The UK TV Anytime test bed

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Formed in 1999, the TV-Anytime Forum is developing open specifications for interoperable and integrated systems that will allow consumer electronics manufacturers, content creators, telecommunications companies, broadcasters and other service providers to most effectively utilize high-volume digital storage (PVRs) in consumer devices. The TV-Anytime Phase 1 specification was published as an ETSI Technical Specification in October 2003.

In the UK, the Digital TV Group set up a test bed in 2004 to prove that TV Anytime is workable within the constraints of the UK DTT platform (DVB-T). If it could be shown to provide a commercial advantage on this platform, then it should also work as the core for almost any other delivery system (e.g. DVB-S, Broadband TV and Mobile TV). This article gives an overview of the TV Anytime system, in the context of the UK test bed.

"Gentlemen, you have now invented the biggest time-waster of all time. Use it well."

Isaac Shoenberg, head of the Marconi-EMI TV development team.

A number of strands have come together to support the creation of a test bed for trying out TV Anytime concepts – with a view to developing a practical implementation.

One could argue that, since the invention of television, an immense amount of effort has been put into ensuring that we do watch and listen to as much television as possible. And yet … the time we spend doing just this is limited and may remain so until we can increase the number of hours in the day. Actual viewing – assessed as the number of hours spent by the eyeball, focused on the screen – seems to reach a limit within each culture. The demographic distribution of television viewing is far from even: the average time spent each week, on a global scale, may vary by as much as 4:1. In the UK, an average figure to take is 25 hours per week. Roughly the same time is spent on TV viewing in most other European countries.

Revolutions in the air

For an industry which is driven by "eyeball share", the challenge is to eat into the viewing time which other service providers have achieved. Perhaps the first revolution in this step was the provision of the ***remote control***. Indeed it might be interesting to think just how reactionary might be the behaviour of the industry were the remote control to have been invented only recently. Perhaps we would

see attempts to permit a viewer to change channel only if he/she had paid a subscription. Maybe viewers would need a code to enable the remote control to access channels which were not within the same commercial management. Perhaps there would be legislation which would require a remote control to be able to select any free-to-air service, or one made available as a result of "must-carry" requirements.

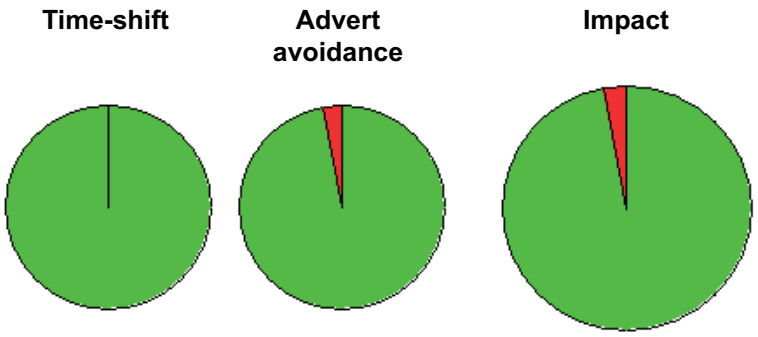


Figure 1
The net impact of the remote control on viewing of adverts

Image courtesy of DR

But the remote control was established in an earlier era when there was less programming from which to choose and, although it fuelled a revolution in viewing habits, it had only a small effect on the key aspects which would affect commercial service providers. *Fig. 1* illustrates the impact that the remote control had on viewing. ***Time shift*** was not, of course, a possibility, and "advert avoidance" was relatively insignificant. In any case, the world's most favourite technique for advert avoidance was then, and is likely to remain, the dash for the kettle or the next can of beer from the fridge. So the overall impact turns out to be minimal.

VCRs offered the next revolutionary change in viewing habits. Here was a device which was fast becoming a consumer staple product. Every home would have one. In fact, there are some 30m VCRs in use in the 25m UK households at this time, and this ratio of usage is likely to be repeated across the European countryside. Despite this widespread adoption, perhaps its most feared impact from the point of view of the service provider – that of avoiding the adverts – has had remarkably little real impact. The potential for advert avoidance is certainly present but its use is limited to those programmes which have been time-shifted. As for rights abuse, any cases involving broadcast programme content appear to have been mostly hot air; nothing that a blank tape levy may not have salved. Professional piracy, on the other hand – if that's really the right term – is an industrial issue and probably not of concern to the home user.

There is little which can be done in practice to make the VCR more intelligent. Teletext – now a sunset technology and surely too long in the tooth – provided the PDC technology for signalling when a programme was really starting so that recorders would begin and end at the right time. But, as many a user will testify, often has been the time when the programme was too late, too early, short, cancelled or there was simply not enough tape to capture the final thrilling moments. And many service providers found that it was quite difficult to drive the PDC system accurately from their manually-controlled automation systems. Arguably it would have helped if there had been a widespread adoption of a universal EPG – such as that set out in the ETS 300 707 standard, but that's history now. The impact is essentially the product of the amount of timeshift and the degree of advert avoidance and this is shown in *Fig. 2*.

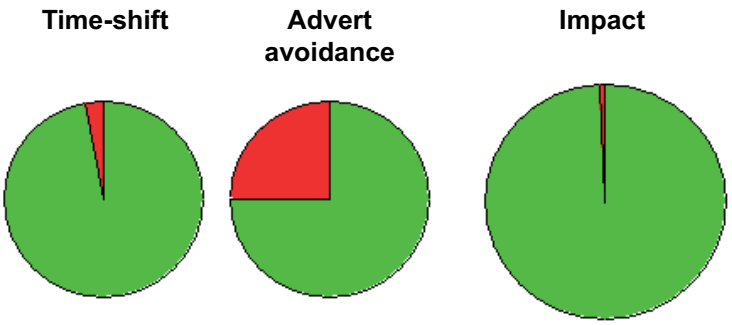


Figure 2
The net impact of the VCR on the viewing of television commercials.

Image courtesy of DR

So, arguably, we are probably facing the next revolution in the way that we watch television and listen to radio services. A clutch of new technologies has arrived and initially is affecting mainly the consumption of audio content: eager pricing undertaken within the recorded music industry, and its inertia in responding proactively to embrace new technologies, has resulted in increasing Internet

and broadband sharing of ephemeral content – using cheap memory capacity in highly portable devices.

And the same thing is now beginning to take place in the video domain where tape devices are giving way to ***personal video disk recorders***; the PVR era is now with us. The confluence of technologies is bringing with it a reduction in the cost of storage and processing power, and the ready integration of a range of technologies such as broadband connectivity and wireless networking within consumer units – as happened with the remote control and the VCR at an earlier stage. But there is room for a big change now, because neither the remote control nor the VCR could really benefit from any additional service elements that the service providers inserted into their transmissions.

The PVR changes this because, for a given cost, the amount of processing power and available storage is increasing. Experience shows that consumers will adopt many complex technologies in everyday objects – if the benefits are worth it. The mobile phone is a clear example with its built-in camera, games, Internet connectivity, and audio/video capture and replay facilities. So there's no reason to assume that viewers would not appreciate being able to watch just the programme parts they want – at the time they want and without the interruptions caused by programme promotions (trailers) and adverts.

Viewers simply need a technology which can enable this – and that is pretty much what the PVR can offer. From the experience of early adopters of PVR technology, it seems that time-shifting may occupy some 40% of PVR use and that advert avoidance may account for at least 50%. From research carried out by commercial payTV operators, there are indications that the PVR is leading to less viewer "churn" [1] – and also higher usage of, and satisfaction with, the available content. *Fig. 3* suggests the spread of advert avoidance which might arise (the orange colour) and the effect that this might have on the overall impact for users of the plain common PVR. Of course, a properly provided TV Anytime service, when allied with new creative thinking, could have a marked effect in reducing this impact whilst providing new commercial opportunities.

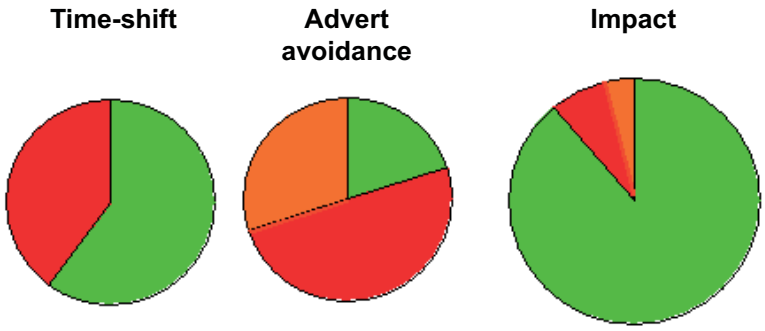


Figure 3
The range of net impact of the PVR on advertisement viewing in the early adopter market. Note that this is in the absence of a TV Anytime service.

Image courtesy of DR

How well this behavioural model is followed by the later adopters of PVR technology may depend on many factors. Among them is the provision of a really accessible user interface, and the choice and quality of the services it makes available. This strand is important. Just listen in any crowded bar or pub when the conversation turns to mobile phones ... their great features, their ease of use and their reliability. Owners of a mobile phone have a view-point which is well founded on shared experience. The fact that, over time, they buy newer phones with newer features obscures the fact that the basic cellular service can be patchy and inconsistent when used for its primary purpose – voice communication. This illustrates a requirement that television services need to respect – and let us not forget radio services too, whether over DVB or DAB delivery systems. We live in a world where others will compete to make a desirable service ever easier to use. Those manufacturers and developers who are not working in advance of the consumer curve, need to be aware of this.

Roughly, then, the impact of the PVR on the business models of operators can be estimated and, for many of them, its effect is quite significant. There may be two approaches to follow:

1. "Churn" means that some existing subscribers are *unsubscribing* from a particular service while, at the same time, new subscribers are being added, i.e. it is a measure of subscriber turnover. A high "churn rate" indicates that many people are unsubscribing from a service.

- Operators could work against the technology, prevent its use, make it difficult for the viewer to be able to use it on their services, find ways of legislating against it, raise the fears of outrageous copy abuse, and so on.
- Or they could work with the technology and provide a service which enhances its value to the viewer, and put the other issues into their rightful perspective.

But this is, perhaps, just the start. Arguably it was the remote control that enabled multi-channel viewing, and the VCR that enabled basic time-shifting. But neither are intelligent approaches for the multiple content world into which we are now moving – a world in which it should become more clear that suppliers, intermediaries and consumers need to see themselves as part of a ***unity***: none of them should see the others as a predatory feast. It is also a world in which it may be useful to take a more holistic view of the industry, of the changes which may be taking place and of the potential options being offered to the viewer.

Actually, the PVR as a device is already a growing market with its own language or jargon (see the table below) and there is already a growing culture which values technologies such as ***podcasting*** in implementing these for plain audio services. It's a simple matter of time before these technologies meet up with video.

Buffering	Putting the kids to bed
Bookmarking	Never miss an episode
Grazing	Record now ... decide later
Stacking	Binge on “Friends” or “Eastenders”
Archiving	Dump to tape or DVD
Compressing	Miss the boring bits
Extending	Watch the goals again
Pausing	Answer the phone, go to the loo

Switching technologies

The large number of television services which could be accessed – it has been estimated that some 1500 digital television services are available in Europe at the present time – is an evolution whose roots were set in the days of analogue services. With careful frequency planning, most terrestrial analogue systems could support perhaps six television services at the rate of one service per RF channel or carrier. Digital coding and compression have enabled the same channel space to carry six times as many services and, with a revision of the frequency plan, it should become possible for national administrations to consider leasing the spectrum space under their control to more profitable operators of radio services. Planning for analogue television switch-off is thus well in hand in most European territories, and national television and radio services – whether state or commercially funded – have privileged access. Viewers have come to expect that there will always be a valued television service, perhaps constrained within territorial boundaries but entirely free to view.

The penetration of analogue receivers is highly pervasive. In countries where television receiver ownership is in the region of 98%, many households have two television receivers and, additionally, may own at least one VCR [2]. Television sets have migrated from the living room to the kitchen, bedroom or children's rooms; their lifetime is longer than ever before, as electronic equipment becomes more reliable. However, VCRs suffer from being primarily mechanical beasts and, with typical intensive household use, they eventually fail with a half life of perhaps five to six years. Many

2. Figures from the UK’s ITC survey of 2000 give 50m receivers and 28m VCRs in use in the UK's 25m households.

of the major manufacturers have ceased VCR manufacture and indeed, in the UK at least, some major retailers no longer sell them. Perhaps the UK is a special market – it already has some 5m households adapted to watching digital terrestrial television and some 8m homes subscribing to BSkyB's satellite services – but it is also a territory which has planned carefully how to turn off the analogue television system – with a starting date in 2008 and completion by 2012. It is the replacement of the dying analogue-based VCRs that's of interest at this time, as their replacement looks set to be the PVR.

The analogue switch-off is taking place at a time when the UK is becoming an increasingly broadband region, according to BT [3]. Although, in general, the broadband provision – with its 50:1 contention and relatively pedestrian bitrates – lies uncomfortably below the rates at which even standard-definition video could be reliably provided, it is a pointer to a direction which future content delivery could take. It would certainly be possible to consider dribbling quality content overnight to a hard-disk store in the home, under the viewer's control. Of course the content would have be found using some form of search engine – a "Voogle" or "UltraVista" – which had been adapted for televisual and audio content, rather than being a direct access to a single service provider's gateway.

Actually, hints that this kind of development is already in hand is in evidence from:

- **Blinkx** – **http://www.blinkx.tv**;
- **Google –** **http://video.google.com/**;
- **Yahoo –** **http://video.search.yahoo.com/**.

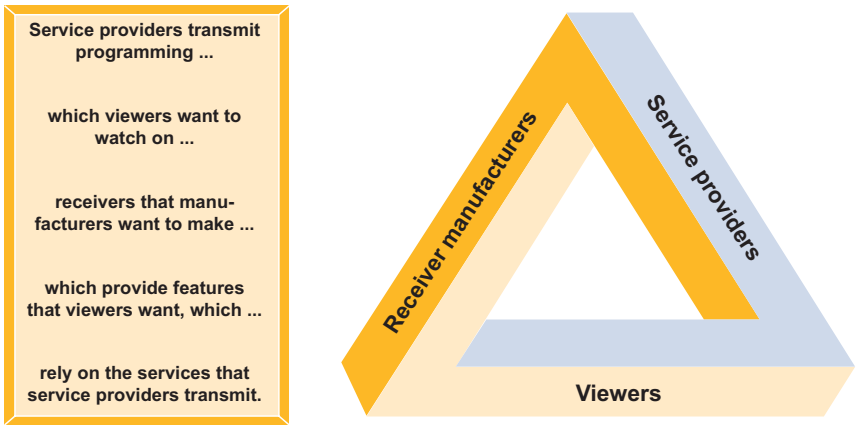
Other delivery models are appearing on the horizon. The current experiments with handheld TV reception being carried out in Oxford, England, and other parts of the world suggest that there is a major revenue market which could be provided for – always assuming that spectrum can be obtained at the right price. Initial thinking places a high consumer value on services such as the ability to provide specialised sports and news clips, and to satisfy the implied market need for video "snacking". Current mobile phone operators are naturally very interested in allying handset technologies to combined service provision. But, outside of a protective gateway garden, how does the viewer find and have delivered the desired content? Besides, why should it be delivered to the mobile handset when it could be delivered in higher quality to the home PVR – either by broadcast or IP transmission technologies?

With eyeball time being so strongly competed for, the home viewer could now do with a consistent reliable service for operating and, indeed, managing the home PVR. There would be a further benefit too because, if each content item were properly identified, then its retrieval from the vaults of the hard disk might be a lot easier. Recall that there may be no reliance on the sunset technology of teletext to provide the identity of the service provider or the programme. So where is the information going to come from?

And if the Digital Home does become the place where video and audio networks becomes truly established, just how is the viewer to make sense of the months or years of content which the hard disk vault may store? Moore's Law suggests that, for a given price, the storage capacity available will double every 18 months: there are some PVRs already able to store some 300 hours of video. By the time analogue switch-off starts, the implied available capacity will be some 2400 hours. Think of this as a library of nearly two years of average viewing or ... as a collection of half a tonne of 1200 part-filled, uncatalogued and irretrievable, VHS tapes. Perhaps the content will also comprise personal video content such as weddings, holidays and front-door security camera shots. Perhaps it will be available on a ShareIT peer-to-peer basis. Furthermore, it may give rise to a new business in the provision of networked video (and audio) content storage, in which backup and conversion to newer systems is provided as part of the service.

3. BT was reported as installing 46k broadband lines per week and said that the installed base was 3.3m lines at end September 2004. This is up 146% on the previous year.

The three-way equation



There are three main players in all of these change scenarios; the ***viewer***, the ***service provider*** and the ***receiver manufacturer***. They depend on each other; actually they always have but it's just that it is becoming a little more clear what this dependence will mean in the future. Surrounding this core, there is a full industry-wide end-to-end value chain, but the truth of the matter is that the only source of revenue which is paying for this chain ... is the viewer.

The initial business model of service providers required most of them to feed the market with subsidised decoders. Initially – let's say seven years back – these were high-cost items and it would take some time for the price of a plain free-to-air "zapper box" to tumble. Today, a plain DTT adapter can be bought for some €60 and it does exactly what it says on the packaging; it provides television video and audio. Actually, this very low unit cost leaves the manufacturers with almost no margin to use for re-investing in future more-advanced receiver products. Indeed, there's little in the current free-to-air programme offering that would benefit from any such receiver advances. So where does this leave the roughly €5'000m analogue replacement market [4]?.

The plain PVR represents a similar risk for the manufacturers because, without additional service elements from the service providers, the forward route for such recording receivers could simply be to include better advert skipping. Note that this is not ***fast forwarding*** – a tape analogy – but ***skipping*** which is much easier to implement with the increasingly cheap processing power that is becoming available.

At this point it will be useful to set out what we understand by the use of the term "PVR". Initial entrants to the PVR market were based on digitizing the ***analogue*** input signals and placing them on a hard disk. Many DVD recorder replacements for VHS-VCRs are simply this. But, increasingly, the PVR is a device which can capture the required ***digital DVB stream*** in its native digital form. In principle, this means that the video need not suffer further degradation by being recoded from the PAL footprint and it also means that all the access services [5] associated with the video can be properly captured at the same time. The mandatory DVB event information [6] can be used to provide a primitive form of titling and timing for the recording.

Commonly the term ***personal digital recorder*** (PDR) has been used for such a device. By the same token, so has ***digital video recorder*** (DVR). Taking the view that the analogue PVR is likely to be historical before too long, we feel that ***personal video recorder*** (PVR) will stand duty for all of these classes of recording devices.

4. The figure is roughly that of the UK in 2004 and covers the overall value of television sales. This admittedly includes large flat-panel displays, recordable DVD and PVR devices but, perhaps surprisingly, the bulk of the market appears to comprise small-screen, less than 600mm, analogue receivers.
5. An access service is one which provides access primarily intended for those with impaired visual or aural abilities and includes subtitles, audio description and signing services.
6. At least it ought to be there.

Thus, of the two approaches mentioned earlier which could be taken by the service operators, it is the mutually collaborative one which is likely to hold the long-term promise of success, for each of the participants.

And that's where the story of ***TV Anytime*** (TVA) begins.

TV Anytime

From the ashes of the closure of the DAVIC initiative in 1999 arose the concept of TV Anytime. To be clear, the TV Anytime Forum [7] always had the vision that one should be able to access any content ... anywhere ... anytime ... on anything ... with anyone ... through any system .... and so on. It was never intended to be limited to broadcast television and its potential for use in the newer methods of content delivery should be clear. The principal interest was in the use of TV Anytime as a means of discovering and retrieving content for adding to personally-controlled storage systems, either for immediate or later use. However, it will become clear that TV Anytime is just as applicable as a service to receivers which lack vast content-storage facilities, and for returning content from DVB-H mobile services, WiFi gateways and other IP-enabled delivery methods.

From the outset, TV Anytime has been seen as a service that can be used to make a PVR perform.

The founders of TV Anytime determined that it would result in a suite of standards which could, if desired, be agnostic of any specific Application Programming Interface (API), delivery system, content type or content format. Some 130 members agreed to the memorandum of understanding which was devised to honour any intellectual property which might be created or included within the emerging standard.

Two phases of work were defined. The first would focus primarily on services to the recipient in the absence of a defined ***return communication channel*** for true two-way communication. The second phase would be based on the assumption of the presence of an established ***return channel*** and it would include a number of features such as viewer personalisation and off-line delivery, based on actual or perceived viewer preferences.

The TV Anytime test bed in the UK

Enter then, the UK's Digital TV Group (DTG) which, in 1999, established its PVR working group with a brief to review the technology and to determine what kind of features a PVR should offer. Its output formed the key element of the DVB PDR group and, in turn, this provided MHP's TAM with the input to determine the API calls for a PDR working within an MHP environment. At the same time, the TAM group has been reviewing the TV Anytime phase 1 specifications and working on an API which could be used in the MHP environment.

The DTG PVR group continued its meetings and resolved to use the considerable international effort which had been put into the TV Anytime Forum. The promise of the phase 1 standard was that it should be workable within the constraints of the UK DTT system and, if it could be shown to provide a commercial advantage there, then it should work as readily as the core for almost any other delivery system, most of which would use a declared API of some kind.

There were two key parts which needed checking:

1) The provision of metadata which encompasses the trivial (e.g. DVB event information, present and following), through to full use of the tables which were identified by TVA Forum members as being of potential value to both service providers and users.
2) The use and implementation of TV Anytime signalling within a DVB broadcast stream.

7. See **www.tv-anytime.org**

Abbreviations

API	Application Programming Interface
CRI	(TV-Anytime) Content Referencing Information
CRID	(TV-Anytime) Content Referencing IDentifier
DAB	Digital Audio Broadcasting (Eureka-147)
DRM	Digital Radio Mondiale
DSL	Digital Subscriber Line
DTG	Digital TV Group (UK)
DVB	Digital Video Broadcasting
DVB-H	DVB - Handheld
DVB-S	DVB - Satellite
DVB-T	DVB - Terrestrial
DVR	Digital Video Recorder
EPG	Electronic Programme Guide
ETS	European Telecommunication Standard
ETSI	European Telecommunication Standards Institute
GBS	(DVB) Generic data Broadcasting & Service information protocols
IP	Internet Protocol
ITC	Independent Television Commission (UK)
MHEG	Multimedia and Hypermedia information coding Expert Group
MHP	(DVB) Multimedia Home Platform
PDC	Programme Delivery Control
PDR	Personal Digital Recorder
PVR	Personal Video Recorder
RF	Radio-Frequency
SI	(DVB) Service Information
TAM	(DVB) Technical issues Associated with MHP
TM	(DVB) Technical Module
TVA	TV Anytime
URL	Uniform Resource Locator
VCR	Video Cassette Recorder
XML	eXtensible Markup Language

In November 2003, ETSI published phase 1 of the TV Anytime specifications. By then the DVB GBS working group had started on the process of defining the carriage of TV Anytime metadata, and signalling this carriage within a DVB broadcast stream. In July 2003, the DTG PVR group funded a project to look at the requirements of a TV Anytime test bed and, in March 2004, the test bed organisers held their first formal meeting. By September 2004, ETSI was able to publish the DVB GBS group's TV Anytime phase 1 specifications and the test bed was by now working with a relatively stable set of standards.

However, there have been changes – some resulting from work which the test bed has carried out – and there is still an extremely important part of the DVB GBS phase 1 specification which has yet to be implemented, as it was only signed off at the recent March 2005 DVB TM. The test bed now has perhaps the world's most completely conformant suite of tools for creating valid and legal TV Anytime metadata carousels, and content referencing information (CRI), for insertion into the DVB streams. Part of the role of the participating receiver and test equipment manufacturers is to ensure that the created DVB streams are legal and that any "bugs" are removed as soon as possible. A four-way trial of interoperable streams was managed in January 2005 and that has formed the basis for the second-year work plan.

It was clear from the start that a test bed would need to be set up, in order that a number of service providers could evaluate some commercial scenarios involving real viewers and listeners. Unlike trials of digital video which, no matter how complex the coding, are not much more than a trial of signal processing, the trials of TV Anytime required the creation of some new test tools to work with metadata and their integration into a working system. The metadata is information which no service provider actually has at this time, as it is simply well out of scope for the usual channel and schedule management system. Also, the signalling technology is not yet available from any of the current vendors of multiplexers or play-out control systems. Thus, other than the core of the existing DVB SI information, everything else had to be created from scratch.

This stresses the fact that TV Anytime is simply not just an EPG. Indeed one way of trying to understand how different it is, is to consider that the EPG is a means of accessing linearly broadcast programmes while TV Anytime provides the means for a viewer to thread his/her way through the content – whether it is broadcast, stored on their local hard disk, or is coming from a third party via a broadband connection.

The project is scheduled to take two years with the first year being focused on bringing all of the participants up to speed on TV Anytime thinking, and on integrating the various softwares and carousel inserters into a working end-to-end system. Those taking part in the project are DTG members who have signed up to provide the working finance which the test bed needs for its staff,

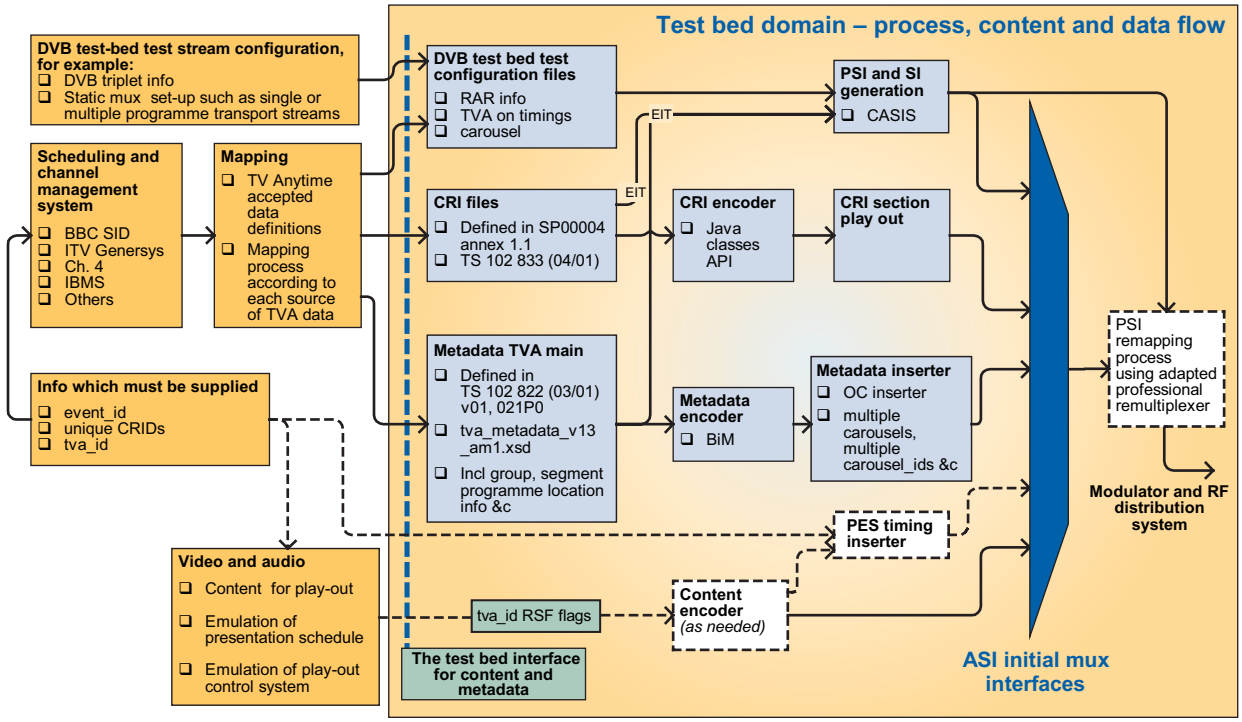


Figure 4
An overview of the core technical facility provided in the TV Anytime test bed. Note the use of publicly-defined data interfaces.

and to pay for essential hardware and software where these could not be loaned from the participating members. *Fig. 4* sets out an overview of the test bed architecture and the principal process flows which it manages at this time.

The second year of the test bed has taken the established stream-creation ability, with its increasing accuracy, as the starting point for creating a broad suite of test streams for its members. These streams cover a number of areas and are essential if a future TV Anytime service is to be consistently and reliably available to service providers and viewers alike:

- Technical streams test the system's conformance to specifications and they exercise the timing and complexity of signalling and the practical range of bitrates which may be needed for information and signalling in a practical network.
- Commercial scenarios exercise to the full, the various tools in the TV Anytime phase 1 and DVB GBS phase 1 specifications.

Built into this is an understanding that there are some clear guiding constraints:

- There is no specific API involved in the tests so far. The test bed is setting out to see if the core foundation of TV Anytime can be commercially useful. Thus, there is no MHP, or OpenTV or J2EE and the fruits of the test bed should be as applicable to broadcast television as they are to radio, DVB handheld (DVB-H) and DVB IP delivery.

  We would welcome the participation of those who would like to use the facility to work with interactive applications on any platform.

- The project is focused on bandwidth-constrained platforms, as typified by the UK's DTT platform.
- There is no explicit use of a back channel, as none is specified in the UK D-Book and none is mandated in TV Anytime phase 1. However, because TV Anytime phase 1 permits a URL reference, the test bed will be ensuring that such a reference is not ignored if a receiver has the ability to process the reference.
- Legacy receivers remain legacy receivers. The one key requirement is that they shall be stable enough to operate in the presence of the wide scope of TV Anytime signalling provided by all

the test streams which the test bed will create. The test bed has access to a wide range of some 50 current receiver models.

The physical side of the test bed is based on a relatively simple signal flow, as set out in *Fig. 4*. The provision of content and metadata takes place using the designated TV Anytime XML interfaces and it is the responsibility of each of the service provider participants to make the metadata as representative as possible. Within the test bed the metadata can be tailored more precisely to fit the requirements of a particular commercial scenario, using some specialised editing tools which have been specifically created for this purpose.

The target is to establish the use of TV Anytime phase 1 across as wide a foundation as possible in the knowledge that an initial service would probably focus on the simple use of only a small part of the tool range. Thus the test bed is not defining anything quite so restrictive as a ***profile***; the market into which any TV Anytime service would be working would be an open one and setting a mandatory standard is not within the power of the UK DTG. However, receivers which can handle the range of test streams defined in the phase 1 foundation may well justify their own presence and be promoted by service providers as stable trustworthy products for consumers.

The results of the second year should be a body of work and a set of working examples which will allow both service providers and receiver manufacturers to determine if there is any commercial advantage to implementing a TV Anytime service and if so, what would be its initial starting point and what would need to happen to the back-office systems in order to support it. How long this is likely to take is a trickier question to answer. It will take longer than the participants would like, as there are real significant issues still to be sorted out.

Firstly it turns out that receivers are not going to be that simple to devise. The project was absolutely clear from the outset that TV Anytime services would not to be compromised in order to enable legacy receivers to work. On the contrary, the existing DVB SI with its event information and primitive schedule would be left in place and, in doing so, it would allow legacy receivers to flourish and

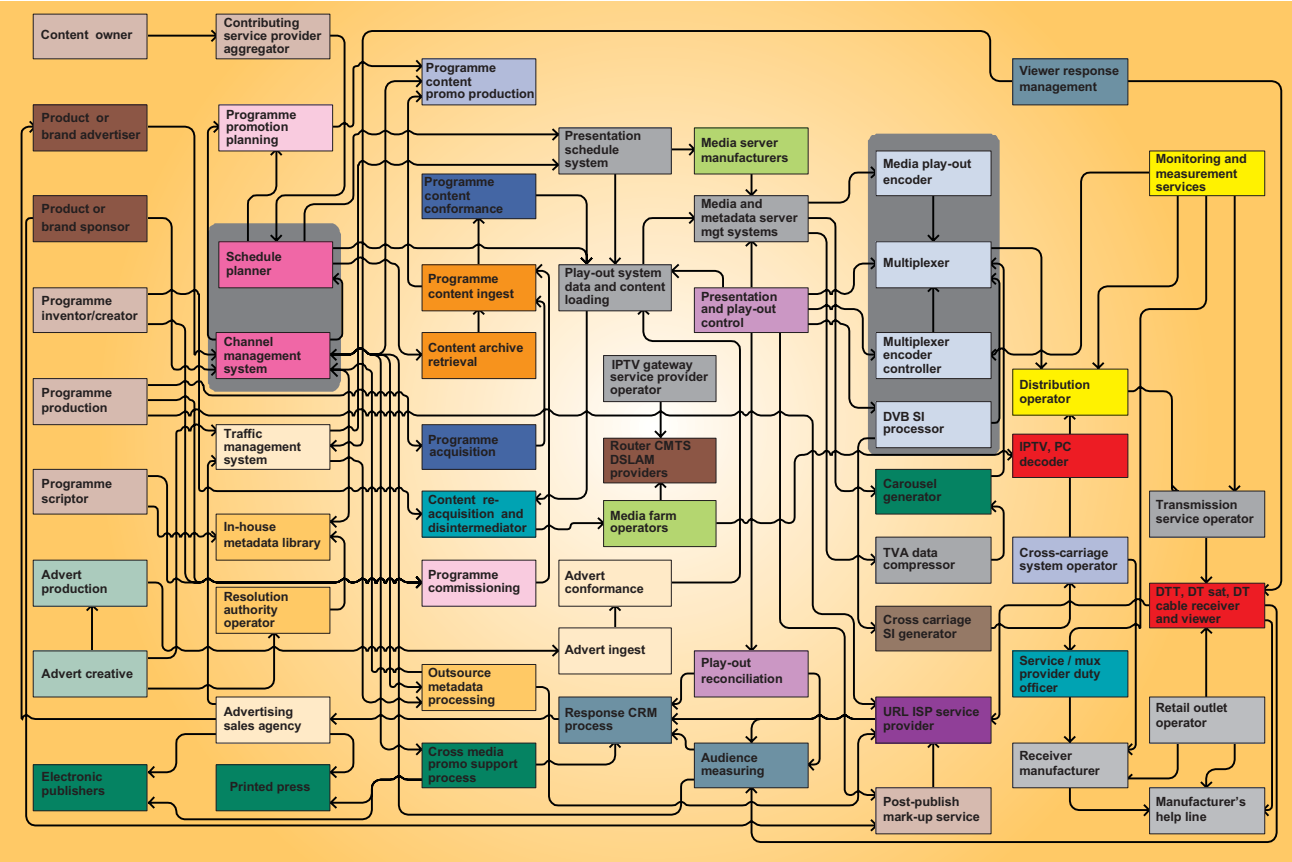


Figure 5
A sample view of the range of impact that TV Anytime metadata gathering and awareness might have within the end-to-end business flows of the television and radio industry

help the final push to complete analogue switch-off. Importantly, this means that a TV Anytime service could begin: the existing SI would not need to depend an any specific API.

Secondly, when a review is made of just how far back the impact of TV Anytime could spread, it becomes clear that the reach could affect a number of business activities and not simply those in the immediate vicinity of the play-out process of the service provider.

Here's one simplified view of the processes and commercial activities which could be involved *(see Fig. 5)*.

Close into the play-out process, it is clear that there will need to be a considerable change in the workflow process associated with acquisition and promotion of content by a service provider. The software systems which would support this activity are not yet commercially available and many of the conventional vendors of traffic, presentation scheduling, channel management systems and play-out control systems remain largely unaware of the changes which may be needed. Along with the internal processes of change management, there is the need for each service provider to determine for themselves those aspects of the TV Anytime phase 1 foundation service which they would most value providing for, and to plan the system workflow and software updates to match this process.

The value of being able to use the core of TV Anytime metadata schemas to drive business opportunities in other delivery systems should be made more clear. The value-adding process needs to start at the first opportunity, it needs to be accurate from that point onwards and its value is in being able to certify that the content reference identification (CRID) can be relied on as a unique identifier whatever the ultimate delivery mechanism or consumer apparatus. While the diagram on the previous page suggests some of those aspects which relate to television, there are highly parallel paths which could equally well relate to Digital Radio (DVB-T, DVB-S, DAB or DRM), Mobile TV (DVB-H), broadband TV and other emerging forms of content delivery.

The full value in the UK DTG test bed is in its indications of just what the wider value of TV Anytime might be on a European and global scale.

Ultimately the knowledge which the project builds up will be placed in the public domain – most obviously as a special appendix to the UK receiver D-Book. This contribution – known within the project as the T-Book – will have a focus which is not simply UK DTT or even DVB-T oriented but relevant to other systems with their specific signalling and API requirements. That's because the impact of TV Anytime extends well beyond the shores of the UK and that's where the real value of TV Anytime lives for all the receiver manufacturers, service providers, broadcasters and third party data service providers who are taking part in the project.

Conclusions

There is a new revolution about to affect viewing habits and it is coming in the shape of the PVR. It will require service providers to review their business models and their approach to their viewers – and to consider how to generally raise their game to retain the viewers' attention. Considerable help

Allen Mornington-West's career has spanned technology and industry processes from detailed analogue and digital circuit and system design, through to large-scale project management and consultancy. He has written and lectured extensively on his field of knowledge. Recently, he has been consulting full-time in the television and radio broadcast industry, and his clients have been located in a number of EU territories as well as in the UK. The scope of this work has included business and systems modelling, detailed project management, operational workflows, security systems, standards authoring and physical / chemical systems analysis.

At present, Mr Mornington-West is extensively engaged in the overall programme management of the world's first open-standards systems-level approach to determining a commercial launch of a TV Anytime service.

is available to service providers through the use of the TV Anytime standards as these give commercial advantages which provide a competitive edge. More than that, TV Anytime metadata schemas stand behind the big future of content discovery and delivery management, whatever the delivery system or whatever the platform API. It couples the viewer to the content in new ways and it will make relatively painless the introduction of rights management protocols on consumer apparatus. In this future, if there is no data about the content, then the content is far less likely to be seen and if it is not seen it will not be earning any revenue from subscriptions or advert placings.

The TV Anytime test bed is a crucial stage in resolving how to use the new standards to mutual commercial advantage and to show how the core schemas and signalling are applicable across any platform or delivery system – and not just the initial test-bed project constraint of DVB-T.