Chapter 1: Interactive, Personal, IPTV: From TV over Internet and Web TV to Interactive Video Media

Video can be experienced from the sofa, or from a chair by the desk: laid back and/or leaning forward. How the programs are distributed is secondary. IPTV can offer totally new things in terms of user experience, which is why it is so exciting. Not that the video itself changes – while there are different ways of telling stories with moving pictures than those we are used to today, the social conventions of video have become so ingrained that programmers will change it at their peril.

Introduction to IPTV

Interactive TV is not new – it has been around at least since the end of the 1990s – but it is still a rather stiff and artificial experience. Interactivity, where the users can change things happening in the story as the program progresses,

Why IPTV? Interactivity, Technologies and Services Johan Hjelm

works when you rely on the participants. As in a computer game, the actions of the user can change what happens on the screen. And games technology is probably one key in creating this new extension of the medium.

That said, there are plenty of experiments with different ways of storytelling, for instance nonlinear videos (think of it as curved loops of stories turning back on each other), which create a different experience, but the existing, linear, format is likely to dominate IPTV programming for a long time to come. However, if the "TV" part is resistant to change, the "IP" part will make it. When broadcasts were analog, there were always pioneers trying out ways to interact with the audience through chat and web pages, and although the formats were interesting, they were never successes.

Interactive programs have not been a success in most of the world. In general (apart from the UK), there has not been a widespread deployment of interactive video applications, although there is one exception: programs where the viewers can vote.

Users tend either to interact at any time (e.g., when they are using the service to get additional information – during sports events for statistics – and are interested in getting information all the time, not just when a player scores), or once the linear program has ended ("half-time factual and learning" viewers). The main reason to interact is to get a more convenient and enhanced experience, and to engage in the program to be entertained in a richer way. Usage peaks after the TV program is broadcast, even if it is made available on video on demand (VoD). The most efficient trigger for interaction is the call for interaction from the presenter – in other words, when the viewers are asked to interact, they will interact, if they know how.

Interactive TV is not the web, however. On a website, there are hyperlinks, which make the site into a big ball of interconnected pages. There is no single "right" way to go through it. A television show is different – it has a linear story. The storyline may be fixed in time (which is usual, since that is how people experience the world); but it can also be fixed in space, and in relation to other stories. Although spatial stories are more complicated to tell, these are where the next generation of user experiences are likely to happen.

The most successful interactive service is betting. Even if you regard it as user-provided content, the function of betting is to intensify the user experience, while at the same time it creates an additional revenue source for the broadcaster (however, note that betting is forbidden in many countries). There is one thing that can be gained from the betting experience: if the content and the interactivity work together, instead of being disconnected, they enhance each other. This also makes the case for live interactive TV, which is also cheaper to produce than TV programs built out of chunks of video by an automatic system on the fly.

In interactive TV, the content creator works more like an advertising company than a traditional broadcaster. It produces content for which it sells the rights; if the buyer is a broadcaster, the broadcaster gets the rights to show the program a number of times, under certain conditions. Usually, the content

provider produces the content when commissioned by the broadcaster, not on speculation.

Viewing has become increasingly decoupled from the original transmission, and users do not want to be slaves to an arbitrary schedule which says that "Children's programs are broadcast at 6pm, no matter what". They want to be able to decide. However, when the nature of the program is an event, they are perfectly willing to follow it live. Sports events are one example.

The Value Chain

The value chain (see Figure 1-1), the organization of the industry working in IPTV, is not very different from that of traditional television, and today – since there are so few IPTV systems actually deployed – not very different from its big brother, digital cable. In the US, these two are positioning themselves as competitors, but in reality, digital cable is just one way of carrying IPTV.

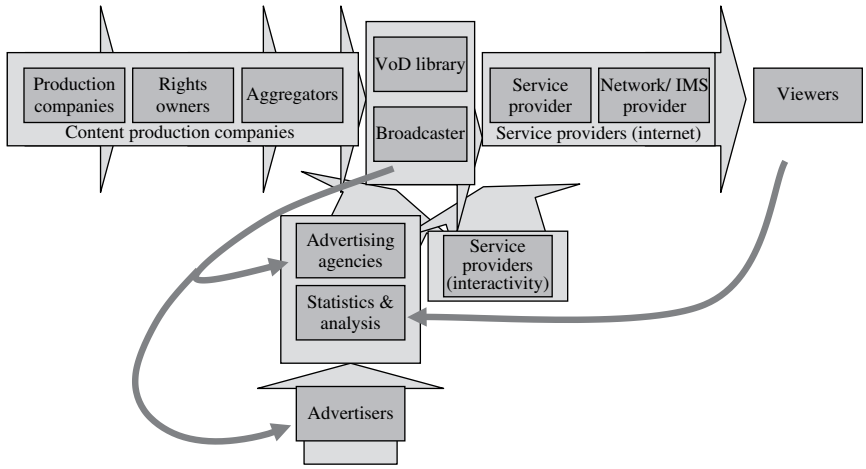

Figure 1-1. Value chain for IPTV.

The value chain looks different depending on who draws it. It depends on what you want to show, and who you are. As always, there may be national variations as well – different countries have different regulations, for example, how much advertising may be included in editorial content. Such regulations, as well as regulations on what data can be used and which audience can be targeted (in some countries, advertising towards children is forbidden), may put constraints on the system.

One constraint that has to be taken into account is privacy. Laws about which information can be given out to whom are nowadays strict in almost all countries around the world, except the US. The strictest laws when it comes to individual permission are those in Europe. These laws are based on an EU directive, and one of the provisions is that the express permission of the user has to be obtained before any data is used, and data may only be used for the purpose for which it is collected. So an advertiser either has to very painstakingly ask everyone to whom he wants to provide information whether this is allowed, or the service provider has to gather the information with the explicit purpose of providing it to advertisers.

To get user consensus, it is probably sufficient if the subscription agreement contains a provision that the service provider can use the data; there is no need to ask for information every time. Periodic checkups may be required, but the laws vary in different countries – the European directive is a minimum stipulation.

In the ecosystem of the earth the majority of life is driven by energy coming from the sun. In the ecosystem of IPTV, all the actors are driven by energy coming from the end-user. The end-user pays in three ways: a subscription fee; a connection fee; and with his attention when he is provided with advertising. Interactivity adds a fourth way, which the broadcaster currently shares with a number of service providers.

The IPTV value chain is likely to be the same as the traditional television value chain at first. It will start diverging, and in a few years the picture may look completely different. Table 1-1 indicates what it looks like today. The roles do not necessarily happen in all companies. Many of them are the same, but different parts work in different parts of the chain, and in a variety of ways. To confuse it a bit, these roles often overlap. A production company is frequently the rights owner of its productions; a broadcaster can be a production company.

The value chain ends with the viewer, since it is from the viewer that all the revenues come in the end. Users want to have the same services that they are getting today, but better and cheaper. Television is, despite the rise of the Internet, the most viewed medium. Attractive as it may seem to add the web to television, things are not that simple. Over 10 years ago, Web TV (later purchased by Microsoft) tried to make the television the information terminal of the home, by providing a web browser. Tempting as that may seem, it is not a way forward: the television is a lean-back device; the web requires the user to lean forward, to be active. Marshall McLuhan, the last great media philosopher of the twentieth century, characterized television as a "hot" medium, which engaged the user and forced them to focus on the content provided; as opposed to the "cool" medium of radio, which fostered detachment. The PC is a "lean-forward" device, where we have to act to interact, press keys or move the cursor to make things happen. Games are the same. The television is a "lean-back" machine, where the user is not engaged – other than when the television shows become social objects, and you have to watch *Hannah Montana* to be part of the gang of girls at school.

Role	Function	Example
Production company	Creates the program (and the advertisements) which are going to be shown	
Rights owner	Owns the rights to the production, may lease them to production companies and broadcasters	Endemol
Aggregator	Aggregates content, perhaps according to a type of event, and resells the aggregation	Formula One
Advertising agency	Purchases advertising time for the advertiser, manages the production and insertion of the advertisements	Havas
Statistics & Analysis	Tracks usage, according to demographics or individual preferences	Nielsen
Advertiser	Purchases time in programs to leverage the captive attention of the audience with commercial messages	Unilever
Service provider (interactivity)	Provides voting services and aggregation, e.g., SMS aggregation.	Netsize
Broadcaster	Produces and sends out the program, manages the advertising time	BBC
VoD library	Provides old content either for a fee or free	iTunes
Service provider	Provides the technical resources for the broadcaster and the VoD library	Akmai
Network/IMS provider	Provides the network and the identity management and other services (today assumed to be the same actor)	BT
Viewer	Consuming television	

Table 1-1. The roles in the value chain.

Business Models and the Value Chain

A value chain reflects a chain of business models. The viewer pays a license fee to the broadcaster (directly in some countries, indirectly in others, not at all in some). However, to get the content from the broadcaster, there has to be an Internet provider, who provides the connectivity; and a service provider,

who provides the servers from which the content is delivered. In some contexts, the viewer pays with his attention, not with money, to view the program. Advertisers pay for access to the audience that is watching the show.

If the broadcaster is providing interactive TV today, they are probably using a service provider for the service. This is an aggregator of SMS messages or premium phone calls; the aggregation can be done at a national level, but if it is to be profitable, it has to be done for many countries and operators. The user pays for this, too, but over the telephone bill. If one of the middlemen could be disintermediated, it would mean more income for the broadcaster and the other parts of the chain.

Video on demand is popular also for traditional television shows. Many public broadcasters are putting their programs online (some charging for it), and people do use them: every month, 7 million program instances are watched from the Dutch public broadcaster; and on YouTube 70 million videos are watched every day (although those are mostly short). If users can delay their television viewing to a more suitable time, they will do so – 50 % of users in the UK with Sky set-top boxes already do. And enabling this in IPTV is easy.

Most IPTV services – especially VoD services – are not free. They are based on the user paying a monthly subscription. In some countries, there are free-to-air channels, which are financed by license fees or taxes on television sets or by similar means; they have to be shown to anyone who has a television set. Often, this means cable systems must carry them; and while the rules are not clear when it comes to IPTV, it is not unlikely that IPTV providers must also carry the free-to-air channels in countries where they exist. This is, of course, a constraint on the business model – on the other hand, the user has to have a network connection, and that has to come from a network provider. In this book, an IP Multimedia Subsystem (IMS) provider is also included, but for practical reasons that is likely to be the network provider. Even though the IMS standard talks about the possibility of roaming and interoperability (and we do too in this book), there is no way to do it today. Anyway, the IMS operator has to be able to interact with the network infrastructure to provide the service in an acceptable way, as we will see later.

At the beginning (or the end, depending from where you see it), there is a different group of companies: those who work with content. In the television industry, broadcasters outsource the production of television series and programs to independent production companies. Their role is to coordinate the programming, sell advertising, and act as an interface towards the IPTV service providers and network operators – they have established themselves in the role as a middleman. The media industry is based on maintaining copyrights, and while there may be other ways to measure and meter content usage, digital rights management (in the widest sense) has emerged as the favorite method of the industry. However, the methods that are applied today, tightly coupled to devices and charging, may be diminishing user interest.

Content production and IPTV

The content is normally created by specialized companies, or units within the large companies. In the old days, only a large broadcaster such as the BBC could afford a unit to produce a drama series, and these were sold to other broadcasters around the world. Smaller companies started taking on the production role, however, they did not become really interesting until they started taking a different role: not just as a producer of a TV series on order, but as a creator of a concept and a packager. Sometimes, the broadcasters take on the role as content aggregator and content producer, in addition to being the service provider. Other times, the service provider is the network operator. There is no standard in the industry for how the roles are distributed – this will depend on the local economy and regulations. But the roles exist in most, if not all, IPTV systems. If a company is a bespoke producer, it is unlikely to be very much impacted by IPTV; if it takes a bigger role, it can use IPTV to its advantage.

The pioneer here was the Dutch company Endemol, which made its name with the Big Brother television show – which by combining television shows, live Internet webcasts, chat (in the early editions), and viewer interaction (to vote out participants) was also a pioneering multimedia experience. The interaction really changed the way that television was produced. The producers had no idea what would happen in next week's show. They did not have any control over it either. They gave that up to the users, in exchange for their curiousness – did the person you voted for get booted out? What happened next? And who would you vote for next week? Strictly speaking, the Internet was just an additional peep show – the big money in the show was made from the advertising, and the voting. Attempts to sell the naughtiest bits on DVDs and as private material did not turn out to be big successes.

Endemol is a content rights owner in this picture, a packager of content and deliverer of it to content aggregators. Aggregators can be broadcasters, but also, for example, specialized sports channels, or companies that create golf news for television channels, by combining coverage from several live events. The rights owner can be very powerful in the television industry, since copyright gives them a very strong tool to ward off anyone who might use their content without permission. Broadcasting without permission means a lawsuit.

The content industry is large – there are specialized trade fairs in both Europe and America where content owners can offer their content to aggregators and other distributors, as well as make deals among themselves. At these companies, interactive TV is usually very sparsely represented. The number of companies that work with interactive TV and productions directly for IPTV are low compared to the number of companies that work with Internet content – even if the techniques of production are largely the same, as we will see later.

It used to be that the broadcaster was the company that owned the studios, the equipment and all the resources required to produce television programs. This was when production equipment was expensive; nowadays, a professional television camera does not cost much more than 10 times a good amateur camera, and often it is hard to tell the difference in the result – the

skill of the filmmaker is becoming more important than the technology. Creating a television studio is not a matter of expensive investment in recording equipment, it is more a matter of creating a workable space for the recording.

In traditional television, the broadcaster used to be the operator of the radio network (and still is in many countries). In other places, the radio network is run by a specialized operator, and the broadcasters pay a fee for the broadcasting, just like the broadcasters who go directly to satellite. In IPTV, the radio network is replaced (from that point of view) with the Internet. The model that is emerging is more similar to cable-TV, however, where the user pays a subscription fee to get the service, and the operator pays a fee to the broadcaster to get the content.

In cable-TV, the user fees finance the purchase of a number of channels, packaged by broadcasters, some of which have a very high number of subscribers, others of which are more specialized and have fewer subscribers. The low-subscriber channels are often packaged with the popular ones as part of the conditions from the content owner (who may wish to promote a channel that users do not yet know about, or be able to claim to advertisers that the channel has a certain number of subscribers even though they did not choose it).

In the same way as users have stopped buying CDs, in preference of buying individual songs, television viewing in the US has gone towards individual program viewing – a trend enhanced by personal video recorders such as the TiVo. Some cable and satellite network operators offer this as part of the service subscription, but this is an expensive proposition – you need high economies of scale to be able to make enough to offset the costs. Smaller operators do not have that option, and for them providing a VoD service in the network is cheaper and also provides an opportunity to sell advertising, however, this brings a heavy penalty in terms of network traffic, which requires an expensive network and very tight control over it.

While the network operator is rarely the same as the broadcaster, the IPTV service provider often is. This is because they need the tight control over the network, but it is not two roles which marry easily. The network provider wants to provide a network that is optimized for the transmission of IPTV, but the IPTV service provider wants a network that always gives the absolutely best quality of service. This duality is likely to become disruptive in a few years' time, as network providers start devolving their IPTV services (if they have not started out by subcontracting the IPTV service).

If all the service provides is cable-TV over a different cable, then it is not adding any value to the user; and the only way to give the user value and make him switch to the IPTV service is to lower the price. For most IPTV operators, this means lower than zero, since the broadcast is provided free to air. They have to add other values, most often VoD libraries. Very seldom do they try to add interactivity, despite its excellent track record in the UK as an additional source of income. Sometimes they are constrained by legal frameworks, it is true; but often, it is simply because they have not thought about the possibility.

The value chain of IPTV is not different from the value chain of television, especially interactive television, but the technology used to deliver it is different – it is what this book is about. The difference is most marked for two roles: the user, and the network provider. Another party that will see a significant advantage is the advertiser, since the interactive advertising models, which have emerged in the digital cable and interactive television industries, will get a significant push by the IPTV technology.

The consumer electronics manufacturers are working towards IPTV. They have created the basic standard, leveraging Web 2.0 and IMS. The transport of the television stream is standardized, the interaction mechanisms about to be. This book describes one set of interaction mechanisms, based on the IP Multimedia Subsystem (IMS) standard. There are others, but they are not as flexible, or as good – though the threshold for developers may be lower. Consumer electronics manufacturers are slowly getting into the act. Television sets are already delivered with Ethernet connections for IP connectivity (at least in Japan), and built-in web browsers. Full IPTV clients are not far behind. This is because Internet usage is increasing, and one way it is used is watching video.

At the same time, there are many more devices today that can be used for viewing television than there ever has been, from handheld mobile phones to 100-inch plasma television sets, not to speak of televisions, PlayStations and Xboxes. There will be more in the future, and those suitable for IPTV viewing will have greater capabilities and possibilities, which can be leveraged by IPTV viewers. And the set-top box, which has created so many constraints for the television industry by trying to conserve the cable-TV model, is far from dead. Rather, it is set to get a new life – as the interaction box.

Advertising is the primary means of monetizing television today. However, as more television channels have become available, the "mass media" effect – to place advertisements in front of millions of people at the same time – has diminished. IPTV technology can be used to help advertisers find **the** right audience for their advertisements – by adding statistics.

Advertising in IPTV

Traditional advertising came about when early television networks time-sliced the programming time previously dedicated to one single sponsor (e.g., the US Steel Hour, the Palmolive Soap Theater – the latter the origin of the term "soap opera"). As big a revolution as that was, it was driven by the ability to splice content from different sources together to form one single continuous show, although interrupted by advertising. Advertising interruptions have now become so familiar that we hardly react to them anymore, and according to some researchers mentally tune out during the advertising breaks, if we do not even take this opportunity to change channels. In time-shifting systems, such as the TiVo and other set-top boxes with local memory, users can decide when they want to see something, instead of having to wait for the time that the broadcast planner has decided (which in turn

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is based on measurements allowing them to pinpoint the desired demography of viewers, in terms of age, type and group).

Advertisers on traditional television have a problem: the audiences are leaving. Despite the program producer's best efforts, more and more viewers are turning to pre-recorded programming (either which they have recorded themselves, or which has been recorded for them). When you buy television programs or films from a site on the Internet, they can either be downloaded to your computer – or the recorder in the set-top box – or they can be streamed to your television directly, with the storage at the service provider's site. It becomes very easy to fast-forward past the advertisements.

Advertisers need to measure the result of their advertising, and traditionally this was done by questionnaires and different kind of sampling techniques, including putting boxes in people's homes to measure what they were watching. Since it simply would not be economic to cover all households, this meant putting boxes within a statistically significant sample of viewers. As target groups become narrower, it becomes impossible to do this using traditional broadcast.

However, it becomes easy to do using IMS-based IPTV, because the broadcaster can collect the statistics in real time (even to the extent of telling the advertisers how many people are watching their advertisements just now). The issue becomes more one of aggregation and anonymization, since it is not at all certain that the users want all and sundry shoe and soap companies to find out what they are watching, or even what they have watched in the past.

Selling video films on the Internet – or from the portal of an IPTV service provider – has its own challenges, as we will discuss a little in this book. But it is broadcasters who have the biggest problems. The audiences are disappearing from viewing the advertisements, so why should advertisers pay for the attention of the audience, when they are not reaching them?

There are three ways out of this dilemma for broadcasters, the first two are: they can make better programs, so nobody wants to leave before they know what happened; and they can charge more for advertising – making it interesting enough for viewers to watch. That is happening to some extent.

With today's technologies, even in the most sophisticated cable-TV networks, you are stuck with guessing who your audience may be. There are attempts to measure who watches what, but all methods are based on sampling and statistical analysis. There is no way of either telling who has watched an advertisement – or who that person is. Demographic information is only available on a very general level. And even if you can profile the household, that information does not say anything about who in the household watches the show. A few years ago, it would have been a foregone conclusion that if the cartoons were watched at 5pm, that was the children, and the economy news at 7pm was the father. But nowadays the father is

equally likely to watch the cartoons. And the one watching the economy news may be the grandmother. There is no way of telling with the existing technology.

To provide an IPTV service, which adds more value than traditional broadcasts and video rentals, the next-generation IPTV systems have to both make registration of user data easy and practical, and give users control over it. And luckily, IMS comes to the rescue again. There are alternative ways of handling user identification and data, but only the Liberty Alliance protocols allow for federation of data across different service providers. Liberty Alliance and IETF Geopriv both give users some control over their personal data, but they do not have any idea about the data structure – which is one of the features of the personalization system in IMS.

So this book is about the third way to create value for the viewers: turning them into participants. It also has another consequence: since it is far cheaper to make live programs which adapt to feedback (just watch any shopping channel) than to create compositions out of recorded videos, this will mean a resurgence of the live format. This will have consequences for the technology of television, as well.

There is another constraint on the business model: very little professionally produced content is available for free. The rights owner has set the price for his content so that it fits the existing market, but the world is changing. While it may have been possible to buy productions at the prices demanded when there were just a few television channels and everyone had to watch, the industry has changed. Now, there are thousands of television channels, with much fewer viewers, and the advertisers are discovering that they are being sidelined by technology.

Changing the role of Digital Rights Management (DRM)

Up until now, the broadcaster has had the monopoly of bringing the user what he sees. Not so with mashups. Deciding who owns the interaction ability – and hence the ability to make money from it – is likely to be a major struggle in the media industry, which has already moved to use legislation to gain control over subtitles, crows and other content additional to the television show. In some countries (like Japan) legislation actively forbids any overlays over the content sent out in the television channel. But fighting users who want to add value is a losing proposition, as almost 15 years of web experience should tell us by now. Enabling the possibility to create added value to the television show, rather than constraining it, will mean driving new business, rather than locking in old.

The broadcaster can commission content, and hence get the rights to it, but the rights to the content can be sold to others as well. These include aggregators, who take many different types of content and sell them on (e.g., creating golf shows for sports channels). The content industry is a large industry with well-established actors, and since the existing content is seen as the key to making IPTV take off, it is not likely that it will go away. This is different to what happened

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on the web, where the existing content owners were sidelined by individuals and small companies developing new content. While this is likely to happen once IPTV becomes widespread enough for dedicated channels to take off, television is dominated by popular series and movies, and will likely remain so for many years to come. We will look more at copyright and DRM in Chapter 6.

The content aggregator usually sells the content to a broadcaster, which acts as an agent for the content; it sells the content rights on to the broadcasters who are interested in showing it to their viewers – and think they can monetize it by selling advertisements in it. Advertising comes from advertising agencies (it may be produced by the same companies who produce the content) and is inserted into the programs by the broadcaster. How this is done, and how the process can be partly automated, we will look at in Chapter 5.

The distribution technology is the same as most users today use to receive an Internet service, which is why it is attractive to network providers: they can get more users for the networks they have already built, and they can get existing users to pay more for the new services. It is also attractive to broadcasters: they can get an additional customer in addition to cable-TV providers, which means that they can sell their programs one more time. It is attractive for users as well, since having one additional service provider will create price pressure on the Internet service, as well as the IPTV programs. However, IPTV is not just a new distribution technology.

If the same service is offered to all users, regardless of delivery network, network and service providers are indeed caught in a bind: there is no way they can get more for the service, since there is no reason for users to pay more, and the only way they can compete is through price. If operators want to be able to create something new, they have to do two things: they have to offer the same (or better) service as their competition, primarily cable-TV networks but also broadcast; and they have to provide something new and attractive.

If the content is so attractive that people want to pay for it, they will be charged for it. Movies and other content where the audience is highly immersed, thanks to the plot and production values, are costly to make, and every returned cent counts. Pay per view has had some success with certain types of programs. Interactivity today is not a large part of the revenue stream for most operators – but it is a source of worry for users, who have to pay every time they want to interact with the television show. Charging a flat fee has increased usage in any other medium; it is very likely to be true for interactive television. And with IPTV, there are mechanisms to do it. They come as part of the parcel when you use a standard called IMS, the IP Multimedia Subsystem.

Interactivity in Reality: The British Red Button

The only country where interactive television has become widespread is the United Kingdom, where the set-top boxes deployed by BSkyB, the broadcasting company of Rupert Murdoch, have been based on the otherwise less than successful WAP standard. The success carries an important lesson for the future of interactive television, both in terms of what content is most appreciated, and how users want to interact with it.

The interaction model of WAP, originally developed for mobile phones to interact with information services in a web-like way, was based on Apple's HyperCard, and instead of pages, the user interacted with a deck of cards, which were interlinked by a scripting language. Overlaying the deck on top of the television signal enables the user to interact with the service. Since WAP was designed for the early mobile networks, the transmissions are extremely compressed and latencies become low even over a dedicated telephone line.

However, in the BSkyB service, as well as in many other services (commercial or experimental), it is not the services that the broadcasters expect will become popular. Interacting with the television programs themselves is less popular than interacting with the dedicated sites which content providers can create. While actual interactions with programs is becoming possible in real time when the user is connected over the Internet – television becoming almost indistinguishable from games, the only difference being the interaction model – there is one type of content which is likely to suffer and flourish at the same time in the new IPTV systems, and that is advertising.

Four levels of interactivity

There is a lot of confusion about what consists interactivity; with some even counting channel switching as an interactive activity. Looking at user behavior in combination with technology and content, however, four levels of interactivity become easily evident.

Level one is where the user interacts with the meta-information about the content, such as the program guide. This includes video on demand, setting personal video recorders, and selecting content in an Electronic Program Guide (EPG).

The next level is where the user accesses external information, which is not necessarily related to the program. This includes Teletext or on-device portals. The user can get news and other information, but the interactivity is limited to pointing and clicking, perhaps with pages pre-adapted according to user preferences. Examples include Bloomberg, a finance and economics show, which displays stock prices and charts; users can call up new charts to see market fluctuations. Voting is another feature, although you cannot vote on the stock price or trade stocks.

The third interactivity mode is where the user can influence the program by voting. This includes programs such as Big Brother and American Idol, and can also include chatting and other interactions with other users through the mediation of the television and the communications device. This is very popular: 27 % of

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all young European owners of mobile phones had voted or participated in game shows on television at some time. In the UK, the red button on the remote control connects users to the interactive services, which is very popular during the same type of events: 58 % of the audience used the service during the 2004 Olympics, according to the BBC, of which more than 60 % watched it in an interactive way for more than 15 minutes. Of all the viewers who had access to digital television, more than 40 % have participated at least once in an interactive television game. The Olympics (a special event, if there ever was one) aside, there have been a number of successful interactive television shows in Europe. In different events, such as Formula One and football leagues, the user can choose which camera angle to view the action from. There are automatic systems which track the ball on the pitch and select the best camera for viewing, as well.

The fourth level is where the actual story changes depending on how the user interacts. This includes both explicit interaction, where the user makes a choice of how the program should proceed; and implicit interaction, where previous user actions are taken into account to change the program. This type of interaction approaches games, and while the games industry is much larger than the IPTV industry at present, there are lots of things interactive television developers can learn from games – since games include many interactive television features. Still, only 81.3 million euro were spent on interactive television games during 2005, with UK users contributing 42 %. SMS can be used for more than voting, however. In Italy, MCS Tutte le Matine, a popular television show, is available in sign language. Users can interact with the subject of discussion, and they can get SMS reminders about when their requested subjects will be discussed.

Interactivity has also been extended to advertising. There are service examples in the UK where interactive TV is used for advertising campaigns with some regularity and success, for instance Adidas. Increasingly, VoD services are placing personalized advertisements into the programs, and making it possible for the user to select an extended version of the advertisement ("tromboning" in IPTV-speak).

Traditional television has tended to see itself as the focus of attention, its schedule binding the user's time, but personal video recorders have turned that around: the user now sees the television signal as a distribution system for the video he wants to watch after recording it. This contributes to the fragmentation of the television audience – but also the opportunity to target the viewers with advertising, since a fragmented audience is a number of specific audiences. This is also the key to success for broadcasters. Offering the right audiences (not always the same as the biggest) will mean revenues from advertising – and, if the audience interest is captured, interaction.

The most convenient way of access to content will always win, in particular in the convenience-driven television medium. Users could not care less if the video they rented was delivered on a disc or via the cable, as long as they can enjoy it whenever they like (or at least within the terms they have paid for). An exciting game can be sent via radio or cable, and the cable can

be analog or digital; the radio waves can come from a satellite or a tower. This does not matter for the user experience (except in setting up the service, waiting for the cable-TV technician to show up, and so on). But not all users are the same. They want to have their own choices. These choices have to be presented in a comprehensive and easy-to-understand way. The least intrusive user experience will be the most attractive. Individual interaction is hard for television programmers to handle – it was not until the interaction turned from the individual to groups, in the shape of voting, that interactivity started taking off. Users could make programs different by voting, for example, in the *Eurovision Song Contest* and *Big Brother*.

That voting is handled through the telecom operators, and users vote through their phones or mobiles. A service provider aggregates the votes, and presents them to the program. The service provider also aggregates the revenues which the television station receives – typically a percentage of the (premium) cost for the message or call. The votes are presented on the air, and the results will affect the program, which is what interactivity means (that you can select different variants of something, but not change it, is not real interactivity). There is a way to charge users for interaction; and you know for sure that those who voted watched the show – since it was sent live, and any voting done after the show would be meaningless. This means that the format of the show has to be adapted to the technology, as with so many other shows which follow a similar model: the viewers have to be given a reason and an occasion to vote.

Interaction works best (according to the EU LIVE project) in documentaries and news. In fiction, people want interaction to be as unobtrusive as possible, not to disturb the viewing and the immersion in the plot and storyline. For the producer, having a number of short video clips, which are mixed together based on user interactions, can be problematic. The shorter the clip, the greater the loss of the meaning the user perceives; and the bigger the opportunity for remixing and sampling.

In the minds of the first designers of interactive television systems, the user configures the system precisely to his needs, and sits back and watches it happens. But most users are not programmers, and they may not know their own needs. They also like some serendipity, surprises in what is being presented to them. This became evident as early as the end of the 1980s in the MIT individualized newspaper experiment, Fishwrap, where the users quickly got bored with their own selections of news, and started asking for an editor to come up with some surprises. Nobody wants to be completely alone, even though we may want to be individuals; belonging to a group, and knowing it, is one of the strongest motivators of human actions. And, even though the next generation of IPTV can be made both personal and interactive, there is also a way to capture the groups the user belongs to, and use that in creating the shows. There are many ways to do this, but unless you build them into the system from the start, they require significant effort to implement – and will feel clunky and pasted on. But if you use the technology, which is the base for the IPTV system described in this book, IMS, you get a solution that is part of the parcel.

How IPTV Services Work

IPTV is different from traditional interactive television, because the backchannel is built in. Today, the best backchannel for interactive television is the mobile phone (or traditional telephone), and that has its own problems, among others, in that the interaction has to pass through a service provider, and that it is rather expensive for viewers to interact with programs, so they tend to refrain other than in special circumstances – and the content producers tend to think about the interaction in terms only of interaction with special events.

Figure 1-2 shows how an IPTV system works at one level: how the request for a television signal gets from the television set to the server delivering the content as a data stream – the streaming server. In the telecom industry, the "signaling plane" is often separated from the "media plane", a convention we will follow in this book, since it makes it easier to talk about the next generation of IPTV. The interactivity we will discuss in this book is part of the signaling plane, at least if you use the IMS-based solution. Other types of interactivity, such as a user providing content, become part of the media plane; and channel switching (which is not really interactivity, since it does not change the program) also takes place on the media plane.

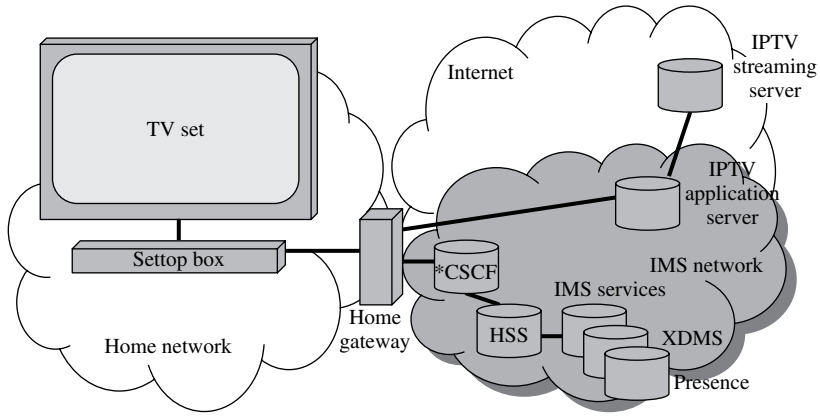

Figure 1-2. How the IPTV system handles communications with the media server.

The killer application: video to television?

If you ask people in the telecom industry, the killer application is video telephony. Despite the fact that it has been promoted as the killer application since the 1950s (but is yet to take off in a big way), and several of the interactive television trials which were conducted during the 1990s showed that people want to watch television, not take video calls on it, technology pundits continue to promote it as the application that will sell almost any new network technology.

This also extends to IMS, one of the cornerstones of the technologies discussed in this book. While the European Telecommunications Standardization Institute (ETSI; despite the name a global standardization organization) is now working on a standard for IPTV using IMS, it has already standardized four other "services" – which means profiles of IMS that can be installed within an existing client. These are "Multimedia Telephony", a new name for what was previously known as video telephony; Instant (or "Immediate") Messaging; Push to Talk over Cellular, an unwieldy name for a service that lets users send short voice clips to each other; and Presence – which makes it easy to keep track of what your friends are doing.

In particular presence makes it possible to create a completely different service offering. While video telephony certainly has a role, it is not making users take telephone calls on their television sets. It is enabling them to call the television show. Interactivity at such a highly personal level is somewhat out of the scope of this book (since only one user at the time can interact with the host).

However, the same technology that enables video telephony makes presence and messaging possible – and those are the basis for the interactivity described in this book. So we will look deeper into how they work.

The layered view of the network helps in understanding and modeling – but it is a model, not the network itself (even if the distinction is dubious when talking about software). If you show the media delivery instead of the signaling layer, you get a different picture – the same components of the IPTV system, but with different relations between them. In IMS, two other layers are used to describe the system: the application layer and the network layer. Applications use signaling to set up media over the network; if you show only the network layer, a different set of components comes into play. For example, there has to be a DNS server, which allocates the IP addresses used in the network; we will not go into how that is done, since that is pretty much standard today. Nor will we look at how IPTV works over ADSL or fiber to the home.

We will look into the home network, since it is important to understand how the different components work together. And since there is a fight in the IPTV industry, despite hardly being standardized yet, over who should own the user interface, and who should create the middleware – and where it should be. There are two extremes in this view:

- Either the middleware, the software that works with the media stream to create the IPTV services, is in the set-top box, and there is hardly any software in the network – only servers getting signals to deliver data.
- Or the software is in the network servers, and the set-top box is just a dumb box (if it exists at all), which forwards the input from the user's remote control.

The reality will be somewhere in between, but there is also potential for IPTV systems to look very different and yet have the same basic functions.

And since the "managed" network of the IMS is an overlay on top of the "regular" Internet, in a part of the Internet where the service provider owns the routers and other systems, a very large part of the system design is already given. The IPTV system also has to work on home networks that may look completely different, depending on the users who built them – both from the perspective of networking and the perspective of signaling.

From a system designer's perspective, the layering (see Figure 1-3) makes things easier. The important thing becomes the interfaces: if the clients and servers conform to them, the software developer can use his time to make things that run more efficiently.

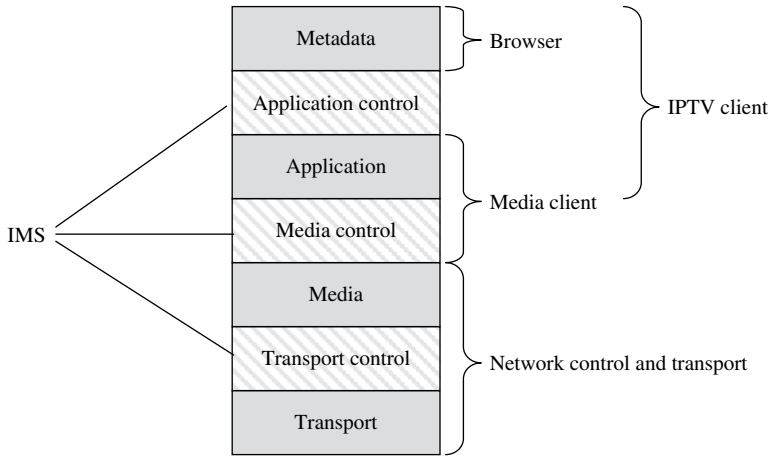

Figure 1-3. A layered view of the IPTV system.

An IPTV system with interactivity will consist of the following parts as shown in Table 1-2.

Most of the components of the IPTV system are already in place. Video servers, for example, are not new – development started in the 1970s. The networks are the same as those used to deliver Internet service today, and there is neither need nor possibility to replace them. This does not leave much space for developers. The client, the application server and servers, which provide services to the applications, are all that is left to make innovations – but this is more than enough, as hardly any of the existing components that enable new types of services are in place today.

In reality, the user wants to see a television program. He clicks on the "start" button on the remote control. When he does that, the IPTV system registers with the IMS Core, to verify his subscription and make sure any profile information is applied. This registration may go through a separate gateway, or it may go directly (as will all the following requests within the session this sets up). As part of the confirmation of the session, the user gets the media stream – either as a stream directly from the streaming server; or as

What it is	How it works	Why it is needed
TV set/Media renderer	Receives the IPTV signal and renders it on the screen	Makes it possible to see the video content
Set-top box/Interaction device	Captures user input and sends it to a central interaction server	Makes sure the user's interactions get to the IPTV service provider, and can be used to change the content of the show
Home network	Connects the different types of equipment in the home together	Makes it possible for different media stores, renderers and interaction devices to interact with each other, and services on the global network (Internet)
Home gateway	Manages addressing in the home, registration with the service provider, and filtering of content (the last two functions can also be performed by the set-top box)	As a firewall and address management system, and to ensure that the user's actions are authorized
IMS proxy	Captures the request for the video service and makes sure it gets to the right receivers, including the QoS system	Interconnects the network and signaling planes of the system, and makes sure the service requests get to the right nodes. Also connects to the profile management system
QoS system	Instructs routers in the network how their queuing mechanisms should be set up	Without QoS, video can be delayed and result in degraded user experience
IMS identity management	Makes sure the user is who he claims he is, and connects the use of the identity to the relevant subscriptions (and hence charging)	Without identity management, anyone could use anyone else's services; the charging systems would have to work offline and with special tokens to keep track of who should pay for what (as it is now)
IMS presence and profile management	Keeps track of what the user does and has done; makes sure this is registered in the system	Makes it possible to personalize content, and to know what other users are watching (if they allow the user to see it)

Table 1-2. The components of an interactive IPTV system.

What it is	How it works	Why it is needed
IPTV streaming service control	Manages the video stream, including switching to a different video stream when the user selection demands. Note that this is not the same as channel switching	Makes sure that the program is started when requested, and eventually creates programs from different video sources automatically on the fly
IPTV streaming service delivery	Handles the streaming of the content over the network. Interacts with the QoS management	Makes sure content gets where it is supposed to go
Advertising insertion	At selected points in the media stream, pastes in video sequences which contain commercial messages (although this could be a generic mechanism)	Puts advertising in the right place in the program
Interactivity server	Captures the interactivity requests (from the user's IPTV session), collates them (if required), and sends to the appropriate server(s), such as charging, profile management and streaming service control	Interactions which come from more than one user need to be collated and coordinated, otherwise they will not result in anything

Table 1-2. (Continued).

a multicast address, where his IPTV set can join an existing multicast group. The streaming starts to the television, and the user can watch it – since it is encoded in a standard format. At the same time, the television program the user is watching is registered in the presence server, and the user's nominated friends are informed that he is watching.

When the user wants to interact, for example, to comment on something stupid the quizmaster just said in a quiz show, he presses the red button. This makes a menu appear on his screen; the menu can either be fetched from the IPTV Application Server (AS; "Application Server" means something special in IMS) when he makes the request, or he can get it from the IPTV AS separately. How it is displayed depends on which standards the IPTV set implements; but if it uses the latest standards from the consumer electronics industry, it can display the content on top of the television program.

The user selects the interaction from the menu, and this triggers a message to the IPTV AS, which includes it in the system used to either select the video clips (e.g., advertisements) to be displayed next, or to change the script on the teleprompter in front of the quizmaster. At the same time, the profile of the user is updated, so the user's preferences can be taken into account (even

though it may be hard to draw conclusions from the user's interactions in a quiz show). The selection of the video clips can be individual (if the user is watching a "unicast" data stream); or it can be done on a group basis. If it is done for a group, the profile of the group is compared with the description of the video clips in the metadata.

What the user is watching can also, after being anonymized, be sent back to the advertiser, or others who are interested in finding out how to monetize the programs.

What is Next for IPTV Users?

It takes a daring (or desperate) producer to invest in a completely new format for television programs – or government funding. In Europe, the latter is the case. The development comes under the scope of EU research projects, funded under the 7th Framework Program.

The EU aims wide in its research frameworks. The intention is to involve a wide selection of countries and organizations. The goal of only strengthening the European industry and creating more jobs through research was widened greatly in the 6th Framework, and this widening is even more pronounced in the 7th. Hence, many more organizations and countries are eligible for research project funding – and will be able to participate on an equal footing with companies and universities from the EU proper.

What this means is an unrivalled funding opportunity for companies and universities in Europe. And for companies and universities outside Europe, it is an unrivalled way of getting involved in very interesting, very directed research projects. However, the process of deciding on a research framework in the EU is nothing if not complicated, and an interesting reflection on the processes behind the EU.

The EU 7th Framework Program

Since 1984, the EU has allocated money for research programs in its budget. These programs, like the rest of the budget administered by the European Commission, are an attempt to create more research-driven industries in Europe, and hence more jobs and more growth. They are framework programs, which means that they have several subprograms, which are intended to cover different aspects in the i2010 plan – to make Europe the most advanced knowledge economy in the world by 2010. All the framework programs are heavily laden with political agendas, covering everything from computer support for the elderly to ethical aspects of research. The 7th Framework is simply the seventh in number.

The process for framework program approval is as follows. The initial proposal comes from the European Commission. This is commented on by the European Atomic Commission (since some of the financing goes to European atomic research); and the Committee of Regions. The comments are then read

(Continued)

by the European Parliament and the Council of Europe, who may suggest proposals for amendments (and then there is some iteration). If all the amendments are accepted (something that does not happen), the program is approved. As it was, the European Parliament did not approve the proposal, and sent it back to the Council with changes, which were discussed, and read a second time by the Council. In the current process to approve the 7th Framework, the European Parliament has taken a much more active role than before.

When the European Parliament (the final example of approval for the EU budget) approved the funding for the 7th Framework, the European Commission (who of course had been preparing for a long time) set its wheels in motion. The process for the 7th Framework is essentially the same as for the 6th, but with some tweaks and additions. In addition, navigating the process requires a great deal of experience in itself.

The framework programs are a budget, as well as a strategic direction. And the budget is big: 3 % of the EU budget should go to research. Two-thirds should come from industry, and one-third from public sources. And only one-third of that is the EU budget for the 7th Framework. This still makes it the second biggest part of the EC budget, after agriculture. The framework will not end until 2013, and there will be a budget revision in 2011, but if the previous framework programs are anything to go by, the lion's share of the budget will be allocated early, during 2007 and 2008. By far the largest part of the budget goes to the information and communication technologies.

The EU-funded research projects have some unique properties, which are not found in other research projects – or even project organizations. The first property is that the consortium signs a contract with the European Commission to undertake a certain piece of work – including disseminating it to a wider audience. These days, this means that the resulting software can be made available as open source, and that reports are expected to be public. The contract is binding to the partners in the consortium, who have to be about half from universities and from many European countries – and can come from outside the EU, as well.

The proposals for projects are evaluated by a group of experts, who look at the technical excellence (note that the EC and other parts of the EU do not have any say in the results). The evaluation is driven by the call for proposals, and the scientific and technical excellence of the proposed results – while a proposal may be politically correct, it will not pass the evaluation if the technical excellence is too low. A proposal which falls through in one call might have a chance in a later call – if it is appropriately modified.

"Research projects" do not mean men in white lab coats chasing white mice with cyclotron beams in imaginary labyrinths. Or at least, not only. It means projects that are aimed at "advancing beyond the state of the art" – adding to what is known in an area. What this is, and the method for it, will depend very much on the area. The EU funding frameworks are intended to drive applied research, which means that projects are expected to

lead to practical applications of theoretical and long-term research; however, product development as such is not funded. Drawing the line between these is not simple – especially in the area of future interactive television, where a new format can be deployed overnight if it turns out to be successful. And part of the research funded by the EU is about new television formats.

Shape-Shifting Television: New Media for a New Millennium

The New Media for a New Millennium (or NM2 for short) was an EU-funded project in the 6th Framework which ran until 2006, and which tried to create a new type of user experience – with IPTV in mind. Participants came from several European telecom companies, and the inspiration was in equal parts computer games and interactive films, a genre which has a small but thriving subculture in art cinema.

The common idea behind the "shape-shifted media", which NM2 created, was that productions would be based on pre-produced content, produced by professionals and to professional standards. However, the users would determine the narrative by voting and sending messages to the show; this was possible because the project used set-top boxes which provided for this type of interactivity. The interactions could determine more than just what would happen in the next scene – also the length of the show, the location, narrative perspective, camera angles – as long as it was available within the pre-recorded content (which is a big constraint on systems based on stitching video clips together). At the same time, the producers were careful to make sure that the changing story did not disrupt the viewing pleasure. Of the eight productions, one was actually broadcast (in the cable network in Helsinki, Finland). The others were made available on the web.

For anyone familiar with the history of hypertext (before and after the web), the storytelling model seems hauntingly familiar. A website, as most designers have realized by now, is a mesh, not a tree, with several possible starting points. Any interactive television production today will have to compete with the ubiquity of the web, and while it is not much harder to create a branching script than one built for linear viewing, it requires a different type of thinking – just as the first websites could claim to change the way people thought about media, when they had to leave the linear way of writing behind.

According to the NM2 project, in a reconfigurable media experience, the storyline is not determined in advance. The production team has a database of footage (either new footage or archive material) that can be edited in numerous ways, with or without preconceived scripts or plots. Depending on the input of the users the story is shaped and configured. The tools used should make it possible to create flexible narrative structures, called narrative arcs by the NM2 project. Narrative arcs consist of a number of video shots based on a particular structure. The tools should be able to model and structure narration automatically. If the system can automatically define the narration

based on information gathered from the user and from the production team, this saves a lot of time.

In an interactive drama it is also very important to keep track of the exact timeline and how much time is left until the end of the program (and for the advertising). The typical slot for the broadcast is 28 minutes, and this should be indicated by the tools. In addition repetition of clips should be avoided, which can be implemented by the use of rules.

Figure 1-4 illustrates the various tools developed by the NM2 project.

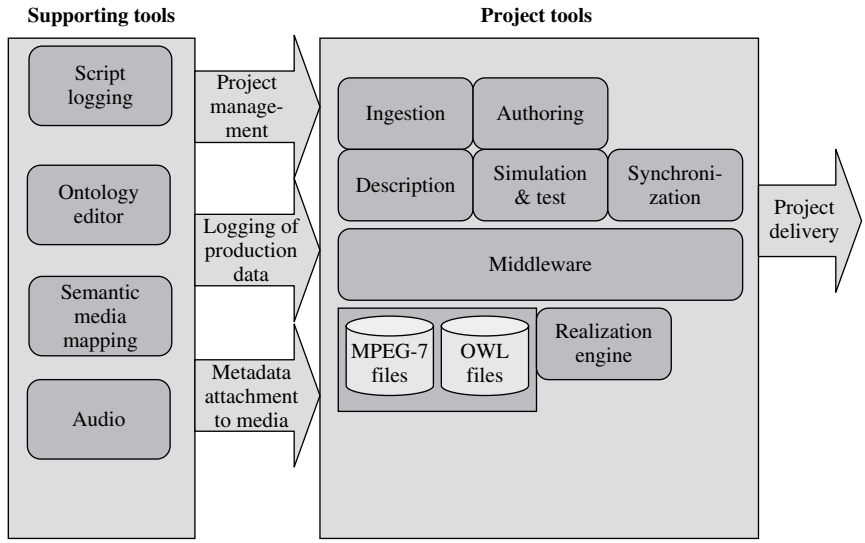

Figure 1-4. NM2 tools.

- The Script Logging Tool is a standalone application, which enables metadata relating to media and narrative objects to be captured at an early stage in the production process, for example, when writing a script, shooting scenes or searching for archive material.
- The Ingestion Tool is the means by which metadata from a variety of sources can be imported into the NM2 tools in order to define media and narrative objects, concepts within ontologies, and other information.
- The Description Tool enables media objects within a project to be created, edited, modified and deleted. It provides hierarchical management of objects and multiple options to review and append metadata to one or more objects. Both MPEG-7 and ontology-based metadata can be expressed in the tool, which also provides a framework for automatic content analysis.
- The Authoring Tool enables the creation of interactive narratives by means of a unique interface consisting of a hierarchical "canvas" on which nar-

rative objects can be positioned and interconnected. Media objects from the Description Tool can be added to the canvas, and specific rules and heuristics can be entered to define the logic of the narrative.

- Simulation and Test provides functions which enable an interactive narrative to be checked and reviewed from within the NM2 tool application environment, prior to deployment on a delivery system (such as an IPTV service). This includes the ability to simulate multiple user inputs and review a synchronized media output, which is representative of the intended user experience.
- The Middleware Framework provides common functionality, which can be accessed by all NM2 tools encapsulated within the Application Environment. In addition, it exposes Application Program Interfaces (APIs) which can be independently used by production-specific delivery systems.

The most important functions provided by the middleware are persistent storage of metadata for both media and narrative objects, including the project's narrative structure itself, and access to the Realization Engine in order to execute a narrative in accordance with external inputs. The Realization Engine within the Middleware Framework is the execution engine for interactive narratives. It combines a narrative structure defined by the Authoring Tool, media object metadata from the data stores, and external input from a delivery system to progressively generate a multilayered media playlist for input to a media composition engine either on the client or server side.

The NM2 project identified six trends, which would make "shape-shifting media" take off:

- A massive uptake of digital networks.
- The convergence of PC and television in devices that facilitate personal media experiences.
- Games becoming truly interactive media productions.
- Mobile phones allowing for media consumption anytime and anywhere.
- The rise of Web 2.0.
- Young generations guiding "us" into an interactive future.

While this sounds like a wish list of media executives from the early 2000s, they do not automatically apply. First, the younger generation is probably the driving consumer, but that makes demographic assumptions which are not sustained in a family context, and that is where television is typically viewed. Mobile phones have become media consumption devices – in Japan and Korea – but they are not used for interactive media, they are used for playing music and watching traditional broadcasts. And the massive uptake of digital

networks has already happened, with the emergence of the Internet and the television industry going digital.

The three trends that do matter are as follows:

1. The convergence of the PC and television – but not in the simple way that you put them both in the same device; just like the web combined features from newspapers with features from computer media, the resulting system is both, and neither.
2. The second trend, the emergence of Web 2.0, probably holds the key to the predictions of NM2 becoming reality. Web 2.0 makes new types of user interactions – using new types of devices – possible.
3. The third trend, that games should become truly interactive media productions, has already happened to some degree. It is in massive multiplayer games such as Second Life that the real change in the way users perceive storytelling has the opportunity to take off. Machinima is already an established genre.

NM2 also rightly saw games consoles as a crucial emerging technology. While designed to be viewed on a PC or using an interactive set-top box, their productions clearly pointed the way towards an IPTV world where games consoles are also set-top boxes (something that is happening with Microsoft's Xbox, and also Sony's PlayStation).

The productions of NM2 used different engines for the system, but the idea was the same: a characterization of the media clips in metadata made it possible to take the user's interactions (triggered by traditional interactive graphics) and select the clip which branched the story in the selected direction. Here is one weakness of interactive media: the broadcast makes it difficult for an individual user to select a favorite direction. The broadcast, although stitched together from different clips, has to appear the same to all users. Hence, it is likely that shows such as those produced by NM2 will work better as video on demand.

The work of the project did not only include the productions, which are interesting enough (and hard to show in this medium, so anyone interested will have to look up their website), they were also able to draw a set of conclusions from existing media and business models, which are worth quoting:

1. Interactive audiovisual formats are not provided as a standalone service, but are added to television programs or offer new ways of exploring and using broadcasters' audiovisual archives.
2. Most of the business models in the cases analyzed depend on strengthening a particular brand and generating audiences and buyers for other, related services. They are not designed to be profitable in themselves.
3. Business models for interactive content are still developing. Although the case studies are successful in terms of numbers and popularity, proper and

fully developed business models are in most cases still lacking. Exceptions were those where existing payment systems could be leveraged; or the brand and model of the broadcaster could be used (e.g., for selling subscriptions).

4. Interactive, nonlinear audiovisual formats need to be highly modular in order to be able to refresh content regularly, and thereby create customer loyalty.
5. Notwithstanding increasing possibilities to distribute content through decentralized and peer-to-peer (P2P) networks, the nonlinear audiovisual formats in the case studies are all centrally operated to prevent misuse, copyright infringements and guarantee a certain quality of service.

Common bottlenecks and dilemmas were:

1. Scarcity of attention: a scarcity in distribution channels has been replaced by scarcity in attention. Companies offering online digital content need to invest in cross-media promotion, search engine marketing and creating a strong brand in order to attract sufficiently large audiences.
2. Copyrights issues remain an obstacle to exploitation of content in new ways. It is time consuming to clear copyrights on archive material and for newly produced material it is difficult to agree on exploitation contracts between right owners on the one hand and distributors and packagers on the other.
3. Digital and online media offer potentially interesting ways of tracking and registering user behavior, thereby enabling new forms of targeted advertising. However, reliable, standardized audience measurement methods upon which all stakeholders agree are still lacking and interactive and targeted advertising are not yet used to their full potential.
4. Fear of piracy and format copying leads to centralized concepts of distribution and DRM. This might not always be the most efficient way of handling and distributing content.
5. Public broadcasters find themselves in a contradictory position. Offering access to publicly funded material in broadcasters' archives and offering their viewers access to programs and related services on digital platforms can be considered as a key part of public broadcasters' remit. On the other hand, offering (free) access to public broadcasters' audiovisual archives might and public broadcasters' expansion on the Internet and in digital domains might be subject to accusations of unfair competition.
6. Public broadcasters generally want to uphold certain standards of quality and objectivity. This prevents them from fully embracing user-generated content as a means to expand and open up their offer to contributions of users.

7. In order to reach audiences public broadcasters need to cooperate with owners of distribution channels and portals. However, public broadcasters are limited in collaborating with commercial partners as they are usually not allowed to directly contribute to profit making of third parties. This makes it more complicated to enter public–private partnerships. More importantly, cooperation between public service broadcasters (PSBs) and commercial partners can be politically controversial and clash with PSBs' professional culture. The main issue to be solved seems to be how to maintain the public broadcasters' integrity and independence, when offering content in the context of commercial services. Also revenue sharing and customer ownership have to be negotiated between PSBs and commercial partners such as network operators.

All the work of the project is, as usual with EU projects, documented on its website.

Project LIVE: Interactive Sports Events

The nonlinear storytelling with which the NM2 project experimented can only work for content that does not follow a timeline. However, there are many types of content being broadcast on television that are forced into a certain frame by the nature of the event they are presenting, for example, sports. Watching a marathon race backwards can perhaps be amusing, but it is viewing an event from start to finish which brings value – especially in sports where the timeline does not force the action in the same way as a race, such as football or ice hockey.

To understand what it would mean for a broadcaster to show a story from several different timelines at the same time, the LIVE project (with participants mostly from European research institutes) designed a system that was able to adapt the storytelling around a sports event to user feedback, and also include other stories which might unfold alongside the main story. See Figure 1-5.

The difference from other interactive television systems (such as that of NM2, or the ability to select camera angles in Formula One) was that in addition to the multiple live audiovisual streams, there was an ability to create transition points, where the consumer could be invited to switch to another subchannel. Zapping between different viewpoints became equivalent to navigation through the event, getting multiple points of view.

There are three keys to making the LIVE system work:

- Annotations of the sports event (which have to be created in real time, since there cannot be any delays in a live broadcast).
- The use of the annotations to select content from the different streams, based on the user's interactions.

- The "staging" of the system – the creation of the transition points and multichannel coordination, which makes it possible to handle the shifting between different channels.

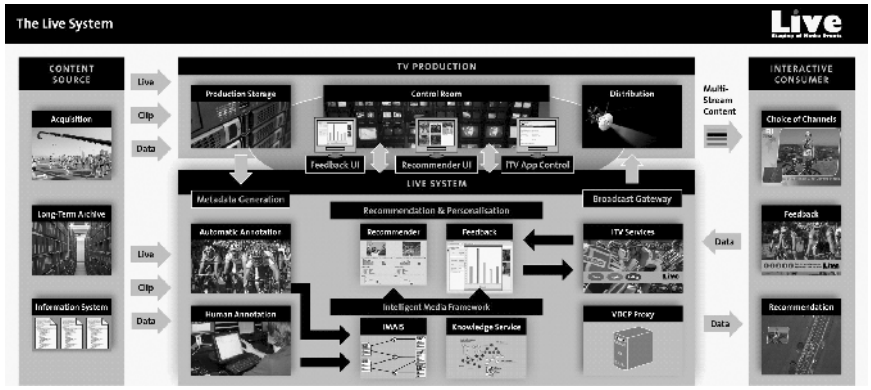

Figure 1-5. The LIVE technical system. Reproduced by Permission of © 2008 Live Consortium, http://www.ist-live.org.

To create the broadcasts, the project designed a console that could be used in combination with a broadcaster's production system. Using the console would not be too different from the way that current production systems are used.

During the broadcasts, four different types of feeds are automatically analyzed and processed into the system:

- live event multi-stream video feeds;
- related event database services;
- relevant archived material (clips); and
- consumer feedback data.

Part of the analysis of the live event feeds is the metadata extraction and human annotation components – where a producer or director can take the material and put annotations on it, for example, describing the event. But automated analysis is also an important component – if the system can identify one runner, then the relevant data for that runner (including previous races) can be attached to that runner. Metadata in the system was handled through an "Intelligent Media Framework" (IMF). Its role in the production process was to accept and handle partial information about particular media items (derived through the application of the automatic and manual annotation), to add semantic information to the items and to infer and attach contextual knowledge to the items probably related to the staged event. It also provided knowledge services that offered controlled vocabularies related to

the current context of a stream, to guarantee the unambiguousness of the terms used.

The IMF also had an important role in the generation of the user experience of the multichannel viewing. It included a messaging system that enabled the real-time aspect of the staging process, by receiving triggers from internal and external metadata generators, which mainly include the metadata generation system (automatic annotators and the human annotator), as well as accessible external information systems (e.g. providing event and timing information of sport events). The IMF was responsible for aligning all these triggers to the already available knowledge of the event and to propagate the resulting messages by using the Action Message Queue to the other components of the LIVE production support system.

If you are interested in marathons, half-marathons may also be of interest to you. That was the basis for the recommender system built into the LIVE system, and which could determine from the user's choices and the metadata what media streams and events may be interesting next; in reality, the selection was primarily done from annotated audiovisual material from the television archives. The goal of the Content Recommender System in the production of the multi-channel television program was to provide automatic selection of suitable content from the pool of available live or archive content. The content selection procedure primarily focused on the selection of semantically annotated audiovisual materials from the television archives according to the preferences of the target audience. The receiver of the recommendations was not the end-users, however, but the director of the broadcast. By receiving content recommendations for each channel in the form of a list of audiovisual segments, he could review the material and decide if it was suitable to be included. The directing process meant that the director was able to instantly include recommended audiovisual segments. The result of this process is a television program composed of several channels. The resulting television streams were sent to the television viewers. The user could be guided through the event by a number of interactive television applications, which also managed the user feedback.

Multiple streams are hard enough to understand for an average user, but understanding when it is a good idea to switch between them is more difficult. When there are multiple channels, the channels, their content, and interrelations need to be defined simultaneously. This may mean different channels have different topics (e.g., you can choose the home or away team angle in a football game; or watch it from the point of view of the referee). In the LIVE system, this was referred to as the staging process, and it was used to assign a profile to each channel, which the recommender system could use to find a suitable set of recommended content. The actual composition of the channels, and the points where a user should be able to transition between them, was not automatically created. This role, often taken by the producer in traditional productions, was given to a "video conductor", who mostly resembles a video jockey, a disc jockey working with video. Whether that

can be automated, or whether it is a skill which requires human intervention, remains to be seen.

As with all EU projects, there is much more material available on the project website.

Me on TV: Five Minutes of Fame for Everyone with a Mobile Phone

Andy Warhol famously quipped that "in the future, everyone will have 15 minutes of fame". If fame is the same as being on television, he has already been proven right, and in spades. What he did not foresee was that you could make yourself famous, by putting your face on television.

So the experience is there. The question is: How do you go about designing in the user into an interactive television show? Dutch content producer Endemol (of *Big Brother* fame) made sure the viewer could participate in the *Big Brother* finals – by using his mobile phone to call into the television show, and then be seen on the television screen (superimposed on a green or blue-screen, a surface where a picture can be projected). This was "productified" by telecommunications company Ericsson, enabling "citizen journalism", where everyone with a mobile phone can be a reporter (or a paparazzi) – not just for photos, but also for video. See Figure 1-6.

Figure 1-6. The Ericsson Me on TV system. Reproduced by Permission of © 2008 Ericsson.

Getting an additional video stream from a 3G mobile phone is not high-tech today, and video telephony was built into the standards from the start. The problem is how to manage many users calling in at the same time, and how to display the phone call on the screen. There also has to be an application on the screen, which helps the user to create the content. For example, tagging of content by the user is also possible, even while recording, so the editor can know that something interesting is going on.

Using a mobile phone during a video call, the picture size becomes 176 xy 120 pixels, and is suitable to be used for a "Picture in Picture" display (the more advanced H.264 standard, essentially a mobile version of MPEG-4, is not yet available in phones). This means displaying the user on a green or blue prop surface in the studio (or splicing the picture directly into the video stream). The video stream from the mobile video gateway is no different from any other video stream. The user calls into a gateway, which forwards the call to a server, where it is tagged and managed; a management tool interfaces to that, and makes it possible for the producer to ensure that the right video stream gets on the screen at the right time.

When using "Me on TV" the user experience is no different from other programs – the only difference is that part of the content comes from other users. However, it comes through the mediation of the producer, who is still in charge of the user experience. It can be viewed on any television set, but to interact with the content, there needs to be some additional support in the home terminal.