AmberFin

making media work

AmberFin White Paper

Transcode Workflows and the role of QC

March 2011

EXECUTIVE SUMMARY

The need for transcoding content from one format to another and creating new deliverables has never been greater.

Broadcasters, Post houses and content service providers everywhere have to deal with a growing number of file formats and there are vast amounts of content stored on obsolete tape and server systems.

Each company has its own transcoding requirements. Some examples are ‘close to air’ ingest of disparate sources for playout, programme production via non linear editors, bulk transcoding of legacy formats held in tape libraries or on servers or even multiple masters of new formats. One common requirement is to ‘create once, repurpose many times’.

HD is growing too, with new quality demands – and as Broadband uptake increases, quality can be delivered over the web.

These and many other kinds of transcoding tasks are increasingly important.

There are many possible ways to convert formats and if converting was all anyone needed, there are plenty of options to choose from.

But there’s much more to transcoding than simple format conversion.

Building an efficient and cost effective ingest and transcoding operation is an investment.

Like any investment, it needs to deliver results on time and on budget – and to do that the results have to be right.

This document helps clarify the investment issues involved in ensuring quality results from transcoding workflows.

Operational requirements

The fundamental requirements of any transcoding operation are quality, process efficiency and faultlessness.

Quality is important because of the growth of HD and HD is a quality format. HD gives content providers a competitive edge. The growth of HDTVs, Blu-ray and high quality games consoles are raising the quality bar.

It's also a fact that if you are publishing to the internet, offering consistently better quality can help towards accumulating more hits and help your brand image.

Demand is also growing for up conversion, for example scaling up low resolution images to SD or SD to HD.

A transcoding system with only average quality algorithms may mean working at higher bit rates to achieve an acceptable result.

Since HD is up to 6 times more data than SD, using more data than needed quickly ties up time, disc space and network resources, all costing money.

Using a transcoding system with superior quality algorithms not only produces a better result, which is more pleasing to viewers, it saves money too, because of the smaller amounts of storage space and bandwidth used.

Process efficiency is important because transcoding involve multiple stages – ingest, quality control and creation of deliverables.

Performing these processes as separate stages with separate systems and even separate operators can be highly inefficient.

Wherever possible, these processes need to be streamlined – ideally using a single operator and system.

Finally, the result has to be faultless. That means maintaining quality at the ingest stage. If quality is lost during ingest, it can't be recovered later. It also means outputting the right content, in the right format, without technical errors like black or corrupted frames, audio mutes and clicks, wrong video or audio levels.

If you are creating a master copy, for example for a Library and later it is found to be wrong, it will be prohibitively expensive to fix all the downstream copies and sometimes impossible to re-create the master copy.

Maintaining ingest quality and identifying potential problems early (and wherever possible automatically) is crucial.

Building a transcoding workflow

Whether you are creating a new department or simply adding more capacity, a transcoding workflow comprises, ingest, transcoding itself and quality control/review.

Choosing how to structure the workflow – and specifically at what point to place QC (quality control) – is an important part of the investment decision.

An apparent choice is to buy a standalone ingest/transcode system and simply perform manual QC by playing back on that. That sounds cheap – but in fact is highly inefficient and can potentially work out very expensive. It's inefficient because of the amount of manpower and system time wasted watching hours of content – time that the ingest/transcode system can't be doing it's real job.

It's potentially very expensive because faults can be missed. The temptation of course is to 'cut corners' and only perform a quick QC spot check. This can be disastrous if faults aren't spotted as it can mean a complete re-ingest to do the job correctly.

Worse still, if subsequent copies are made from a master with faults, all subsequent copies may need to be re-made. In the worst case a client may be lost. So this approach is not really viable in the long term for anyone who cares about quality and is working to deadlines.

Therefore the first real choice is to buy a standalone ingest/transcode system and build a manual QC station, either in the Master Control Room or in a dedicated room, typically based around a playback server. This approach is expensive to set up, time consuming, labour intensive and prone to operator error.

The second choice is to buy a standalone ingest/transcode system from one vendor and a standalone automatic QC system from another. The systems work sequentially, either by passing media from one system to another or working off shared storage.

This approach has advantages over manual QC but it still involves two sets of capital expenditure and operational costs (and unless shared storage is used, the need to manage workflow between two different systems).

Also we need to define what 'automatic systems' mean. An automatic system is a huge help to the QC process but it will not pick up everything (for example lipsync) so some kind of manual viewing is still needed.

If shared storage is used with a web browser viewing off a PC monitor, that only gives an approximation if a final 'eyeball check' is required.

This is because PC platforms have issues with playback interrupts, scaling and showing interlaced material.

The real role of automatic QC is to assist operators quickly find the frames or audio that have failed to meet standards and the operator still needs to perform a final check on a suitable monitor.

Critically, in this kind of workflow, QC is not happening during ingest, which will be discussed in more detail later.

The third choice is AmberFin iCR, which can integrate ingest, quality control/review and transcoding in one single system and into one process. AmberFin allows QC on ingets, QC of fileas after ingets and operator annotation, giving a ‘best of all worlds’ approach.

Automatic QC gives the operator an accurate read out of problems which can then be checked in seconds on suitable monitors. That cuts out the likelihood of faults being passed on and eliminates time wasted viewing an entire programme.

That also means just one investment, one operator and QC fully integrated into the workflow.

This document help outline the likely costs of ownership of the three workflow choices, standalone ingest/transcode with standalone manual QC, standalone ingest/transcode with automatic QC and fully integrated QC with iCR.

To help illustrate matters we’ll use a hypothetical company who has a new transcoding requirement in a department which includes ingesting seven one hour programmes of HD content per week and transcoding to MPEG2.

This company could be a Post house or content service provider offering a chargeable service or a Broadcaster who needs to transcode their own assets.

They charge (or have an internal budget of) $360 per job for a 60 minute HD transcode.

No two organisations are the same and costs can vary between countries and even cities, so it is a useful exercise to input your own figures based on your own experience.

The Initial Purchase

An investment in a transcoding workflow starts with the purchase of an ingest/transcoding system. There are different choices on the market, with varying levels of quality, capabilities and cost. However, when you buy an ingest/transcoding system, you need to perform QC. Our company decides that manual spot checking on an ingest/transcoding system is too inefficient, as it ties up the machine and far too risky, as they are working to quality guidelines, so they investigate a manual or automatic QC system. [1]

As well as the cost of the QC system, there may be costs with commissioning and training, local storage for the QC system if it is based around a DDR plus new peripherals (scopes, speakers, PC monitors, reference monitors, network resources, etc.)

Table one helps identify possible purchase costs of standalone manual QC stations or automatic QC systems. These are extra costs incurred by having separate systems for ingest/Transcode and QC systems not one integrated system that does ingest, transcode and QC.

The figures below are based on samples from a number of manufacturers. Actual prices may be higher or lower. You may wish to use your own numbers. For reference, an iCR 5002 system, which combines ingest, transcoding, manual viewing and automatic QC has been added for comparison:

Table 1: Initial purchase costs.

	Manual HD/SD QC area	Automatic QC system	iCR 5000
System including any local storage	$10k – $30k+	$25 - $50k+	Included in purchase
Peripherals (may including HD reference video monitor, wave form monitors, loudspeakers, cabling, networking etc.)	$10k - $30k+	$3k – $20k+	Not applicable[2]
Systems integration, commissioning, training etc.	$5k - $10k+	$5 - $10k+	Included in overall commissioning & training
Possible initial cost	$25k - $70k+	$33K - $80k+	$0

Storage costs for the automatic QC system assume local discs, not a shared SAN. The automatic QC station may not support HD video output and may simply be monitored off an SVGA display (reducing costs below $3k but which can't show interlace correctly). As the figures show, setting up a well equipped manual QC station doesn't look very practical for their workflow on cost alone, before manpower and time was even considered, so would either be ruled out at this stage, or something cheaper put together from existing equipment. However the operational budget still needs considering.

[1] Note that even if our company already has a QC system, as they are increasing their ingest/transcoding capacity, it is likely that they will need to make a QC system purchase in the near future.

[2] Only needed on main unit.

The Operational Budget - Time

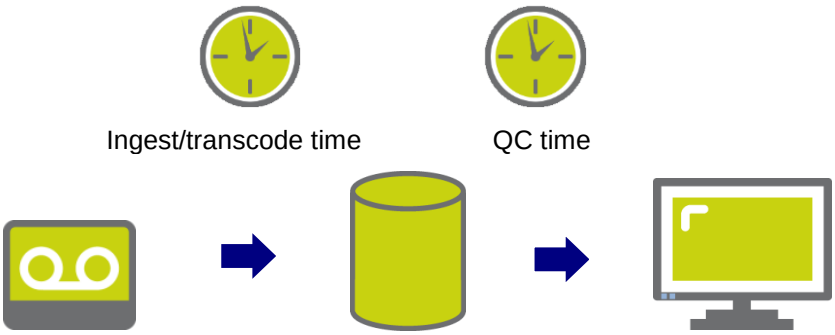
For our hypothetical company, operational costs in a standalone system transcoding workflow are driven by factors relating to the initial purchase (like annual service agreements), day to day running costs and operational efficiency.

Service agreements are easy to calculate but daily running costs can be more complex.

One measure of operational efficiency, is to look for any 'dead time' – unproductive bottlenecks where staff or systems are idle. This is a consideration for any kind of company but a very specific issue for Post houses who operate on a rate card as it may be 'non billable time'. In figure one, a standalone ingest/transcode system is used in conjunction with a standalone QC system. There is one hour of load time for the HD material and after that subsequent automatic QC time.

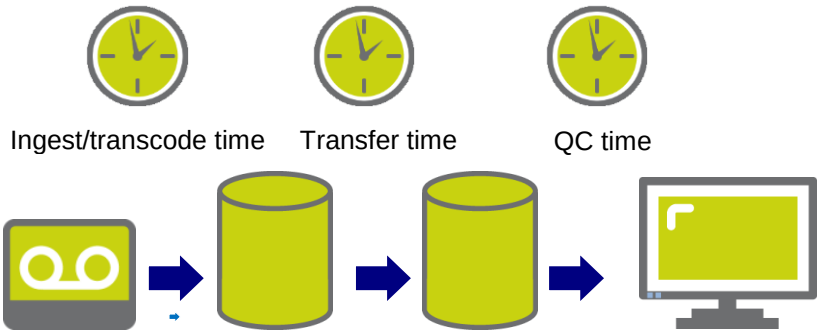
The two systems are working on shared storage so there is no transfer time between the ingest and QC systems, however, since QC is not happening live on ingest, there is a 'dead time' bottleneck between ingest and QC:

Fig 1: Standalone ingest and standalone automatic QC using shared storage



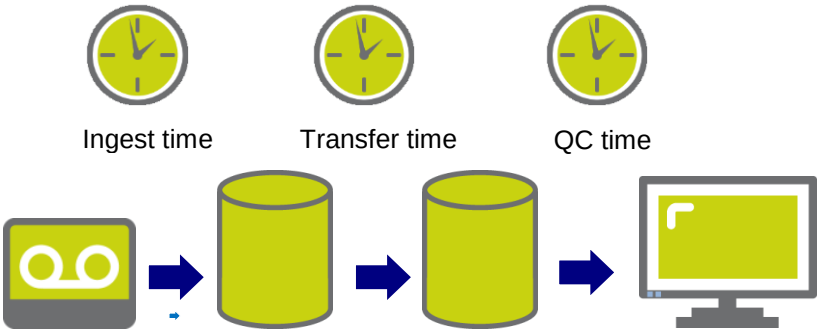
In some workflows, further time may be needed transferring material from the ingest storage to local storage used by the QC system. Figure two shows this extra bottleneck:

Fig 2: Standalone ingest and standalone automatic QC using local storage for QC



We get a similar result with a manual QC station:

Fig 3: Standalone ingest and standalone manual QC using local storage for QC



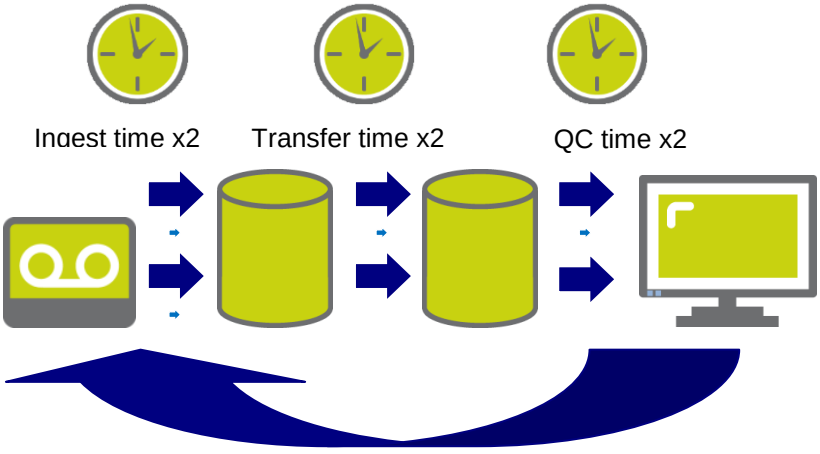
As well as time issues, standalone ingest/transcode systems working with a standalone QC system can mean two separate operators and hence two sets of wages.

Alternatively it can mean having to schedule a single operator to follow a job from system to system[3].

Also, if new media is created, it needs tracking and managing, another overhead. Transfers or copies can go wrong for operational or technical reasons and checking them is another unproductive task.

Critically, pushing QC after ingest or even to the end of the process is inefficient, because problems are not detected early. In the worst case, a complete re-ingest is necessary – more 'dead time'.

Fig 4: Redo cycle



So, our 'turnaround time' can be up to 6 hours in addition to transcode time.

Continued

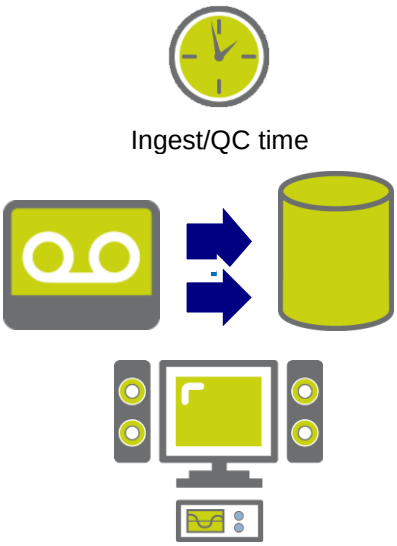
[3] In some cases where QC happens at a different site, there may also be security and transport issues related to moving media between locations.

Measuring the true cost of 'dead time' is difficult but it can be approximated by calculating the overall yearly running costs of the system, estimating the number of hours it is used, then estimating the amount of unproductive time (for example transfer time)[4]. For a Post house an alternative calculation is billable vs non billable time.

The business school theory of Total Quality Management absolutely applies to this aspect of building an ingest/transcode operation - it is far cheaper to get it right first time than fix it later.

The workflow in figure four is based on combined ingest/transcode and QC using iCR.
QC occurs live during the ingest process. There are no bottlenecks:

Fig 5: iCR 5002 Integrated ingest and QC.



As well as time savings, there is a single operator, opportunities for automating the process and no unnecessary media transfers or copies. Faults are found early and automatically during ingest and a full Quality Control report is generated – all drastically reducing the likelihood of re-ingests.

Unlike using web browsers, Broadcast quality video monitoring is available for additional manual viewing. So, going back to our company, who wants to process 7 hours of HD per week, we can compare the overall 'dead time' waiting for material to be available for QC:

Automatic QC, shared storage[5]	
Automatic QC, local storage	
Manual QC, local storage	
iCR 5002	None

Continued

[4] One possible calculation of the cost of 'dead time' is if it becomes necessary to buy more systems to get around bottlenecks.

[5] It's hypothetically possible for some kinds of shared storage to work with a manual QC system too.

In other words, at best part or all of a working day per week is being wasted because QC happens as a separate activity and at worst, if re-ingests are necessary it may not be possible to process the required nine hours in a working week.

None of this is an issue if an iCR 5002 is used. Freeing up a working day, which could be used for one or two more HD jobs, or other tasks, assuming the company ratecard (or internal budget) of $360 per HD job, potentially offers $20k -$40k more revenue (or savings) per year.

The Operational Budget – running costs

Moving on from costs associated with time, there are other operational costs to consider. Table two helps identify possible yearly running costs to our hypothetical company of standalone QC systems. These are extra costs associated with having two systems, not one. For comparison, an integrated iCR 5002 system has been added:

Table 2: Running costs.

	Manual HD/SD QC station	Automatic QC system	iCR 5000
Main unit and peripherals support contracts including storage per annum.	$3k – $9k	$4.2k - $10.5k	Included in main support contract
Operator time (wages and overheads) per annum.	$30k - $60k[6]	$15K -$30k[7]	Not applicable
Possible yearly cost	$33k -$69k	$19.2k - $40.5k	$0

These are average prices and will vary from country to country (and even between cities). For example it may also be necessary to add floor space costs for a QC suite which in some cities would be an important consideration. You may wish to use your own numbers.

So taking purchase costs, time costs and running costs together, we can take an estimate of the total figures for our hypothetical company, comparing the three approaches in the first year:

Table 3: Combined costs.

	Manual HD/SD QC station	Automatic QC system	iCR 5000
Purchase costs	$25k - $70k+	$30K - $80k+	N/A
Forgone revenue (or costs) due to time	$20k - $40k	$20K - $40k	N/A
Running costs	$33k - $69k	$19.2k - $40.5k	N/A
Possible yearly cost	$78k - $179k	$69.2k - $160.5k	$0

Even if a skeptic were to halve the lowest figures, there is a very clear case for our hypothetical company considering a combined ingest/transcode and automatic QC approach.

[6] Figures for wages will vary tremendously between countries and even cities and will also depend on working practices etc. You may wish to add your own figures here.
[7] Note that automatic systems still require some manual oversight.

Summary and conclusions

Just to stress how important Automatic QC is in assisting operators here is a hypothetical example. Imagine one of our 60 minute programmes. It has dual language multi channel audio.

There are two faults. The first is a short video level fault 5 minutes into the programme and the second is a two minute audio mute fault on one language track 40 minutes into the film. Either fault is sufficiently serious that the programme will be rejected. The table below shows the practical implications of using iCR to assist manual QC compared to either full manual QC of the whole programme, or a three point (beginning middle and end) quick spot check.

	Time taken to QC	Possibility of detecting the video fault	Possibility of detecting the audio fault
Manual QC operator working unassisted monitoring entire film.	Over 60 minutes	Approx 90% [8]	50% or less[9]
Manual QC operator spot checking beginning middle and end.	Around 5 minutes	Close to 0%	Close to 0%
Manual QC operator assisted by iCR automatic QC.	Around 5 minutes	Close to 100%	Close to 100%

Transcoding workflows that integrate ingest, transcoding itself and quality control can offer significantly better Return on Investment than a 'mix and match' non integrated approach. Savings can be made in purchase costs, peripherals costs, support costs and manpower costs. An integrated approach offers potential savings in transfer times, disc space and network usage. An integrated approach also helps get jobs done right first time.

There are a final set of numbers to consider. The picture and sound quality delivered by a transcoding workflow method is the hardest value to calculate precisely in an investment decision but is nevertheless a major consideration, especially as operations scale.

Because iCR uses patented image processing algorithms, up to 25% less data is needed to produce an equivalent quality picture to other systems. That can translate directly to 25% savings in investment in new storage and networking infrastructure and a 25% reduction in distribution bandwidth.

For our hypothetical company there is the attractive prospect of offering a premium service and some useful disc space, network and distribution bandwidth savings. If we scale up our example, the bigger the operation, the bigger the economies.

We'd welcome the opportunity to discuss your specific requirements in detail.

To find out more about AmberFin iCR, go to www.amberfin.com or contact AmberFin directly via info@amberfin.com.

[8] This will vary dependent on operator concentration and experience.
[9] Depends on which channels are monitored, operator concentration and experience.