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Peer-to-Peer Video File Sharing: What Can We Learn From Consumer Behavior?

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It is difficult to assess the adoption path for media technologies and services that are very new, as is the case with Peer-to-Peer video file sharing applications. Many critical elements will affect how the services grow. These elements include technology development, regulations, business investment, competition, advertising revenue, content models, and consumer appetite for the new services. Other chapters in this volume address many of these issues. Here, the emphasis will be on content models and consumer behavior.

A starting point in this assessment is current media behavior by consumers. What types of video files are consumers currently downloading and sharing? Are there overt needs that video file sharing meets? Are there latent demands that could grow into video file sharing or current behaviors that might be transferred to this new activity? For example, will large numbers of people who like to take cell phone photos and send them to friends, use the latest generation of cell phones to capture short video clips and share these files with friends? How many of those who have digital still cameras with video capability are using this new feature? Will the instant messaging craze among teenagers expand into video instant messaging? Are people who once recommended TV programs to co-workers at the water cooler ("Water Cooler TV") now passing along clips of favorite shows in email? In general, how much of video file sharing is new, disruptive behavior and how much a transfer of existing behaviors into the video file sharing realm?

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Beyond the questions associated with consumer behavior, what types of content do people want to share with others – clips from a child's Little League game, frivolous behavior of teenagers at a party, movies and TV programs, pornography, video blogs (Vlogs), webcams of a beach, or other content? Who is creating the content – amateurs, large media production groups, government, or education groups? There may be many surprises, for example, a summer camp that takes videos of campers and posts them on the Web for parents to share.[1] Why do ordinary consumers and other non-professionals create videos? Is it a lark, a component of social networking, a desire to become a professional video producer, or to gain status on a video-posting site by having enough viewers to achieve a level of prominence within the site? New technologies enable new forms of video file sharing, e.g., monitoring household security cameras from a cell phone while traveling or creating web-based television programs from amateur videos that consumers share with a producer, and these are being tested in the marketplace.

History also provides clues. For example, there has been much discussion about a new generation of videophones that allows the sharing of live video or video e-mails between people or groups.[2] The videophone has been introduced a number of times over the past four decades and has failed each time. A group-to-group version of the videophone, often called video teleconferencing, has achieved moderate usage.[3] However, those who have promoted each new generation of videophone have claimed that the problem in the past was poor video quality, the new technology has improved video resolution, and this will lead to broad acceptance. Research about videophones indicates that there are many other obstacles to wide acceptance such as a feeling of embarrassment in being seen.[4] Perhaps all of these obstacles will be overcome and a generation that grew up with instant messaging will embrace video messaging, but it would be foolhardy to ignore the lessons from the past.

In order for Peer-to-Peer video filing sharing to grow into a mass medium, consumers must have the tools and bandwidth to support it. How many households have broadband access to the Web (A majority of US households at the end of 2007, or, two-thirds of households with Web access, and projected to grow to more than 70 million by 2010)? Video file sharing is not limited to the PC, but also includes devices such as advanced cell phones, video MP3 players, and personal video recorders (PVRs). These devices are growing in penetration, for example, the PVR was in an estimated 22% of US households at the end of 2007 and is projected to grow to 33% by the end of 2010.

The core concept of Peer-to-Peer video file sharing is not clearly defined and many academics as well as industry groups disagree about the scope of activities it includes. Video file sharing overlaps with the more general category of Web video viewing. People can access video by downloading or streaming from a content producer's site such as CNN.com; download or stream from a content aggregator such as YouTube.com or social networking sites such as MySpace; receive videos attached to emails or instant messages; and use Peer-to-Peer networks such as BitTorrent to access videos. While the definition of Peer-to-Peer video should not be so wide as to include any form of video sent over the Web or other digital network,[5] it may be appropriate at this point to define it loosely. For example, there is likely to be much interaction, both positive and contentious, between the sharing of video files among people and the publishing or transmission of video content by traditional sources such as broadcasters and movie distributors. Similarly, institutions such as universities and government agencies are likely to be sources for video files that are shared among consumers. In this sense, video file sharing goes beyond consumer-to-consumer and includes business-to-consumer, business-to-business, entertainment companies-to-consumer, government-to-consumer, and institutions (e.g., universities)-to-consumer.

The Technology Context and Behavior Indicators

Peer-to-Peer video file sharing must grow in a context of transmission networks that support video (e.g., broadband Web access and advanced digital cell phone networks), access/storage devices that can accommodate video (e.g., PCs, DVDs, advanced cell phones, PVRs, and portable media devices), players or software that can download and display video (e.g., RealPlayer, iTunes and Windows Media Player), and, for some applications, technology that can capture or create video (e.g., digital camcorders, Webcams, digital cameras with video-capture capabilities, and PCs with video editing software).

In many ways, the context of equipment and networks to support video file sharing is strong. By the mid 2000s, a majority of US Web usage at home was from households with broadband Web access, and the penetration of broadband has continued to grow. There are also high penetration rates for digital camcorders, digital cameras, and DVD players. These technologies tend to cluster in the same set of households, i.e., broadband households have more digital camcorders, DVD players, and digital cameras than dial-up households.[6] Further, broadband households do much

more video downloads than dial-up households. Video player software is also ubiquitous on computers. DVD burners, PVRs, and cell phones with video capture or playing capabilities are in fewer households, but they too are growing in penetration. Similarly, cell phone networks in the USA are being upgraded and a number of companies have begun to offer video services for cell phones.

If much of the enabling technology and transmission networks for video file sharing is in place, what about consumer behavior? Are people using these technologies to access and watch video? Video streaming has grown sharply over the past few years, rising more than tenfold between 2000 and 2006. Many of these sites receive very high volume of usage – some download hundreds of millions of videos per month.[7] The types of video content consumers are accessing through video streaming include short clips (the average viewing time is 2 min per clip): music videos, sports highlights, and news stories. Some longer form video streams have increased in usage, e.g., downloading of TV shows. There is little evidence so far that many consumers are directly sharing large video files that they created (e.g., emailing them to family members), such as highlights from a vacation. The capability to share very brief video files taken with advanced cell phones has increased. However, most sharing of amateur-produced video is passed along through postings on file sharing sites such as YouTube or social networking sites such as MySpace and then telling friends where they can access the videos. There is also much sharing of "hot" video clips and uploading of video clips to news sites when there is a disaster. The former included a *Saturday Night Live* clip of Ashley Simpson caught lip synching and a clip of Jon Stewart clashing with the host of CNN's *Crossfire* on *The Daily Show*.[8] These were transmitted as attachments to email or links within email by millions of people. Examples of the latter included thousands of postings to news sites by people who shot video clips of the tsunami in the Indian Ocean and the London underground bombings. All forms of postings and retrievals help increase the number of people with the skill set to create, transmit, find, and view Peer-to-Peer video.

There are indicators of a potential latent demand for video file sharing based on some current activities. For example, many consumers share music files, send photos to others, refer friends to Web sites with cartoons or photos, and lend tapes or DVDs of movies and TV programs to friends. Does this indicate a latent demand to share camcorder tapes of family events, cell phone videos of a party, music videos, television programs, and movies? Probably yes, but the scope and size of these forms of video file sharing are difficult to estimate. It is important to examine some of this behavior more closely. For many consumers, it is relatively easy to take some digital photos, select a few of the best shots, and send them to

someone else. It requires much more work to edit a videotape and send a video file of the edited version to a friend or family member. Downloading songs, compiling a song list, and sharing the file with others requires a modest amount of work. However, music listening is highly repetitive, justifying the work involved. Will the same work-to-reward ratio hold for music videos that may not be viewed as repetitively? In the case of television programs and movies, there is a high value in being able to share the video files with others. What is unclear, however, is the work, cost, and risk (in the case of pirating copyrighted work) involved. In some cases, such as using Tivo to capture, store, and share a television program, it appears that the work, cost, and risk is low.[9] In other cases, such as burning a DVD of a television program on the first generation of DVD burners then transmitting it over the Web, the work, cost, and risk were high. As the cost of DVD burners decreased and the user interface improved, the attractiveness increased.

Early Adopters: A Younger Generation

It is typical for the first group of users for a new technology or service to be different from later groups when adoption of the technology has spread widely.[10] In the past, early adopters of new electronic technologies have typically been males in their late 30s to early 50s, with high income. However, with broadband Web services, early adopters of many applications have been younger, more diverse in terms of gender and with a greater range of household income.[11] This has been the case for Peer-to-Peer video file sharing as well. The author conducted a study of the media habits of a core component of these early adopters – those between 18 and 34.[12] What are their media usage habits and how does Peer-to-Peer video file sharing fit into their existing habits?

In trying to understand the media usage patterns of this group and their interest in video file sharing, the place to start is not technology but lifestyle – where and how they live, and the ways lifestyle affects media usage. First, they have very hectic and irregular schedules. Much of their media use moves later into the evening and their apartments are crammed with media options: multiple TVs, PCs, cell phones, videogame consoles, and MP3 players. In order to reach them, media have to fit flexibly into their irregular schedules because they may not be available when regularly scheduled media are playing. Peer-to-Peer video file sharing is an effective way to do this since it is predominantly unscheduled – a user can access a file at any time.

Second, the settings where most 18- to 34-year-olds live, work, or attend school are different from the images we have of average American households, offices, or colleges. By virtue of their age, most are just starting out in life, so they typically have smaller office and household spaces. Yet, they are generally well equipped with media. Further, many 18- to 34-year-olds use media in public locations such as a gym, sports bar, or coffee shop. A number of these locations are well equipped with media and young people often bring their own media to these locations. In addition, it is very common for people in this demographic group to carry media such as a cell phone or an MP3 player with them wherever they go. This generation has come to expect pervasive access to media and demand portability. So, access to video files is not an obstacle for this group. These experiences in turn shape attitudes about media and have led to some important changes. For example, many young people in the author's research indicated that they have easier access to the Web than to a newspaper, reversing earlier notions that newspapers are portable while computers are a burden to lug around.

The college environment has changed significantly compared to a decade ago. Access to the Web, through wired and wireless broadband networks is pervasive – by one measure, more than 80% of college students have broadband access to the Web.[13] Students can access the Web in drop-in labs scattered around campuses, library carrels, hallways outside of classes that are equipped with rows of computers, lounge areas near dining halls, and ubiquitously throughout dorms. In addition, some campuses have wireless wide area networks so students can access the Web virtually anywhere on campus via a laptop computer. A more subtle change is the use of better speakers on most computers compared to a few years ago. This relates to the growing use of computers for entertainment and video is a significant part of their entertainment experience on the Web.

Equally startling to an observer who attended college 10 or more years ago, cell phones are everywhere. As students exit a class, it is common for half of them to go on their cell phone; some professors schedule cell phone breaks during long class sessions to keep students happy. The cell phone as well as MP3 players/iPods further strengthen the core expectation of this young generation for portable access to media. In addition, this group replaces their cell phones frequently and wants the latest generation of the technology, which now includes access to video.

At the same time, the core functions of Web video are not very different from the core functions of television: escape, entertainment, and information. They watch Web video to escape from everyday tedium and enter a fantasy world that is fun and offbeat, or for simple entertainment such as music videos and TV programs. In addition, Web videos keep them informed about the world around them through news, weather, and sports.

The Web is perceived by this group as convenient, customizable to personal interests, and giving people control over content. One young woman said, "It gives me what I want, when I want it." MP3 players are characterized by their portability, depth, and control. Cell phones are characterized by their portability, instant communications, and lifeline to a person's network of family and friends. In addition, many are using added features of cell phones and perceive it as a multi-application device. All of these attitudes influence their expectations for Peer-to-Peer video file sharing.

What matters a great deal in the current media environment for 18- to 34-year-olds are their schedules and place in life, and the ways these interact with the media that are available to them. Media that are relatively schedule-free fit more easily into the irregular schedules of many 18- to 34-year-olds and the narrow slices of time available to others. Downloaded and streamed video files fit flexibly into the lifestyles of 18- to 34-year-olds – they can access desired content at any time.

College students in particular have been among the earliest adopters of video file sharing. Gali Einav conducted a study of the file sharing habits and attitudes among college students.[14] She found that nearly all of the students did some form of file sharing. Further, video file sharing was very common in dorm settings. Students did file sharing for reasons of convenience, control, and immediacy. They also used file sharing to check out new content before buying it – a form of sampling. Very few were concerned about copyright issues.

Who are the early producers of Peer-to-Peer video files? Reviewing the current scene of Web videos that are created by people outside established media companies shows that they include video bloggers, underground filmmakers, political activists, and amateur videographers. Much of this content is satirical or self indulgent, for example, political satire, funny pet videos, and karaoke-style musical performances. These appeal to the tastes and sensibilities of a younger audience.

There are two others groups who create and share video files over the Web with consumers. One group is businesses that create and share promotional content as well as many forms of consumer information as video files, e.g., a video tour of a hotel resort or a video about how to build a patio. Businesses also create video training materials for employees and share these across the Web to sites in multiple locations. The second group is institutions such as universities that create and share video courseware, distance learning materials, and video newsletters, e.g., a video of a college lecture or a video of the groundbreaking ceremony for a new building on campus. Much of this content falls below the radar of media analysts because it lacks the star power or broad appeal of entertainment content.

Clues from the International Scene

The USA does not lead in many areas that are crucial to the development of Peer-to-Peer video file sharing. Finland, Norway, and Japan have higher ratios of broadband to narrowband Web users; Korea leads the USA in penetration of advanced cell phones[15]; and the UK is more advanced in the development of interactive television applications that could be adapted for broadband Web file sharing.[16]

Are there lessons to be learned from these countries about applications that are likely to take hold in the USA? Certainly, some applications have migrated from foreign shores to the USA in the past. Text messaging migrated from Europe and Asia to the USA. Cell phone photos migrated from Japan to the USA. It is important to monitor video file sharing activities outside the USA. However, this analysis requires at least two filters. The first is cultural. Different cultures may adopt or reject a technology, or differ in how they use it, based on how they perceive privacy, personal space, individual expression, and other values. For example, in Japan it is common for teenagers to decorate their cell phones with tassels, stickers, and other symbolic objects, treating them as an icon of personal expression and displaying them prominently for others to see.[17] There is no equivalent in the USA, although specialized ringer tones add some degree of personalization to cell phones and have been very popular.

In the case of shared video files, the question is how they might serve as an expression of values for different groups within each country? Do people place a value on the number of files they have accumulated (as in the case of music files), securing taboo content such as pornography, or sharing pirated content because it is illegal? A second filter is the existing infrastructure in each country. There are many differences between the USA and Europe in attitudes about new media based on the history of earlier technology deployments, e.g., interactive television services have developed more quickly in the UK than in the USA in part because they had a lower installed base of PCs and broadband Web, making the television a natural host for interactive video services. In the USA, these services are spread across a wider range of technologies. In the case of Peer-to-Peer video file sharing, there are many technologies that can act as a host for the video files, but the deployment of these technologies varies widely, e.g., in the USA there is very high penetration of PCs but a relatively low penetration of PVRs.

It is also likely that video file sharing will cross national boundaries. The USA is a major exporter of television programs and movies. These transactions are controlled by contract and regulations, although piracy is a significant problem, e.g., pirated DVDs of movies. Video file sharing via

the Web adds new opportunities, complexity, uncertainties, and greater risk of piracy. On the one hand, countries with higher penetration of broadband such as Japan and Korea provide millions of potential consumers of US video content. On the other hand, copyright laws differ from country to country. The Web crosses national boundaries with impunity and makes copyright law difficult to enforce. Much Peer-to-Peer video file sharing is pirated content from international sources such as China.[18] Attitudes about piracy also differ internationally. Jonathan Marks' research indicates that in some countries where people pay a license fee for television, many young people feel they have a right to download any content from file sharing sites since they have already "paid" for it.[19]

The Importance of Mobile Access to Media

One important value that is affecting the development of Peer-to-Peer video file sharing is mobile access to media. Over the past decade, we have become accustomed to accessing a number of media in mobile settings. These include cell phones, laptop computers, TVs in airports, building lobbies, and sports stadiums, WiFi hotspots and cybercafes, portable DVD players (including rental units at airports), MP3 players, and two-way pagers. More recently, the list of mobile media has expanded to include satellite radio and entertainment centers for cars, and a new generation of portable media players. Further, many new services have emerged to serve these mobile media technologies, e.g., TV programs, video blogs, and even pornographic movies for cell phones.[20] It is unclear which of these new services for cell phones will succeed. Early research suggests slow growth and a number of obstacles such as a need for longer-lasting batteries that do not drain quickly when used for video.[21]

It is important to ask how this reliance on portable media and expectation for media access just about anywhere will condition demand for Peer-to-Peer video file sharing? One piece of the equation is the presence of so many mobile technologies that could be used to access, store, or display video files. Another piece is how these technologies have conditioned the habits and appetites of those who are saturated with mobile media content and services, for example, an appetite for using a laptop computer as an entertainment device and expecting access to entertainment just about anywhere. The context of media access may, in turn, affect what types of content are consumed in these settings just as the television content consumed by one person in a kitchen setting often differs from the type of content consumed by a family group in a living room setting.

There are many issues associated with style of use. First, what is the role of these video sessions in everyday life? In general terms, they are for entertainment and information. However, a closer examination of usage suggests that many sessions are to kill time, take a break from work, check out the latest sporting news or music video, or simply a habit that has started to develop. It is also a conversation starter, as in the case of students who show sports clips from a video cell phone to buddies at school as a way to start a conversation about sports.

Some people use mobile video device as an alternative to Tivo or a DVR. That is, they use it to time shift their viewing of a favorite program because they were not available to watch it at its scheduled time. Just as ease of recording is very important to Tivo use, convenience and ease of downloading is very important to those who use a mobile video device for time-shift viewing. Perceived control is another important attribute of mobile video. In the author's research, people have indicated that they feel more in control of what they are watching on their mobile video device compared to regular TV. Part of this perception is freedom from the TV schedule. Another element is the perception that video files from the Web are uncensored and there is a wide variety of content.

The overall design and screen size for mobile media devices have a strong impact on content that users will download. In the case of video cell phones, the small screen size limits the length of time people are willing to watch content – it leads to eye strain. For this reason, most content is short clips, including some original TV series with 60-second episodes. The screen size also makes it difficult for users to find content. Often, they must navigate through many layers of menus to find specific choices.

The Role of Interactivity and Mashups

In trying to assess the value of interactivity in Peer-to-Peer video file sharing, it is useful to begin by examining the ways in which people currently interact with media and interact with each other through media. There is much more interactivity in our media environment than appears at first glance. The Web is inherently an interactive medium. This includes person to person interactivity in the form of e-mail and instant messaging (IM) and the interactivity that takes place in navigating across and within Web sites. Cell phone conversations, text messaging, and videogames are also highly interactive. Sharing music files involves some interactivity through the process of sending and receiving the files, but the music content is not generally interactive.

Most video file sharing has the same low level of interactivity as music file sharing. However, this could change, depending on the actions of content producers and consumers. In the UK, the BBC set up a "Creative Archive" that gives Web users access to video files and encourages them to re-mix or otherwise interact with the content to enhance and customize it.[22] The term "mashup" has been coined to describe this type of content editing. In Europe, interactivity has been built into a number of programs and these could serve as models for interactive Peer-to-Peer video, e.g., *9Live*, a German call-in quiz show that generates millions of calls at 49 Euro cents per call.[23] This form of interaction has migrated to the USA in shows such as *Deal or No Deal*.[24] There has been some experimentation in bringing interactivity into American television, e.g., by MTV and Fox Sports,[25] but overall interest in European style interactivity has been modest. Many American distributors of programming perceive video-on-demand as a form of interactive television. This has been a common model for video distribution on the Web and advanced cell phones. However, this may change over time as a generation that is comfortable with file sharing and interacting with technology begins to control more of household spending.

Content Models

Starting from the perspective of current and past consumer behavior, it is possible to create models for Peer-to-Peer video content sharing. Notice in the examples below that most do not involve direct consumer to consumer file sharing. Often, there is a media organization that enables the file sharing, whether for a consumer-created video or content created by professionals.

Live Video Interactions

Videophone calls between people, as a form of video file sharing, appear to face long odds given the past history of videophones. However, there may be new versions of videophone calls that will be adopted. For example, instant messaging (IM) that has become so popular with younger audiences could evolve into video IMs. Similarly, some e-mails may evolve into video-mail. This form of video file exchange in non-real time may help to overcome the concerns of people in the past that they might get a videophone call while they were not dressed or otherwise didn't want to be seen.[26] Further, the Web can provide a cheaper alternative to business videoconferencing that is currently used by many companies.

Home Videos

Sharing home videos with friends and relatives faces a few hurdles. Digital camcorders have been widely adopted. However, it is not clear how many people edit their home videos. Photos are inherently easy to edit: a person selects from the photos he shot and sends them to a friend or relative. However, editing video footage is time consuming and requires special software. Sending an hour of unedited footage of a vacation or Little League game requires a lot of bandwidth and may lack appeal. This could change if new software emerges that makes it very easy to edit video footage or pull out a clip from a longer tape and send it as an email attachment. The current generation of cell phones and digital still cameras includes many models with a capability to shoot brief video clips and email them to friends. These models, typically with no editing capability, are popular with teens who readily adopted still photo emailing. Many of the postings to sites such as YouTube are short videos from these sources.

Niche Services to Build Awareness and Appetite

There are many services that have demonstrated modest (or, in some cases, wide) appeal but which collectively can build awareness and interest in video file sharing. These include short underground films, video blogs, and video promotions/press releases. Since these applications are promotional for the producer, it is less likely that there will be restrictions placed on the sharing of content among consumers. Some of these applications have become fads and generate "buzz" among peer groups. This could lead to broader interests in video file sharing. For example, in 2006 movie trailers and clips for *Snakes on a Plane* were released well before the movie. Fans did mashups of scenes, mixing actual footage from the movie with their own videos and distributed these widely on video blogs and file sharing sites. One person created a mashup that caught the attention of the producers and they shot a new scene for the movie based on it. This generated further publicity. This type of fad helped the movie in this case, but it can be hard to replicate.

Institution or Business-to-Consumer

There are many applications of video file sharing that have received relatively little attention but which build on existing services and needs. Many of these involve institutions such as universities or business services. These include distance learning, tapes of classroom lectures, video

newsletters, guest speakers at universities, and business training tapes. These can be downloaded from an institution, then shared among people with no, few, or strong restrictions. In addition, security companies can distribute tapes of homes or businesses to appropriate parties who wish to monitor them. These can be powerful forces that introduce the concept of video file sharing to broad audiences who may then adopt other applications in the home. In the past, many technologies such as computers and cell phones were first adopted in business or education, and then moved into households.

Pornography

Adult content has been a part of the launch for many new technologies and services, from videocassettes to paid Web content, and it is a significant component in Peer-to-Peer video file sharing. It is often a greater share of content overall during the initial stages of a new technology introduction. Over time, the share of adult material diminishes as more mainstream entertainment applications grow. In the early stages of Peer-to-Peer video file sharing, x-rated movies, amateur adult content, and pornography for cell phones are readily available.[27]

Mass Entertainment

A conservative perspective on the demand for Peer-to-Peer shared content suggests that over time people will want to share the same content they currently watch at great length – movies and television programs – and those amateur videos will have a relatively small role in file sharing. Some will disagree with this. With mass entertainment, there is uncertainty about the principal way in which the content will be distributed over time. Will it be part of a store-and-forward service such as Tivo, video downloads from traditional distributors, or through (legal or illegal) video file sharing services? Other chapters in this volume address the many technical and copyright issues associated with file sharing of mass entertainment content.

In the first few years of video file sharing, much of the mass entertainment video that was offered consisted of movie trailers and promotions for TV shows. Many branded video producers such as TV networks and movie studios actively encouraged viewers of a clip to email a friend and include a link to the clip. More recently, some full length movies and many TV programs became available. Traditional video producers also serve as a re-distributor of some amateur video content, much as they have packaged

some amateur content in programs about silly pet tricks or funny home videos. News programs re-distribute amateur videos by inviting people to email videos shot at the scenes of disasters and other breaking news events.

Generally, the mass entertainment industry for video content has accepted the Web as a distribution and file sharing medium in ways that the music industry resisted for years. However, the business plans for video content, for example, free with advertising or paid content as well as digital rights management models, are still evolving.

Creative Surprises

Whenever new services are launched, the opportunity emerges for new forms of content to be created. One interesting and highly creative form of video on the Web is long form commercials-on-demand such as those created by American Express and BMW. Peer-to-Peer video file sharing may encourage the creation of other new content forms that cannot be predicted but which emerge as creative people get their hands on the technology. One example is "machinima," a mixture of video gaming and cinema. Many video games such as Quake allow users to capture and edit a section of game play, then share the file with friends. They are a form of underground film and have developed a modest, cult-like following. There is an annual film festival for machinima and a Web site (Machinima.com) that serves as a portal to game-based films.[28]

Short form advertising is another wild card. As video commercials evolve on the Web, will they be the same type and length as appearing on television or will new, more entertaining commercials emerge to keep the Web user engaged? Will viewers who now tell friends about funny or interesting television commercials they have seen, send a file of the commercial to friends in Web environment? Some Web advertising has encouraged this practice.

As video files have proliferated on the Web, video search engines have followed. These include major search engines such as Google and Yahoo, which have developed a separate search engine for videos as well as smaller, independent groups, and search capabilities on video file sharing sites such as YouTube. As video files proliferate, search engines will be challenged to sort through millions of videos to return what users are seeking.

Obstacles

There are several potential obstacles to the mass adoption of Peer-to-Peer video file sharing. The first is price: what price are consumers willing to pay for content that they can share with others; and, what price will video distributors charge? A combination of "Web think" (i.e., "we don't pay for content on the Web") and unrealistic pricing by video distributors could slow adoption. At a practical level, will pay-per-view or a subscription model or free with advertising be more attractive to consumers? A second issue is complexity – will consumers be able to download and share video files without taking a 10-week course about how to do it. The devices for sharing files vary enormously in ease of use. Some, e.g., Tivo, iTunes and the current generation of video players for PCs, have received reasonably high marks for usability while others, e.g., the first generation of DVD burners, were panned by reviewers. Related to this is interoperability – will files move across devices transparently or will proprietary hardware and software restrict where video files can be stored and how they can be accessed? Many portable video players have followed the model of music players and made it difficult to download files from many sources. Legitimate concerns about piracy by copyright holders could also lead to draconian protection mechanisms that discourage people from using services at all. In this sense, will the Motion Picture Association of America (MPAA) follow in the footsteps of its counterpoint in the music industry, the Recording Industry Association of America (RIAA), which has sued thousands of individuals who engaged in music file sharing? There is some reason for optimism that video piracy will not be as harmful to copyright owners as music piracy. First, it is more complicated and time consuming to download long-form video compared to audio. Second, in the author's research with 18- to 34-year-olds, many indicated a fear that Peer-to-Peer file sharing sites with pirated content were often a source of viruses and were avoided for this reason.

The quality of video over broadband networks is also an issue. While video quality over the Web has improved significantly over the past couple of years, there is a great deal of variability in the quality of video experienced by consumers. This relates to a few factors including the speed of connection, the method of accessing video (e.g., streaming versus downloading), and the technical configurations of host servers. None of this is obvious to an average consumer who simply wants good video, just

like TV. The quality of the user experience will also be affected by the length of time to download a file. This can vary enormously, depending on the size of the file and how the file is sent, from a few seconds to many hours. Badly produced videos are common on the Web, especially those produced by amateurs. The occasional gems that attract enormous publicity and usage are buried in a sea of boring and inane video content. Users need ways to sort the wheat from the chaff.

In the mobile video arena, obstacles include batteries that drain quickly when used for video, small screen size, poorly designed menus, and glare in some outdoor settings. Laptop computers are the most robust for storing and watching videos but they are heavy compared to other players. MP3 players with video capability and portable media players are a reasonable compromise. Cell phones are the most challenging in terms of screen size and menus. Further, if a cell phone battery drains, a person loses his connection to the world, not just music playback as with MP3 players.

Discussion

The development of Peer-to-Peer video file sharing will continue to evolve over time. It is important to distinguish applications and service features that have been adopted early in the process from applications and feature that will take time to develop. In the near term, it is likely that most shared video files (for PCs) will be shorter and work effectively in media player windows that are less than full screen. So, movie trailers and promotions for TV programs are easier to implement than full-length movies and TV programs. Many video applications for cell phones are rough approximations of where the technology is likely to be in a few years. Tivo-based shared networks support high quality video files. Over time, each of these video file sharing networks will support better quality and longer form video. In addition, there are currently many different content providers, from video bloggers and underground filmmakers to major entertainment groups. If history is a guide, a number of these early groups will fade away over time and mass entertainment will dominate in the longer time frame.

A core issue is whether the early users, applications, and devices will build towards a critical mass in which a large group of consumers develop an appetite for video file sharing that can spread with its own momentum and lead to a greater range of users and applications. Rogers has demonstrated that this pattern has occurred frequently with other innovations that were subsequently adopted by the mass market.[29]

The concept of Peer-to-Peer video file sharing also raises the question: which groups are targets for these services? There are many natural groupings based upon particular services, e.g., sports fans, movie buffs, alumni of a college, and business colleagues. These are likely to be younger people in the near term. The use of the Web as a network for file sharing suggests that the reach of Peer-to-Peer file sharing will span great distances. However, we should not ignore Peer-to-Peer file sharing within households or a neighborhood. Currently, much videotaping of television shows is by one household member for another person in the same household or friends at school.

There are many other uncertainties surrounding Peer-to-Peer video file sharing. One is whether many Web services will add video over time and if a mass audience of consumers will embrace video on the Web? Personal computer applications evolved from spreadsheets to word processing to email to entertainment. Will people who collect and share music files want to do the same thing with music video; will the millions of people who share photos over the Web share home videos? The actions of major video copyright owners are also uncertain. Will they embrace or fight video file sharing? Will major networks adopt the BBC model (i.e., the Creative Archive) and put some content into the public sphere, encouraging people to edit or alter it? Further, will they re-edit existing content (or create new content) and create video files of different lengths and with new forms of advertising, as American Express and BMW have? Will more media organizations encourage the public to send them video files and use them to create programming, either in the tradition of funniest home videos, news, or interactive programming?

In order for a mass audience of consumers to have a positive experience with Peer-to-Peer video file sharing, a number of pieces have to come together: continued expansion of broadband into homes; improved compression techniques to enhance video quality; interoperability among devices to access, store, and display video files; broadly accepted, safe, and secure intermediaries (i.e., player software and re-distributors) for video files; the availability of high quality content and special interest video; acceptable pricing; and well-designed user interfaces for hardware and software. Bringing video files into mobile environments is also likely to boost consumer appeal.

Video file sharing has been enhanced by the same types of support services that have made Web text browsing more appealing, i.e., video portals, search engines, and video content aggregators. A number of these have already been created, e.g., MSN and AOL have created video portals and a number of video content aggregators serve as an intermediary between consumers of various types of videos such as sports, news,

independent films, and amateur videos. Some of these have evolved from photo post-and-share sites to video post-and-share. Further, a number of video search engines have emerged, including major search organizations such as Google and Yahoo, along with smaller, niche video search sites.

Does video Peer-to-Peer video file sharing pose a threat to major brands of video such as TV networks or movie studios? Putting aside the issue of pirating branded content, it does not appear that file sharing poses a threat to major brands. On the contrary, much of the content that is downloaded is from branded sites and viewing files from branded content providers appears to boost interest in the movies and TV shows from which they were excerpted.[30] Branded content providers also serve as enablers in the sharing of amateur content and search engines for video files.

Peer-to-Peer video file sharing is a fast moving target. A few years ago, it was barely on the radar and consumer experience of video, e.g., with dial-up networks, was poor. Today, it is in the marketplace and many consumers are actively sharing video files. If the pieces come together and no major obstacles slow it down, the novelty of video file sharing will likely become a core habit and Peer-to-Peer video will become a mass medium.[31]

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