg, commonly used by vendors – although these require some advanced programming skills to ensure that the output file conforms to the standards required by playout servers.

3

4

5

SPOT CHECKS

Transcoding will require spot checks to look for transcode artefacts. While this is possible on a number of players it's important to verify with tools that can provide a good quality video display to ensure the detection of any artefacts.

ARCHIVE POSTERITY AND RIGHTS LOGGING

At this point, the production company may archive the project and carry out an archive log – whether for posterity or to start the process for finalisation of the rights. For UK commissions this is often done via Soundmouse for cue sheets and Silvermouse for PasC forms.

LAYBACK MASTER TO TAPE OR FILE

The final Master for delivery in the UK is currently predominantly on tape, and HDCAM SR is the format of choice for HD commissions from major UK broadcasters – but not for much longer. ITV, BBC and Channel 4 are currently piloting file-based delivery and have, through the DPP, agreed that delivery on file will be the preferred format by 2014.

Currently the creation of a master involves layback to tape for audio mastering, and most likely dubbing clones. These are then distributed to customers, via courier or taxi. This process can often involve the hire of relatively expensive HDCAM SR decks, as smaller companies in particular could not justify the cost of outright purchasing.

In the near future TX Masters will increasingly be files. Their creation will be a three stage process:

- 1 Completion of the programme file – with final video and audio.

For HD commissions by DPP broadcasters (ITV, BBC, C4, Five, UKTV, BSkyB, S4/C) this will be AVCi 100 Mbs, to the DPP specifications.

- 2 Inclusion of Editorial metadata (e.g. series title, programme title) which will be required by the broadcaster. This ensures the master programme file is well labelled and can be found in the archive and played out in broadcast systems once delivered. This can also be done in advance of the programme completion if required.

The DPP are currently building a simple downloadable application for programme makers to use freely. This will make entering the required metadata in the required format straightforward.

- 3 Entering the Technical metadata and Wrapping of the file – using the DPP application – the metadata can be entered and will then be wrapped into the programme file, some of the technical metadata already present in the file will be extracted and re-written as part of this process. The end result is like a virtual tape box label and technical reporting sheet.

Once wrapped the master programme file will be ready for delivery to the broadcaster.

FILE DELIVERY NETWORK

When one talks of taxis and expensive deck hire as the current industry standard it isn't difficult to see that file-based delivery should represent an opportunity for savings and efficiency.

The DPP's technical and metadata standards for HD file-based delivery should make the process even easier as there is now just one agreed file format, structure and set of metadata requirements for the UK's seven major broadcasters. This means that the process for creating the completed programme file will be the same whether you're delivering transmission-ready files to BBC, ITV, Channel 4, Five, UKTV, S4/C or Sky.

Broadcasters have adopted secure, accelerated, file delivery over IP networks

to a very significant extent over the past five years, using such technology for internal as well as external traffic and traffic workflows. Such solutions are cheaper than tape traffic, and also faster and more secure than methods such as FTP.

However, these tools are currently only pervasive in broadcasters and very large production and post-production companies. For the rest of the market, the only remaining obstacle will be achieving file delivery over an IT network, as even if production companies had the necessary uplink, people would still be anxious about using unsecure FTP (file transfer protocol) as a means of transferring content. While there are proven secure software based methods of transferring content over public and private IP networks (such

as Signiant and Aspera), these are not yet pervasive outside broadcasters and distributors and in the near term the most common form of file-based delivery is likely to be a removable drive. While this may make commercial and logistical sense for production companies, it is less effective for broadcasters: they would prefer to receive files over an IP network so that they can avoid manually copying files, and make use of fully automated workflows starting at the entry point into the broadcaster's architecture.

Realistically, broadcasters may need to share infrastructure based on technologies such as Signiant and Aspera to enable companies to transfer completed programmes to them. Both of these technologies now have workflow

components, in addition to core network acceleration capabilities that could support automated file delivery workflows.

These are not problems that producers can solve on their own. It is reasonable to expect broadcasters to take the lead – with key suppliers – in defining the most effective and pragmatic means of file delivery over the next year or two regardless of the volume of content delivered.

For now though, through the DPP, broadcasters have published a preferred list of 'modes of delivery' for completed programme files.

These can be found at:
www.digitalproductionpartnership.co.uk/technical_standards_file_del_options.html

DELIVERY ACTIVITIES

DELIVER				
	LAYBACK	TX MASTER	TRANSCODE FOR NON-BROADCAST DISTRIBUTION	ARCHIVE
 VIDEO	Dubbing to HDCAM SR if not using file transfer Creation of Tx File	HDCamSR or AVCi 100 to the DPP format	Transcode into lower bitrate file formats for web, mobile and tablets	Long term archiving on tape or file
	 AUDIO	Integrated with Video	Integrated with Video	Integrated with Video

WHAT NEXT?

Has there ever been a programme maker who was happy to see their world reduced to a series of process workflows? For all that television programming may have become more formatted in recent years, the notion rightly persists that something magical happens in the production process – and that by overdescribing the process, the magic may be driven out.

The only reason we find ourselves now having to describe the production process in such detail is because it has fundamentally changed. And those changes, for so long as they are poorly understood, threaten to constrain the very creativity they are intended to release.

So we hope the readers of this guide – and especially those who work within production – will find that the routes we offer through the processes of file-based production, while at first perhaps appearing analytical and tiresome, are actually liberating.

What we in the DPP hope will happen now is that the industry – producers, broadcasters, facilities, manufacturers, vendors, service providers – will share the commitment to making digital production smoother and more easily understood. Once that has been achieved, the production process can go into the background – as it did in the world of tape – and we can all refocus on the creative potential of this new way of working.

It is our belief (although the case perhaps still needs to be made) that file-based production has the potential to enable greater creativity than ever before. The magic hasn't been lost. It just needs transcoding.

GLOSSARY

File-based workflows have given rise to new terminology, often borrowed from IT. Some of the dictionary definitions are therefore too technical to accurately describe what these concepts mean for most production users. As a result, the following definitions have been simplified and made specific to their use in this industry.

2k, 4K and 8K Formats of a resolution greater than HD. HD has a horizontal resolution of 1920 pixels whilst 4K has a horizontal resolution of 4096 pixels, for example.

AAF *Advanced Authoring Format*. This is a file type used by Avid Media Composer that contains information about video and audio clips, including metadata and sequence information.

AVC-I 100 HD Codec specified in the DPP file delivery specification for finished programmes. It uses a bitrate of 100 Mbs. It can be recorded by some Panasonic cameras and is supported as a native codec by some NLEs.

Avid Whilst a company name, it is often used to refer to Avid Media Composer, the NLE suite they produce (although they offer other post-production tools).

Bitrate Bitrate refers to the amount of data per second that is captured. Typically, the more data captured the higher the quality of the video or audio, but then similarly the larger the file size.

CBR *Constant Bitrate*. As the name suggests, this is where the bitrate remains the same throughout the duration of the clip.

CF Card *Compact Flash Card*, a low-cost consumer camera card used in higher-end DSLR cameras and the Canon XF305 and C300, for example.

Codec A compression format for video and audio, both of which can have their own independent codecs. At present, it is not common to work with full-frame uncompressed formats due to the huge file sizes and difficulty in handling (storing, moving, editing) them. Cameras tend to record and automatically compress the video and audio into the specified codecs according to the associated settings. Some cameras can record to more than one codec and with different parameters (such as bitrates) and you may choose between them for different reasons. Similarly, NLE suites may not support all codecs and may therefore require a transcode to change into a supported format.

Cloud The Cloud refers to remote services accessible via the internet.

Conform Re-link the edit sequence to the high resolution master media after a low resolution edit.

Data Wrangler Someone on location to ensure all tapeless media gets copied and backed up correctly. It is also a function performed by edit assistants when ingesting and transcoding media prior to editing.

DIT *Digital Imaging (or Image) Technician*. This is a relatively new position. It was created in response to the transition from the traditional film medium to digital cameras which utilize various formats like HD 2k,4k etc. Since digital video reacts differently from film, the DIT's job is to work with the DOP/Camera operator to help achieve the best results. This includes, but is not limited to: monitoring exposure, setting up "look up tables" (LUTs), camera settings, and media management.

DNxHD Avid Media Composer's preferred codec. Typically, HD footage will be recorded at or transcoded to 185 Mbps.

DSLR *Digital Single Lens Reflex Camera*. Traditionally, these were stills only cameras, however since 2007 they have been able to shoot video. They are being used increasingly by small production companies for a number of reasons: the quality of the lenses and images at low light levels are both high, and when combined with the large sensor and the fact they are cheaper than most traditional broadcast cameras, this makes them a natural choice for many companies. Some broadcasters

however do not accept the footage as HD due to the fact it is shot at below 50 Mbps, yet later models are now capable of shooting at 50 Mbps. Older models also did not record a timecode and were not able to record synched sound, however later models are also beginning to remedy these issues.

EDL *Edit Decision List*. A file that describes an edit sequence in terms of a file reference and in/out timecodes. It can be used to share an edit sequence or to transfer edit decisions from offline to online (low-res to high-res). A modern example is the AAF, which can also contain a much richer set of metadata such as effects parameters and caption text.

FCP Apple's *Final Cut Pro* NLE Suite.

IP The acronym stands for *Internet Protocol* which defines a method of communication between devices on a network. Each device is assigned an IP address, a numerical label that allows each device to identify each other and know where to send information to in order to communicate/send files.

LTO The acronym stands for a digital tape often used for archive and back up of file-based media.

MAM *Media Asset Management (system)*. A database that allows searching and browsing of video and audio content.

Master/Mastering The creation of a TX Master (the

final production output version ready for transmission). Traditionally, mastering has always been to a HDCAM SR tape, however in a file-based world this could be the file on an XDCAM disk, HDD or transferred across a network. Note: broadcasters only accept a limited number of delivery mediums and codecs – be sure to check this before delivery. See the DPP's guide:

http://www.digitalproductionpartnership.co.uk/technical_standards.html

Metadata Technical and contextual data about the audio and video content that is recorded and edited. In the tape world this would have included information written on the tape or notes included in the tape cartridge. In the file-based world it relates to information labelled against the card or file.

Physical Metadata: Card labelling.

Technical metadata: the facts stored in the file wrapper, e.g. the codec, bitrate and file size.

Descriptive Metadata: logged information that describes the content of the video/audio.

Native Editing Editing media in the original 'native format' it was created in (without prior transcoding or transwrapping).

Native Format The original format the camera encodes to (also referred to as source format).

NLE *Non-linear Edit [suite]*; such as Avid, Apple Final Cut Pro, Adobe Premiere and Sony Vegas.

P2 Refers to Panasonic P2, a type of camera that shoots on Panasonic's proprietary P2 card.

PCM A sound format.

Premiere Adobe's Premiere Pro NLE Suite.

ProRes Apple Final Cut Pro's preferred codec. Typically, HD footage will be recorded at or transcoded to ProRes 422 (HQ) (at 176 Mbps VBR).

Proxy A lower resolution or lower bitrate copy of the master media used for review or editing. Proxies are sometimes generated in camera, on ingest or at the start of editing for the ease of handling the media.

SxS This is a solid state card format, for example used by the Arri Alexa and the Sony XDCAM EX range of cameras.

Scanning The way the picture refreshes. The main two types are Progressive or Interlaced.

Progressive: A scanning mode that describes the way the picture refreshes. The whole image refreshes at the same time. At low frame rates such as 25 fps this gives a filmic quality to the recorded pictures.

Interlaced: A scanning mode in which the odd lines of pixels are scanned first followed by the even lines

of pixels a fraction of a second later. This creates two fields of pixels giving a perceived doubling of the picture refresh rate, but where each field has half the resolution of the whole frame. For example, at 25 frames per second, the picture is divided into 50 interlaced fields per second giving a more realistic "video" look than progressive scanning.

PsF: Some recording formats use a hybrid of the two scanning types called Progressive Segmented Frame or PsF. Here progressively captured pictures are reprocessed in-camera to be interlaced. A PsF picture has the same filmic quality as a progressive picture although it is actually interlaced.

Schema A definition of a structure of optional or required fields and allowed values for data entry. Often used in relation to metadata within files or within a database.

Transcode Changing from one codec to another. This is sometimes required as the destination (such as an edit suite) may not be compatible with the source codec.

You should aim to keep this to a minimum as:

- 1 There is a small loss of quality each time you transcode; often referred to as a 'generational loss'.
- 2 It can take a lot of time and computer processing ability to change between codecs.

- 3 You will require more storage to store both the original codec and the destination codec (in the short term at least, as you may later decide to only keep one).

Transwrap Changing the file wrapper.

TX Abbreviation for *Transmission*.

VBR *Variable Bitrate*. As the name suggests, this is where the bitrate changes throughout the duration of shooting. For example, a Constant Bitrate of 100 Mbps stays the same at every point within the duration, however a Variable Bitrate of 100 Mbps could be more or less at any given point but the standard average would be around 100 Mbps.

Wrapper Also referred to as a 'file container'. This is the file structure around the video/audio codec that contains technical metadata about the file. Video/audio players/editors will use this information to understand how to play/edit the file (assuming they understand the format, as not all players can play all formats).

XDCAM EX A recording format used by a Sony range of cameras such as PMW-350 or the EX3. Content is recorded onto SxS cards. Only the 50 Mbs version is considered as acceptable quality HD by the DPP broadcasters.

XDCAM HD422 A recording format used by a Sony range of cameras such as the PDW-700. Content is recorded onto removable optical disks at 50 Mbs.

The Digital Production Partnership (DPP) is an initiative formed by the UK's public service broadcasters to help producers and broadcasters maximise the benefits of digital production. The partnership is funded by BBC, ITV and Channel 4, with representation from Channel 5, Sky, UKTV, S4/C and the independent sector on its working groups.

For further information about the DPP please go to:

www.digitalproductionpartnership.co.uk

For any press enquiries regarding this report please contact:

mary@marycollins-pr.com.



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