

Digital Entertainment

Where is it heading and how can we play a part?

Opinion Whitepaper

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CONNECTING
NEW ZEALANDERS



Disclaimer: This paper is a personal view of content delivery. It is intended to stimulate discussion and should not be interpreted as Telecom policy.

This paper is intended for distribution into the public domain to act as a background for a conference topic on the distribution of digital media. That said, these are my opinions and are subject to change as external influences change the realities of the New Zealand and global marketplaces. I am more than happy to discuss my points of view and welcome efforts to help me keep this document accurate and relevant. I hope you find this information useful.

Regards,

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Executive summary

As connectivity to the internet becomes more and more commoditised, the differentiator for businesses has become the range of services they can provide to their customers. This paper outlines one author's opinion on where the digital entertainment industry is heading and identifies some areas of opportunity for companies looking to enhance their customers' entertainment experiences.

The paper covers both production-house and community-generated content of all digital media types, with a skew to digital video. Studio requirements, distribution and content protection mechanisms are discussed, as well as what happens once the content reaches consumers' premises and how it will transit the in-home network to the play-out device itself.

What is the purpose of this paper?

This paper has been written for two reasons: firstly, to provide a background on digital media and the issues and opportunities it presents; and secondly, to generate discussion around the themes raised. While there are some highly complex related areas for discussion around digital media, such as digital rights management (DRM) and the role of online content-sharing and recommendations-based communities, it is not the aim of this paper to cover these areas in any great depth.

Types of digital entertainment

News, information and opinion

Established news sitesⁱ, information services from government agenciesⁱⁱ and international bodiesⁱⁱⁱ and opinion and news from the blogosphere^{iv} are all sources of information now at our fingertips^v. Today, more than ever, people are getting their news and information online at times convenient to them^{vi}.

Another important and growing source of information is the social networking site, used to stay in touch with friends^{vii}, associates^{viii} and people of similar interests^{ix}. A recent study found that one in four internet users visits a social networking site at least once a month^x. For users of popular sites such as Facebook^{xi}, the ability to keep friends updated about what they are doing is part of what drives them to visit the site regularly or text in updates via services such as Twitter^{xii}.

Audio and music

Digital audio is what many people most readily associate with the idea of digital entertainment. The first file-sharing networks such as Napster suddenly allowed easy access to a wide variety of audio tracks, and the public grabbed the opportunity to explore new artists and genres and download music for free. The industry retaliated to protect its artists' work, but it was too late – the public was already hooked on the idea of easily-accessible, low-cost digital music. Bit-perfect replication has driven not only the development of a range of devices that let you take your music with you wherever you go, but also a significant amount of work in the field of digital rights management and content protection, in an attempt to stop widespread illegal distribution.

But it's not just about music; the podcast is also a growing trend in user-generated content. While it is still only a recent phenomenon, RSS distribution of podcast shows and the ability to subscribe through software such as iTunes have raised awareness of the format, which is on the brink of widespread adoption. A 2006 study indicated that podcast circulation was growing at around 20% per month.^{xiii}

The barriers to entry into the music and audio space are lower now than ever, and the results from new entrants can be remarkable. Daniel Bedingfield created his first hit 'Gotta Get Thru This' in his bedroom using a computer, a compressor, a mic and some sampling software. He now uses his website to connect to his fan base and promote new albums and upcoming tours. Many podcasters are starting their shows using little more than a PC and a headset, and using software such as Skype to conduct 'phone interviews'. These shows are then promoted directly from the hosts' websites via RSS, but also through syndication sites such as Podcast Alley^{xiv} or The Podcast Network^{xv}, which group the shows and allow subscribers to rate the quality of the content for other members of the community. On the back of the work in digital audio formatting, the tools to create, mix, publish and distribute that are now available have allowed many artists who would not otherwise be heard to gain worldwide popularity through sites such as garageband.com.

Gaming

PC- and console-based games have been around for many years. However, in recent years consoles have become something of a Trojan horse^{xvi} for digital entertainment in the home as they gradually build out the feature set of these devices to include an increasing range of entertainment functionality.

On a technical level, the compelling experience of online gaming is all about the latency or delay in getting the commands from your keyboard to the server controlling the game and your interactions with other online gamers. On a human level, it's all about engaging with other gamers without boundaries and enjoying the challenge of working with, or against, someone at the other end of the cable. Massively Multiplayer Online Games or MMPOGs such as Blizzard Entertainment's World of Warcraft^{xvii} continue to attract and retain a massive subscriber base (9 million at last count^{xviii}). This remarkable success can be attributed to an ongoing commitment to developing additional content, driven largely by suggestions from the game's subscribers, to continually refresh a game released in 2004 and keep it constantly entertaining to its subscribers.

Video

Digital video is the latest frontier for digital entertainment. The big questions are what do consumers want to watch and to what degree will they sacrifice quality for price and fulfilment?

To answer these questions, we must first understand the options available. There are currently two obvious sources of digital video delivered via an IP network:

1. High-quality, professionally-produced blockbusters with big-ticket actors. These are created by major production houses and released across the globe, in cinemas, on television, on DVD and as video on demand (VOD).
2. The 'others' – community- and user-created content, shot on cameras ranging from those embedded in cellphones to prosumer high-definition camcorders. The content is then edited on a computer using readily-available software, or even using online services, to which the end result can then be uploaded.

The content developed on both sides of this production fence ranges from feature films to tutorials^{xix}, from documentaries to community-generated video blogs (vlogs), and from feature-length crazy stunts such as 'Jackass: The Movie'^{xx} to amateur stunts uploaded to video-sharing sites^{xxi}. Some producers are using the 3D rendering capabilities of game engines to stage short and even feature-length computer-generated movies known as Machinima^{xxii}. A notable, more professional, example of the latter was the South Park episode 'Make Love, Not Warcraft'^{xxiii}. Other producers simply change the voiceover in someone else's video to send their own message^{xxiv}; these edits are commonly known as 'video mashups'.

Creating the content

Who creates the content will largely determine the market it is intended to satisfy, what technologies (if any) are used to protect and monetise it, and to what extent its distribution will be managed.

We can loosely group content creators into three main groups: the commercial studios, prosumers/enthusiasts and end-users. These three groups use very different facilities, but in many instances it may be difficult to determine from which source the end product has come.

Commercial studios

These are big-budget, professional studios with sophisticated mixing desks and editing suites. They employ skilled technicians and creative minds to cut, mix and produce a top-quality product. This is the home of the Hollywood blockbuster and with it come the wages of the professional actors/artists and crew, the royalties paid to the creators and all the rest of the investment required to support the marketing and distribution of these productions. The start-up costs are significant and the market is cut-throat.

Prosumer/enthusiasts

The prosumer creator will have a small amount of commercial gear, some mixing decks and perhaps some high-end software or specialised hardware to assist with cutting and mixing. Increasingly, this group can leverage the excellent editing and post-production software available on the market and pair it up with some fast computers and a lot of disk space to create great-quality content^{xxv} at a fraction of the cost of the commercial studios. This in turn allows them to create for niche rather than mass markets, thus avoiding competing head-to-head with the big commercial studios and allowing for a moderately happy co-existence. This group may or may not charge for their content, some relying on the end-user to donate or subscribe and others incorporating advertising as part of their offering to help cover their costs.

End-users

These are the folks at home who have a headset or a video camera and use it to capture an idea they think others may find interesting^{xxvi}. Generally using software rather than specialised hardware to provide the specific functionality of the creation process, this group tends to use applications that came bundled with their computers, such as Microsoft's Movie Maker or Apple's iMovie. Alternatively, the more savvy may head out to the internet and the open-source community, where a number of very good tools are readily available for the home user to get creative with. Cost and ease of use are the main drivers for this group; they want to stitch their production together and have sites such as YouTube^{xxvii}, GoogleVideo^{xxviii} or MSN Soapbox^{xxix} host it on the internet for them. Cost and time are big factors here and many of these hosting services also offer online editing tools to bring everything the consumer needs into one place.

Distribution methods

Overview

After looking at the available media types and the types of people and equipment creating the content, the next part of the picture is the distribution of content from servers to the devices where it will be played out.

Consumers are turning from traditional television broadcast to internet-delivered information and programming, with a recent study^{xxx} putting these two delivery systems on an almost equal footing in terms of viewing hours.

Media tend to be distributed via either downloading or streaming; which is the appropriate method depends on a number of factors.

1. Quality of the content

- The production, editing and encoding quality
- The desired quality of the end-user experience
- Digital rights management and any requirements around content management end-user authentication

2. Quality of the service

- The resilience of the network connection
- The bandwidth availability
- The ability to cope with lost/retransmitted packets

3. Quality of the environment

- The device's local storage capability

- The environment of the consumer when experiencing the media

A high-quality production which needs to be monetised requires protection of the media and a high-quality delivery mechanism to ensure the best possible end-user experience. On the other hand, a user-generated clip, shot on a camera phone and intended to be consumed by a community for amusement or to participate in a community conversation ('I belong, I have something to contribute'), has no protection requirements and can be distributed in a 'best-efforts' manner to the playout device.

Distribution can be broken down into two distinct sections, the first being distribution from the creator to the network core to the customer premises and the second the internal distribution within the premises to the playout device itself. We will first look at the 'creator to the network core to the customer' part of the equation.

Carrier-class distribution

Carrier-class distribution refers to connections, typically via private networks, which are created between the distribution point and the consumer. Factors such as throughput, quality of service, security and the ability to identify sender and recipient are all well-architected, robust and audited. Many content agreements make it incumbent on the distributor to get the content to the consumer with a guaranteed level of service so the end-user can enjoy the media at the quality intended by the content owner.

Creating and operating these networks is not cheap and requires significant investment in infrastructure and personnel. Given that such networks tend to be profit-driven, content agreements also involve usage tracking and reporting requirements, adding additional overhead.

'Over-the-top' or 'best-efforts' distribution

This form of distribution leverages existing IP connections, typically over the internet, to deliver content. As such, the connections are subject to transient network capability and conditions as well as bandwidth availability from the distribution point to the end-user. This means that to deliver the entertainment experience, trade-offs must be made between the time taken to receive the data and the quality of the delivered product.

As discussed earlier, the two distribution methods used to deliver content across an IP network are streaming and download.

Video streaming

Streaming involves sending data from the distribution server to the playout device at a constant rate. Interruptions to transmissions such as packet loss or network congestion impact the playout experience. Devices will often therefore connect at a lower speed than the maximum available to allow some additional capacity to absorb these contingencies.

Video download

When connectivity and bandwidth cannot be guaranteed and a high-quality experience is desired, the media must be downloaded to the playout device prior to display. It is estimated that around 85% of all video currently watched is pre-recorded^{xxxi}. This allows for the full quality of experience to be delivered, but as a trade-off may involve considerable download delays and can use significant amounts of network resource.

There are three main types of download used in this context, each with its own advantages and disadvantages.

1. Full download

Before playout begins, the entire media file is downloaded to the playout device. This suits high-quality content, especially when access to a particular part of the file may be desired (e.g. jumping from the start to a specific chapter).

2. Progressive download

A 'buffer' is downloaded to the playout device, allowing for playback rate and average connection speed, before the file begins to play. The download continues in the background while the initial part of the file is viewed, the object being to begin playout as soon as possible after initiating the download, without 'catching up' to the file being downloaded into the buffer. This suits continuous linear playout as the user cannot jump forward in the stream beyond the material that has already been downloaded.

3. Trickle download

'Trickle' downloading involves the media being marked for download and brought down to the playout device as low priority, often in off-peak hours, and stored for future consumption. This has the advantage of minimal impact on available network resources and lessens the load on the distribution network, allowing the content to be made available at a lower cost.

Issues to address

When choosing an appropriate distribution method, content owners need to weigh up a number of variables.

If monetisation and protection of content are important priorities, then a carrier-class network may be an appropriate choice. Issues to be considered include how to protect the content, especially when the file is downloaded and stored locally to the consumer. A digital rights management wrapper will need to be applied to the content, one that provides a sufficient level of protection and that the playout device will be able to recognise and decipher.

The intended audience should also be a factor in choosing distribution, encoding and protection mechanisms. If the target market has access to large amounts of reliable bandwidth, then streaming may be a good option. If bandwidth is limited, or the cost of the product is critical, then an 'over-the-top' mechanism may be more appropriate. In addition to bandwidth, the playout device's capabilities need to be accounted for: the content may need to be encoded at different rates for different audiences and devices, and use different protection mechanisms to suit the capabilities of the playout device.

For many providers and distributors, this is where the consideration of the user ends. Unfortunately, one of the biggest issues potentially affecting the consumer's experience is what happens to the media after they reach the boundary of the home. This takes us to the second part of the distribution equation.

The home boundary

As discussed, reliable connectivity and the capability of the playout device are hugely significant factors in determining the end-user experience. The issue of getting digital content from the distribution network to the consumer's eyes therefore does not stop at the home gateway or DSL modem – it continues right through the home to the device itself. That means the home network, typically owned and maintained by the customer, is an essential factor in the success or failure of the digital delivery of content.

In-home networks

Most broadband-connected homes now accommodate the sharing of devices and resources and as such, the growth of home networks is continuing to climb^{xxxii}. It is therefore important that end-users are educated as to what their likely future network requirements will be. Content owners, distributors and developers of playout devices need to take an aligned and responsible stance in ensuring that the consumer is properly advised in order to achieve the best experience possible for their budget.

In terms of technologies, we are beginning to see structured cabling being installed into new and some renovated homes, especially in high-density constructions. This structure is based around the CAT5/6 cabling standard which supports network speeds of up to 1Gb/s. Unfortunately, for established homes, the cost and disruption of running a more reliable cable network is prohibitive for many people, and so residential networks in existing homes are for the most part created via 'no new wires' technologies. Typically, these take the form of 802.11 wireless networks, which use an unlicensed, shared part of the radio spectrum over which to transmit their signals. Other options for 'no new wires' networks involve using cabling already in place in the home, such as the existing electrical cables for power line networking, phone lines for HPNA^{xxxiii} or coaxial cable for MoCA^{xxxiv} networks. Power line networking may be a viable option, with British Telecom recently signing a supply agreement with manufacturer DS2 for the use of power line technology to allow subscribers to self-install the BT Vision digital television offering^{xxxv}.

With the rapidly increasing numbers of consumer devices that connect to IP networks, the resilience and ease of setup of these networks becomes paramount to ensure that the end-user has a well-architected, secure and easily-administered home network, without compromising on security or speed. Technologies and standards that move the complexity away from the user need to be adopted and adhered to. Emerging standards such as DLNA and TR-069 compliance will assist greatly with this goal. From a service provider's perspective, the immediate up-front savings to be made from selling less expensive and possibly less robust solutions need to be offset against the savings to be made from reduced after-sales service and support requirements.

Consumer-premises equipment

As the trend to connect consumer-premises equipment (CPE) to an IP network gains momentum, the need to extend the home network to a number of rooms in the home is also growing, and the complexity of the network and configuration of these devices increasing accordingly.

Older, legacy CPE tends to comply with earlier standards for connectivity, security and decoding of media. For devices which are considered 'end-of-life' by their manufacturers, accessing firmware updates to resolve issues around the playout of newer formats, or complying with updated security standards, is impossible. In some situations, depending on the design of the device, the manufacturer will release the source code to the open-source community, which allows developers to write newer, updated drivers and software, but further splits the range of possible configurations and makes it even more difficult to find support outside the development community.

Because of this re-engineering of devices, some distributors will be encouraged by the content companies to retain ownership of the device and contract users to not attempt modification or reverse-engineering of the device's capability in any way. This has advantages in that it discourages poking around in the device's configuration and potentially causing problems, but, as demonstrated by the 'mod' community that has grown around Sony's Playstation, Microsoft's Xbox and more recently, modifications to Apple's iPhone, if the desire of the community is there, workarounds will continue to be found, published and applied.

Environmental issues

Environmental issues are also a factor in attempting to remotely support CPE. Throughput on wireless networks can be affected by neighbouring networks overlapping the home or by other devices that share the same spectrum such as DECT phones or some brands of baby monitor. Power line networks also suffer a similar interference issue when devices with a 'duty cycle' such as hairdryers or dishwashers are switched on.

Assuming that the IP network is stable enough to retain connectivity, another potential issue when attempting to remotely support devices is that many networks will not allow inbound traffic to transit through the gateway device directly to a network resource, unless the device itself initiates the connection – and this can be difficult to achieve if the device itself is not functioning correctly for some undetermined reason.

Consumers expect devices to 'just work' and they should do just that. However, when the device stops working, it requires a broad knowledge of the customer's often very individual environment to accurately and efficiently troubleshoot the cause and rectify the problem. Given the variability of network types and capability, the range of devices (and different versions of devices) which can playout content, and the average technical skill level of the consumer, it is little wonder that very few organisations are willing to take on this essential but thorny issue.

Where to from here?

This paper has only touched on the issues surrounding digital entertainment. Further discussion needs to not only reflect the philosophical imperatives of making information freely accessible, but must also be grounded in good commercial sense.

The outstanding issues that content providers, distributors and consumers all need to consider as the wave of digital content grows can be summarised in two parts.

1. How do we deliver relevant, trusted content to our end-users in a format they value?
2. How can we make this delivery sustainable in terms of financial return and the longevity of the solution?

It is this author's opinion that there is room for both philosophical and commercial realities to be realised, but that it will require further investigation and discussion. In the meantime, the following aspects of digital media creation, distribution and viewership are put to you for consideration.

Digital media creation

Content costs can be offset with smarter advertising^{xxxvi}; the old model is dead and only the agile will adapt and benefit from the new capabilities and opportunities that digital entertainment can deliver.

Distribution

The method we choose to get our content to the playout device largely determines the cost and quality of the end product. There are a number of options ranging from highly-architected models administered by network owners, to peer-to-peer architectures that use public networks and end-user devices to spread and deliver the content. The chosen architecture must support the needs of the content owner, but must also deliver to consumers' expectations in terms of pricing, availability and speed of delivery.

Digital rights and content protection

Content creators put a great deal of time and effort into creating their products, and despite the popular belief that everything on the internet should be free, the reality is that it costs money to create, publish and distribute content. Digital rights management and content protection mechanisms are one method of forcing the consumer to comply with how you want your content to be experienced. DRM is, however, only a lock for honest people, and if you are pricing your content too highly, or unnecessarily restricting its availability in terms of regionalisation or approved playout methods or devices, then the community *will* circumvent your protection mechanisms and make the material more freely available^{xxxvii}. The important thing to note is that it is user perception that dictates this behaviour, so if you are unable to connect with your consumers and demonstrate the value in your methods then you stand to lose your ability to control your product.

Regionalisation

The regionalisation of DVDs is a good example of a protection measure out of sync with public demand. The theory was that people would buy a regionalised player and then, after the cinematic release of movies in that region, the DVD would be released. The theory was adequate, but the execution let the industry down. A number of films were released but never converted to other regions, and with the globalisation of the marketplace, purchasing DVDs from other regions became far more easy and cost-effective than waiting for the small-run, high-cost regional release. To their credit, appliance manufacturers soon caught on to this trend and after a couple of generations that required the activation of hidden unlock codes, appliances are now coming to market essentially region-free, allowing DVDs from any region to be successfully played out on the device.

Viewership

Clearly it is important to keep a finger on the pulse of your user community and be agile enough to change alongside it. Companies cannot swim against the stream any longer; the customer is in control. The solution is to give them what they want and make sure that you can deliver it better and more efficiently than your competitors. Regionalisation does have its place in segmenting a market, as does rights management and content protection. It is, however, incumbent on us as an industry to ensure that our content, distribution and devices work together to deliver a seamless, enjoyable experience that the consumer will want to repeat again and again.

By using consumer profiling and building communities of trust between your subscribers, you can begin to identify trends and deploy content throughout your distribution network. You can also distribute to your subscribers' devices based on their viewing behaviour, so that when they request content, there's a good chance that you have already delivered it to them ready for playback.

Playout devices and formats

What devices will you support? How will you add new devices to your supported list? Can people still access your content without an 'approved and certified' device? What about unofficial support infrastructure such as enthusiast forums/communities? These are all questions that you will need to consider, along with issues such as how much legacy you can allow for before you begin restricting the available library of content or quality of experience to those devices.

In terms of codec support, we should be using open, agreed and/or widely-adopted formats for our media, but recognising that as formats change, some devices will be left behind. A transcode facility or some form

of device-upgrade incentive should be offered to ensure that your consumers can always enjoy the widest possible range of your content.

Conclusion

As digital access becomes ubiquitous, approaching that of the more traditional utility services, the areas in which traditional entertainment channels have worked in the past will change significantly. And as the range of increasingly sophisticated content-creation tools available to end-users continues to grow, along with the range of locations where content may be published, the breadth of available content will also increase. For these reasons, addressing and finding solutions to the issues surrounding digital media will become increasingly imperative.

For businesses to succeed in the brave new world of digital entertainment, they will need to attune themselves to the priorities, expectations and experiences of their customers and find innovative, financially sustainable ways of delivering the kind of content end-users want – where and how they want it.

References

- ⁱ CNN: news site - <http://www.cnn.com/>
- ⁱⁱ New Zealand e-government site - <http://www.e.govt.nz/>
- ⁱⁱⁱ United Nations Statistics Division - <http://unstats.un.org>
- ^{iv} Technorati: search engine for searching blogs - <http://www.technorati.com>; TechMeme: blog news engine - <http://www.techmeme.com/>
- ^v Web reaches 100 million sites - <http://www.cnn.com/2006/TECH/internet/11/01/100millionwebsites/index.html>
- ^{vi} Newspaper readership shifting online - <http://www.marketingvox.com/archives/2007/06/15/for-news-most-watch-tv-but-say-future-is-online-39-read-papers/>
- ^{vii} MySpace: social networking site - <http://www.myspace.com>
- ^{viii} LinkedIn: business social networking site - <http://www.linkedin.com>
- ^{ix} Dogster: social networking site for canine lovers - <http://www.dogster.com>
- ^x Social network user behaviour - <http://www.webpronews.com/topnews/2007/04/10/social-networking-examining-user-behavior>
- ^{xi} Facebook: social networking site - <http://www.facebook.com>
- ^{xii} Twitter: social networking and micro-blogging service - <http://www.twitter.com>
- ^{xiii} Podcast subscription growth - <http://www.marketingshift.com/2006/04/pick-pack-of-podcasts.cfm>
- ^{xiv} Podcast Ally: syndication site - <http://www.podcastalley.com>
- ^{xv} The Podcast Network: syndication site - <http://www.thepodcastnetwork.com/>
- ^{xvi} Consoles as a Trojan horse for digital entertainment:
- Playstation 2 - <http://query.nytimes.com/gst/fullpage.html?res=9C05E2DF1331F935A15753C1A9669C8B63>
 - Playstation 3 - <http://www.guardian.co.uk/technology/2007/mar/29/sonyplaystation.sony>
 - Xbox 360 - http://www.technologypundits.com/index.php?article_id=105
- ^{xvii} World of Warcraft website - <http://worldofwarcraft.com>
- ^{xviii} World of Warcraft subscribers surpass 9 million - http://gamepro.com/news.cfm?article_id=124709
- ^{xix} Video tutorial site - <http://lynda.com/>
- ^{xx} Jackass: The Movie - <http://www.imdb.com/title/tt0322802/>
- ^{xxi} Amateur skateboard stunts - http://www.youtube.com/results?search_query=skateboard+stunts&search=Search
- ^{xxii} Machinima - <http://www.machinima.com/>
- ^{xxiii} South Park episode: Make Love, Not Warcraft - http://en.wikipedia.org/wiki/Make_Love%2C_Not_Warcraft
- ^{xxiv} Video mashup: Vote Different - <http://www.youtube.com/watch?v=6h3G-IMZxjo>
- ^{xxv} Red vs. Blue: machinima series - <http://rvb.roosterteeth.com/archive/>
- ^{xxvi} Women of Warcraft - <http://womenofwarcraftpodcast.com/>
- ^{xxvii} YouTube - <http://www.youtube.com>
- ^{xxviii} Google Video - <http://video.google.com/>
- ^{xxix} MSN Soapbox - <http://soapbox.msn.com/>
- ^{xxx} IBM consumer media study - <http://www.marketingvox.com/archives/2007/08/23/ibm-consumer-study-internet-rivals-tv-as-primary-media-source/>
- ^{xxxi} Vint Cerf predicts download revolution - <http://www.guardian.co.uk/technology/2007/aug/27/news.google>
- ^{xxxii} Growth of home networks - <http://www.in-stat.com/press.asp?ID=2058&sku=IN0703433RC>
- ^{xxxiii} Home Phoneline Networking Alliance - <http://www.homepna.org>
- ^{xxxiv} Multimedia over Coax Alliance - <http://www.mocalliance.org>
- ^{xxxv} BT signs DS2 to drive Self-Install BT Vision IPTV service - <http://www.ds2.es/press/record.aspx?id=90>
- ^{xxxvi} Advertising model changes - http://adage.com/mediaworks/article.php?article_id=120274
- ^{xxxvii} DRM, lock-ins and piracy - <http://arstechnica.com/news.ars/post/20070412-drm-lock-ins-and-piracy-all-red-herrings-for-a-music-industry-in-trouble.html>