Digital Rights Management: Challenges and Issues in the Emerging Mobile Entertainment Ecosystem

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Cellular Telecommunications & Internet Association (CTIA)

CTIA'S WORLD OF WIRELESS COMMUNICATIONS

Prepared by:

Dr. Elizabeth Fife, Prof. Francis Pereira and Prof. Chris S. Langdon

CTM   USC

Center for Telecom Management
Marshall School of Business
University of Southern California
Los Angeles, CA

Objective and Scope

CTM is compiling an initial overview of important issues for developing a healthy Mobile Entertainment market with a focus on the Digital Rights Management (DRM) situation. One purpose of this paper is to serve as a basis for focused interaction between the different stakeholders who must create attractive mobile entertainment products and services.

From February 6 to March 15 researchers from CTM and the USC Marshall School of Business conducted interviews and performed analysis, the results of which are presented in this document draft. Due to a limited to a limited time frame, this draft can only be considered an initial step. The paper should be considered only as a very preliminary draft to a more comprehensive and complete White Paper.

Approach

This paper presents our exploratory analysis of the emerging mobile entertainment ecosystem. We collected data primarily through interviews with business executives of the companies involved in this effort. We have provided a synopsis of each of the key issues and challenges as described by the industry experts, to highlight similarities as well as differences in points of view. We have also included some industry experts' comments on the issues to provide a flavor of the nuances, differences or similarities in thoughts on these issues. These have been kept anonymous so as to differentiate an individual expert's view as opposed to a corporate position. Each section also contains an analysis segment that attempts to frame these issues in a broader historical or conceptual framework. A total of thirteen interviews have been conducted; 10 transcripts have already been prepared and analyzed.

Executive Overview

Although the issues relating to DRM are complex, and there have been differing points of view on appropriate revenue models, role of standards, and best practices just to name a few issues, the industry executives tended agree on the following key issues:

- Ease of use for the consumer in downloading and paying for content is critical. Service operators are in a unique position in this respect. The ideal DRM solution is one where the user will not even know that it is present. This is balanced against what content owners want which is protection of their intellectual property.

- Unlike the Internet, consumers in the mobile culture expect to pay for access and an incremental cost for downloadable content. And any service model and revenue model must be different from that of the Internet.

- Since the virtual pipe runs from the content creator to the end user, it is in the interest of everyone in the value chain to ensure, respect and implement the proper technologies in place to keep that and the content secure.

- Primary leadership responsibility on DRM should fall on the device manufacturers and operators and, to a lesser extent, content providers.

Other issues of interest include:

- Consumers should be "educated" about the types of the technologies offered, and more importantly be made aware of the legal issues regarding content distribution and best way to use the content.

- Technology alone will not offer a complete solution to protecting intellectual property right. Instead a combination of technology coupled with enforcement, and the willingness of consumers to abide by appropriate laws will be necessary. This is made more challenging in a global environment. Ultimately DRM is a "business rules" and a "business practice" issue.

- There are differing points of view on the issue of interoperability. Some industry executives point to interoperability as a requirement to create new business models, such as "Super-distribution" and view it as a requirement for consumer convenience and thus a precondition for successful in the consumer markets. Others, conversely, see it as an unnecessary complication that at least initially risks compromising copyright protection, which limits content supply and, therefore, hurts the attractiveness of mobile entertainment service offerings.

- Several challenges exist ahead to multimedia communications because of device recognition limitation - the lack of ability for devices to know what the respected capabilities are. Thus when content is created, it has to be tailored to each device, make and model. The

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1. Introduction

The upgrade of the digital wireless infrastructure from narrowband to broadband is a recent phenomenon that has raised new issues as it becomes possible for consumers to access and share downloadable content.   Critical issues, fissures and challenges are surfacing in the value chain, as distribution modes for music and other kinds of digital content are changing due to technology. The mobile industry has an opportunity for open discussion and consideration of the various possibilities that exist for protecting content.

2. Market Overview and Situational Analysis

2.1 The State of the Market

Experts' Comments

- ψ "The content market is just starting right now on mobile devices."

- ψ "We have been involved with downloadable content since […] 2002. […]. We started with games, ring tones and images."

- ψ "I wouldn't say that there's much difference [b/w the U.S. mobile market and the Korean market], They are just ahead."

- ψ " we know that in the long run, 3G is really the way to go which is the open standard. This is the format that we're promoting….. [but] I understand a lot of people are probably trying to push closed standards.. and turn that into effective standard."

- ψ "[…] [in Korea and Japan] standard handsets hold about 64 Mbyte [of RAM], and they are moving up to 256 [Mbyte of RAM}. […] What's important is that handset memory is going to go up [in the U.S.], and handset power is going to go up. This is going to enable richer types of content that will be downloaded to the handset."

Synopsis

The market is growing extremely fast for downloadable content. For certain content types its growing by 20 to 100% a month. In the wireless sector, operators have a very close relationship with their users. Hence the users in this market are not as anonymous as the users in the wired internet domain are to the Internet providers. This is very evident as the wired internet provider started from a very different place in terms of business proposition and as a result the motto in the wired internet is very different. Consumers get content on the internet for free but there is a different culture when it comes to phone costs and phone bills. People are ready to spend on their phones.

The content industry is projected to be a billion dollar industry. Correct steps need to be taken to ensure each player in the value chain receives a fair share.

However, some of the areas where improvement is required include:

1) Billing : There is a need to have a uniform billing system. One suggestion is to have a uniform short code across all carriers that anyone at their handset supports text messaging with almost every handset out there and can order at least some kind of content.

2) Customer Awareness : Consumers need to be aware of the technologies offered, and should also be aware of the legal issues regarding content distribution and best way to use the content.

3) Capable Handsets : There is definitely a need for handsets that are capable of downloading premium content.

Overall, the industry views the mobile content market as in its initial stages in the U.S. Certain kinds of content like ringtones and games and graphics to some extent have seen movement. There isn't yet a great deal of activity in information services, however it is thought that this market will grow.

Device recognition limitations are one challenge for example, which make it difficult for the consumer to get content. Thus, in the short term, there will be more phones getting content from the web than from phone to phone.

Analysis
Wireless Carriers & Handset Makers: Creating the Foundation
Mobile carriers have upgraded their networks from narrowband 9.8 KBps bandwidth to higher speed networks (for example, Sprint is offering "fast data speeds averaging 50-70 KBps, with peak speeds of 144 KBps" www.sprint.com/pcsbusiness/promotions/unlimited_data.html; 3/9/04). Increased bandwidth creates an opportunity to enhance old services (Web access) and add new ones (TV programming). The capital expenditure of the network build-up requires mobile carriers to benefit from this opportunity.
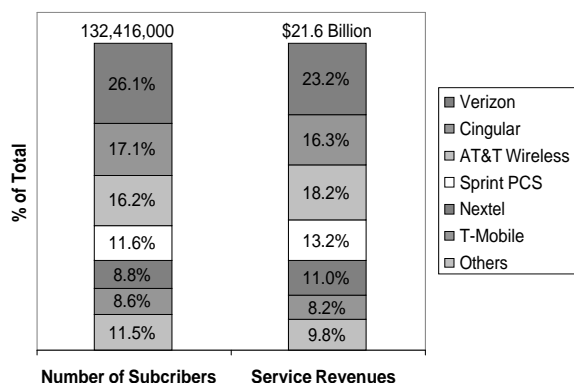
Figure 1: Market Size and Share Distribution, Wireless Communications, U.S., End of Q2 2003
(Standard & Poor's, November 13, 2003, 7)
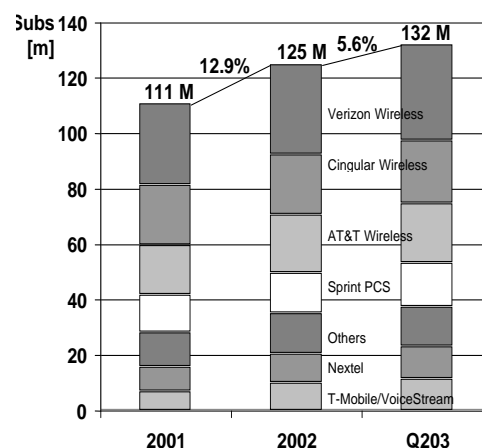
Figure 2: Market Growth, Wireless Communications, U.S., 2001 - End of Q2 2003
(Standard & Poor's, November 13, 2003, 8)

"Desperately Seeking Content"

In order to fully exploit the new network capabilities carriers would like to team with Content industries (see Figure 3 for popularity of multimedia services).
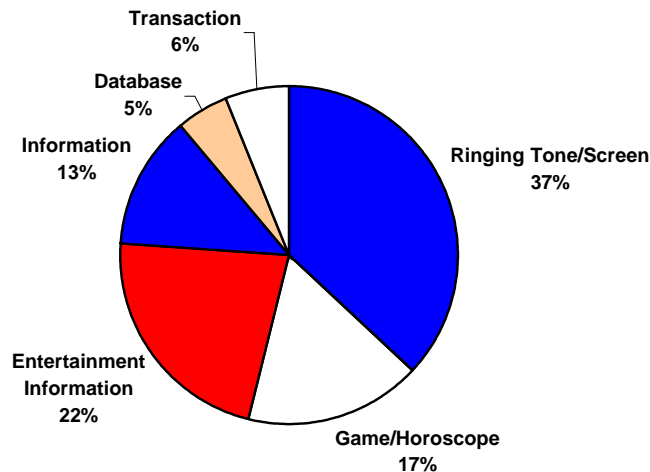
Figure 3: Access by Content Category for NTT's DoCoMo Wireless Service, Japan, December 31, 2003

NTT's DoCoMo provides some indication for the potential of the wireless content market. The Japanese mobile service provider has signed up 89% of its 45 million subscribers to its i-mode service, which delivers a wide range of content offerings to the handset. However, content companies have traditionally been either hesitant to embrace new technology or outright hostile to adapt their content offerings to new delivery capabilities (e.g., radio transmission, terrestrial television, tape recorders). If it has proven complicated to align the interests of communications and content it could even be more challenging to develop a healthy wireless broadband future, because of the entry of companies from computing, an industry that is known for cut-throat price competition and frequent "winner-takes-all" standardization battles.

Computing: A Less Than Universally Welcomed Partner?

The move to add new services has quietly triggered a development that favors entry of another sector, the computing industry. Computing is in a good position to grab market and profit share because many promising new mobile services already exist in toady's wire line world and are controlled by computer companies. Email, one of the Internet's killer applications is a good example. Therefore, any broadband wireless future will emerge as a result of interaction between Wireless Communications (which includes service operators and equipment vendors), Content

(creators like studios and packaging operations such as channels) and Computing (includes hardware and software vendors—OS, languages, middleware, applications) (see Figure 4).
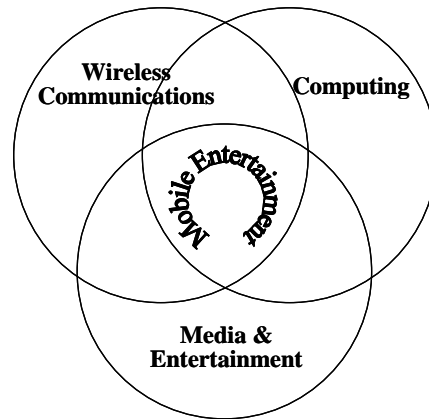
Figure 4: Mobile Entertainment at the Intersection of Wireless Communications, Content and Computing

While wireless carriers have led the evolution of the emerging mobile entertainment business, however our interviewees indicate that software and hardware companies are entering the value chain.

2.2 The Value Chain

Experts' Comments

- ψ "[…] no one knows the entire value chain."
- ψ "The value chain is pretty complex actually."
- ψ "So I guess there are about five to six steps to the value chain."
- ψ "I think that there is sort of a triad of people that have to cooperate and that's the device manufacturers, the operators and the content providers."
- ψ "the market has been fragmented and open… it has been left to the carriers and device manufacturers to develop the eco-system… and they are not good at consumer services.. or deploying consumer services… their interests are not always aligned with consumers… and we get technologies in the market that don't make any sense."
- ψ "I talked about composers, artists, artists groups, music publishing houses […]".
- ψ "You have people that aggregate this music […]. […] they want to pull together a set of games, videos, and other things and build their own kind of MTVish brand in a sense, and then go to carriers and say 'here's a channel you can turn on'".
- ψ "there are three phases [in the value chain] ….the third phase is one that we haven't seen yet but we're starting to hear more about, …. Where people to sit at home and

create content, of things that are important to them, from their computers and then uploading that to the networks and distributing it to the phones."

Synopsi **s**

For this industry to be successful all members of the value chain need to co-operate. The device manufacturers and the Network operators play a major role in this value chain.

It is agreed that there are multiple players in the value chain who are interdependent and therefore must act in a coordinated fashion. The value chain includes content owners, content developers, the content aggregators, the billing companies, the distribution companies, the device manufacturers, and the carriers. Many companies operate in multiple parts of the value chain, while others are narrowly focused. The major carriers operate in slightly different segments of the value chain – for example, Sprint licenses content to hire third parties to produce content, and then they host and deliver it. T-Mobile on the other hand, uses aggregators to handle all of its content.

Many see the principal control point residing in the device and as the handset becomes more powerful with higher memory capacities, the opportunities for transmitting content will become greater.

Analysis

2.3 Lessons Learned

Experts' Comments

- ψ "Mobile Networks are asymmetric. Hence it is not easy to do P-P transfer… Download speed is higher than upload speed…[..]. Hence the model for wireless is different from the internet model."

- ψ "There haven't really been many lessons learned [for the wireless opportunity from the Internet experience]."

- ψ "You gotta build in content protection from the beginning and it needs to be scalable."

- ψ "Most people I know don't want to steal music…but it [Napster] was a wonderful way to get music, and nobody gave them another solution…. People started freaking out about how do we protect the music, when nobody thought about what the consumers wanted, and in the process make sure that the DRM is there."

- ψ "Doing things that make it work only in the mobile environment or only on one mobile device don't seem to make a lot of sense."

- ψ "As soon as you have removable storage, the difficulty associated with moving the content from a mobile device onto a general purpose device becomes trivial. And once it's there then distribution problems that you currently see today will continue."

2.4 Ecosystem Evolution: Shape, Direction and Leadership

Experts' Comments

ψ "I think the leadership comes to either the carriers themselves or the content providers."

ψ "Again I'd say the carriers dominate that [the retailing of mobile entertainment services] […] [because] the carrier is the one that has the reoccurring service with the customer, has the interface with the customer in a daily almost minute basis, and has the ability to do the billing for the customer."

ψ "To be honest, to make it easy the mobile operator already has the billing relationship with the costumer. …. .. If they [consumer] don't have to do anything else, if they can buy a phone, pull up a menu, take it download it tells you, if you continue you're going to be charged this much, it can't be any easier."

ψ "The wireless industry is very dependent on USE case scenarios. One model will not work for all content. The value chain will evolve and develop dependent on individual cases."

Synopsis

Our interviewees agree: The future is uncertain. Overall, it is difficult to identify a unified perspective in the responses. Individual perceptions of the evolution of the industry exhibit great variance. However, consensus among interviewees is that the service providers are in the best position to champion solutions, in conjunction with device manufacturers, since they enable the content to reach the user. Also, carriers have the billing systems, and relationship with the customer.

Analysis

First, content and a wireless distribution system are required to provide mobile entertainment services. Therefore, any value system model that intends to capture the emerging mobile entertainment ecosystem has to recognize assets and skills from these two industries.
Second, in order to consume a mobile entertainment service any end user must have access to a delivery system and programming, and simultaneously.   Third, both industries, content and communications, are fragmented with many categories of specialized firms. These conditions must be considered in the development of best practices for digital rights management.

2.5 Emerging Information Systems Architecture Undergirding Mobile Entertainment

Experts' Comments
Lack of Interoperability

ψ "When you begin to fill more general-purpose devices, it becomes harder and harder to have sort of agreed upon standard proprietary solution."

ψ "[…] if you're using [a phone made by x1 and provided by carrier y1] you need to encode it in this format and do these things, and if your using [y1's phone made by x2] you need to encode it in this format in a certain way and if your using [a different carrier y2] you have to format differently again."

ψ "Super Distribution is very closely tied to the problem of interoperability…[…] Super Distribution allows me to give you a copy [of a game] […]….once you receive that game you're required to […] purchase the rights to the game..[…] [Super Distribution puts] mobile users […] into the situation where they're part of the value chain as well as part of the distribution model."

Threat of Interoperability

ψ "We have a relatively more closed […] technology environment, where we have some control over devices that customers use, we have some control over our network structure"

ψ Forward lock: "We allow content to be downloaded [to] devices and then we don't allow that device to forward the content on. […] That's something we worked with the device manufacturers"

Synopsis

There are already solutions out there that are simple (wrappers and forward lock) and are not onerous for the customer. The technological hurdles surrounding DRM are not the primary challenge, rather coordinating an approach, and maintaining consistency across carriers and services is where attention needs to be focused. The need for open rather than proprietary or closed standards was consistently brought up in interviews. One interviewee stated that when we hear that "standards are dead" we will finally know that open standards have been accepted. However, based on the interviews, two striking observations are apparent. First, there appears to be tension on the subject of interoperability.

On the one hand, some interviewees point to interoperability as a requirement to create new business models, such as "Super-distribution." Furthermore, easy interoperability is also seen as a requirement to make ME convenient enough to be successful in consumer markets. On the other, others see it as an unnecessary complication that at least initially risks compromising copyright protection, which limits content supply and, therefore, hurts the attractiveness of ME service offerings.

Secondly, despite strong opinions on interoperability, none of the interviewees explicitly discussed the notion of information systems (IS) architecture. From a research perspective the IS architecture is where business strategy meets IS strategy.

Analysis

The Microsoft antitrust lawsuit has shown that electronic competition is increasingly becoming IS architecture-based competition. Research has revealed different IS architecture-based strategies (see Figure 6)

Link: Use client installations to pull server apps.
Lock: Use server apps to lock in content providers.
Leverage: Use content providers (and their (exclusive) content) to entice consumers/business users to install (adopt) client; use client-side entry to push high-level/complementary apps, for example (bundling).
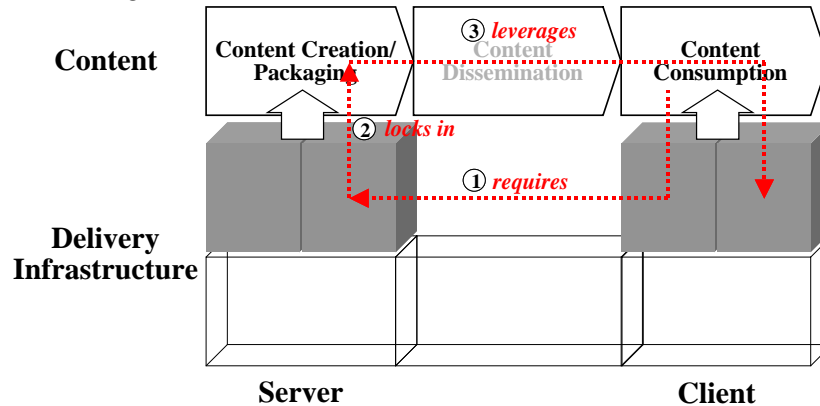
Full-fledged Online Multi-media Authoring Tools
- America Online's 'Rainman'
- MS 'Blackbird' and FrontPage (Vermeer FP)
- Macromedia's Flash (emerging)

Streaming Media
- Apple's QuickTime (player and editor/server)
- Realnetwork's Real (RealOne player and Helix producer)
- MS Windows Media (player and encoder/ producer)

Source: Schlueter Langdon, C. 2004. Information Systems Architecture Strategies. Working Paper IOM -04-02, USC Marshall School, 5.

Figure 6: "Link-Lock-Leverage" Integration Strategies and the War Over Authorization Tools

2.6 Intermediate Summary of Challenges/Threat

Experts' Comments

- ψ "2 challenges […]: (1) Napster effect and (2) interoperability."

- ψ "We're in the situation right now where we need to have a large amount of high quality content […] to become truly successful as media devises"

- ψ "A s a carrier I need to know that I have the right rights, which is also a complex issue […]. I don't want multiple people coming and telling me they have multiple rights to the same thing."

- ψ "The problem is as you go to the value chain, every one of the players, including the carrier, the handset manufacturers, and others are trying to differentiate."

- ψ "We talk a lot about standards, for example standards for ring tones, standards for games, the people who are actually making those things can not have such a fragmented market."

- ψ "..there are many formats for content on devices, there aren't any standards for those formats, there are many protocols when you create a piece of content you have to create it for each device, make and model."

- ψ "[..] so you cannot get enough scale to get the content.".

- ψ "…challenge that we see is that of… interoperability. There are several DRM standards out there. We happen to have subscribed to the Open Mobile Alliance variation of DRM. But just the fact that there are several of them that presents an interoperability problem".

Synopsis

The ring tone download business, often cited as the lucrative killer application for wireless narrowband content, may fail to serve as a template for success with wireless broadband content. On one hand, a ring tone is probably cheaper than rich media content, which would reduce the economic incentive for stealing of a ring tone relative to more valuable multimedia content. On the other hand, rich media requires the handset to become more like a PC a system with plenty of local processing power and storage. If this is achieved by essentially turning a proprietary handset into a PC-type systems architecture with many open systems and application interfaces then it would be more difficult to contain use and protect copyrights.

Analysis
The Standardization and Application/User Interface Dilemma

- Competing interface standards in the delivery infrastructure layer will increase supply side uncertainty (developing games for Playstation or X-Box?) as well as demand side uncertainty (buying a Betamax or VHS player?). As a result the growth and size of a related content market will be severely constraint.
- If there is only one universal standard per interface and if it is open then markets can explode (see TCP/IP and Internet usage) but there are no or very little economic advantages in owning the standards (see Web standards and Sun's sponsorship of the Java programming language).
- If there is one universal standard but proprietary then markets could grow faster and be bigger than in the scenario of competing technologies. But the market will be smaller than in an open standards scenario, because the market is exposed to monopolistic pricing of the standard bearer, which will increase cost for everybody else.

Vertical Foreclosure and Tying
Can control of access to delivery systems (e.g., cable TV link and decoder box, AOL welcome screen) help influence content selection? Can control of programming system influence content selection (e.g., channel allocation and line-up, design of search interface and selection of categories or channels)?

Vertical foreclosure can apply to downstream as well as to upstream markets. For example, is a downstream company at risk of being cut-off from its supply chain (upstream) or its channel system (downstream). A widely publicized example of the former is the 2000 incident when Time Warner Cable took Disney's channels off line to better negotiate lower rates for Disney Content. A less visible example of the latter is Microsoft's refusal to provide space, icons, on the Windows screen to competing and complementary service offerings.

3. Digital Rights Management (DRM)

3.1 What is DRM

DRM technology is a set of technologies designed to help content owners protect their copyrights and stay in closer contact with their customers. In most instances, a DRM system encrypts digital media content and limits access to those users who have obtained the right to use it (Kwok 2002).

- Media right protection and management
- Secure delivery and distribution of digital contents
- Processing authorization, data authentication and verification for Content Service
- Data security, integrity check, access control, and management for distributed ystems and peer to peer (P2P) networks
- Multimedia watermarking for copyright protection, media authentication and integrity checking, finger-printing, and data annotation

3.2 Role of DRM

Experts' Comments

- ψ "We believe that DRM is necessary step […] that'll enable the market to really take off".
- ψ "To only think about DRM as a 'Yes/No' right to a piece of content is not thinking like a consumer."
- ψ "We don't believe that any kind of DRM is going to be able to prevent piracy or illicit copying of copyrighted content, but what we think DRM does is make it more attractive for the content providers to put high quality content out there".
- ψ "Technology alone […] is not a sufficient solution […] you have to have a combination of technology coupled with enforcement, coupled with […] people willing to live by the rule or law, which is challenging in a global environment".
- ψ "It isn't a technology issue. It's a business rules and business practice issue".
- ψ "We also don't believe that if someone spends a lot of time to make some art; audio, video, etc that the world should have free and unconstrained rights to that because musicians and artists deserve to be compensated for their work."

ψ "Interactive services is the least of the DRM concern because the nature of them being interactive typically means you log into something, so you can control a lot of instances the use of it…areas of DRM continue to come up in the music and games."

ψ "So if you think about a situation [multiple device ownership]where that's the case, and you have a user that purchased a ringing tone for one phone and come the weekend they want to switch it to another phone."

ψ "[Consumer's]… interface and purchasing experience are critical, and you have to make it easy and simple for people to buy content. If you put a lot of locks in there you're going to scare them away or discourage them. If they can't buy their content with two or three clicks the likelihood is, you're going to lose them."

ψ "Way too often people think of it as black and white…. [when we should be asking] ..what does the consumer really want and working backwards against the various limitations, you can basically find solutions."

ψ We see a solution that actually scales across a broad range of devices, across a range of media types, and then allows for importation and exportation wherever possible. And it's on the DRM systems to make it really easy for people to legally move content around and for content owners to get paid."

ψ "The ideal DRM solution is one that the user doesn't even know is there".

Synopsis

Digital Rights Management (DRM) in the wireless industry is widely discussed because from the device manufacturer to the content provider, each player is affected by illegal use of content. Associations like OMA,3GPP are offering guidelines to protect the wireless space .There are control points in the system where illegal content can be blocked. At the network level it can be blocked because it's inherent and typically in a filetype. At the device level, most devices have a function called *forward lock* **.** Thus one can't send content to someone else. This mechanism should be present on all devices unless there's a mechanism for charging the actual retail price for every piece of content that's forwarded on.

DRM should play a role by coming up with a solution to ensure growth in the content market. One major issue is there are many format for content on devices , there aren't any standards for those formats, there are many protocols. If a piece of content is created one has to create it for each device, make and model.

This is not a feasible solution in the long run for this industry.

DRM needs to lay down certain standards for each member of the value chain and if need be impose fines on members that do not abide by those rules. This will help to have a systematic and more efficient working of the value chain and lead to growth in the wireless industry.

3.3 DRM Responsibility

Experts' Comments

ψ "If you got a house […] and you strip out the walls and take a look at the plumbing, everything needs to be water tight. Because otherwise you've got leaks all over the place […]. And we believe DRM is exactly the same. If we go back to the value chain […] there's this virtual pipe that essentially goes from end to end and that pipe cannot be compromised".

ψ "It's got to be a handle between them because no one knows the entire value chain".

ψ "Responsibility? I don't know. I think that's more of a legal question".

ψ "[…] the carrier community though is very sensitive to the entertainment communities concerns about digital rights. […] we would actively seek ways to find a way to make the business take off in a way that works for the entertainment community".

ψ "Carriers have taken the onus on themselves as a way to control billing…they have put themselves in a position where they should control it… haven't given other people the option to really control it."

ψ "…from a technology perspective you need to make it such that you keep people from doing the wrong thing by making it increasingly harder for them to do the wrong thing. But when they're doing the right thing it is completely transparent to them."

Analysis

3.4 Structure of the Digital Rights Management Challenge

The initial discussions with the interviewees and the study of past ecosystem formation processes[1], suggest that the DRM challenge is as a problem that requires aligning technology capabilities, regulatory sanctions, consumer expectations and behavior, and economics of supply and demand. We call it this the DRM diamond (see Figure 7).

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[1] such as cable TV, consumer online services, and interactive TV, for example
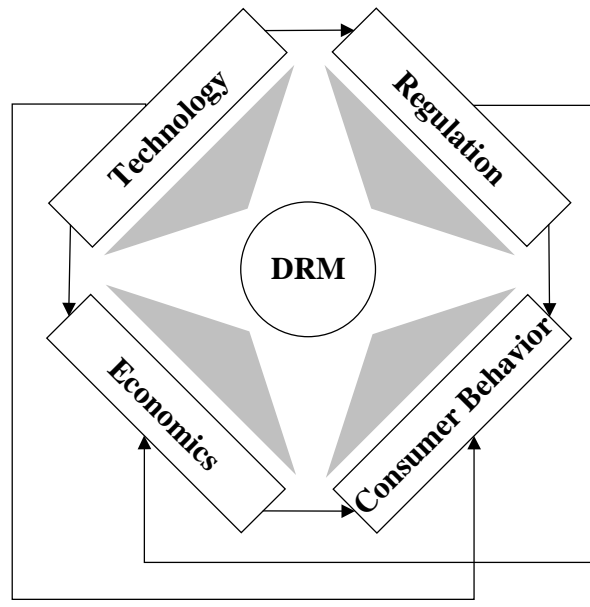
Figure 7: The DRM Diamond™ - Structure of DRM Challenge

For example, any software-only-based copyright protection mechanism is inherently insecure ("technology"). A software-based solution can only make it more or less difficult to make a copy. Therefore, in order to be effective any copyright protection has to be designed so that the cost of breaking it exceeds the value of the content. This cost has two components: first, cash that has to be spent ("economics") and second, the social cost and opportunity cost of a confrontation with the law ("regulation"). At the same time though any copyright protection has to be designed to be also consumer-friendly. It cannot be designed so that it would deter consumers from purchasing the package in the first place ("consumer behavior). Tight copyright protection is required but it can only be as tight as there are at least as many customers left willing to accept it so that their collective willingness to pay exceeds the cost of content, delivery and its protection. In other words, protection has to be as transparent as possible and as tight as necessary.

This is indeed a formidable challenge and history suggests that it requires multiple, synchronized activities to shape the opportunity or in this case the DRM diamond (see Figure 8).
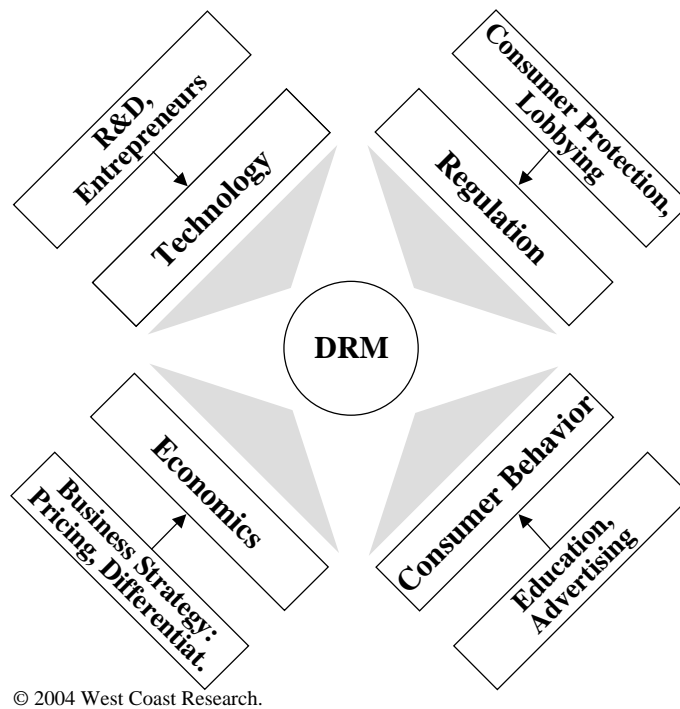
Figure 8: Shaping the DRM Diamond™

One approach that has a good track record is trial-based experimentation and deployment that is contingent on successful pilots. The early 1990s saw many "video dial tone" trials ("From A-B-W to D-B-W 1.0"), the most extensive one was Time Warner Cable's "Full Service Network" in an Orlando, FL, neighborhood complete with a "Home of the 21st Century" model home. All of the many trials failed, which was a success as it prevented larger scale deployments and disaster. Back then as today, competing technologies and "implementations" caused two key problems: (1) high cost of equipment and consultants, and (2) uncertainty with consumers and application developers. Particularly application developers were cautious to commit funding for the development of "killer applications" in order to avoid sunk cost.

3.4.1 Technology – R&D, Entrepreneurs

Experts Comments

- ψ "We believe that the OMA version is the one that works best on the mobile device".

- ψ "The way OMA DRM technology works is [that] the content provider takes a piece of content [and] puts a wrapper around it what we call a DRM wrapper."

- ψ "Media producers are media producers, and they shouldn't have to worry about all of these other issues unless it can be easy for them to encode their content in a wrapper and somebody has to write the rules."

ψ   "There is a downside for standards that the associations like OMA and 3GPP want to propose. If there is a common standard then the HACKERS might target that common standard which might affect the mobile content market. On the other hand standards are required to deploy content quickly."

Synopsis:

Consortia such as the OMA & 3GPP have an important role to play (consensus view) in providing guidelines. However, the impression is that market and business concerns are not always factored in to decision- making. Also, the pace of their activities often is behind the market. Also, when there is agreement on a standard, there are no enforceable mechanisms in place. The technical bodies are worthy of support, but in reality its not clear that the DRM issue will be settled through this process.   Thus far, they haven't energized the industry or fostered the broad base of understanding that is currently needed.

Analysis

Competing DRM Technologies

DRM standards and systems can be classified into two groups, namely, cryptographic-based and watermark-based DRM solutions (Kwok 2003). Cryptographic systems permit only valid key-holders to access the encrypted data after receiving it from the authenticated senders. However, once such data is decrypted, it is impossible to track its reproduction or retransmission. Therefore, cryptography only provides protection during data transmission. Digital watermarking technology complements the cryptographic process and protects copyright ownership (Kwok 2002). Digital watermarks can be visible or invisible. They are preferably permanently embedded in the data and present within the data after any decryption process (Doherty 2002).

Several international standard organizations have been developing DRM solutions for various distributed multimedia, for example digital music and video. The Secure Digital Music Initiative (SDMI) (SDMI 2003) backed by the Recording Industry Association of America (RIAA) and 200 music and technology companies (as of October 2003), has been proposed to provide a secure environment for music distribution over the Internet. Another standard for multimedia content being developed by the Moving Picture Experts Group (MPEG) is known as MPEG-21 (Bormans and Hill 2002). MPEG-21 defines an interoperable framework for Intellectual Property Management and Protection (IPMP). The IPMP can be interoperable with other MPEG standards, for example, MPEG-4.
The Open Mobile Alliance (OMA) DRM standard is the result of a collaborative effort to create a mobile DRM standard (Poropudas 2003). In addition, there are commercial DRM systems. They include, for example Windows Media DRM for Pocket PC (Microsoft 2003).

- Light Weight DRM (LWDRM), based on MPEG-4, content encoded according to specifications of IPMP, involves RSA, AES and ISMACryp (Streaming Media Alliance) algorithms

- Standards Bodies (OMA, 3GPP)
- Other=?

3.4.2 Regulation – Consumer Protection, Lobbying

Regulation (the establishment of specific rules of behavior), monitoring (observing whether the rules are obeyed), and supervision (the more general observation of the behavior of financial firms) are typically required in order to protect public interest and consumer welfare. Regulation, laws, and supervisory actions are designed to provide incentives for regulated firms to adjust their conduct so that consumers benefit. These measures set the basic economics and create the boundaries of any business model.

Changes in regulation are often a response to technology innovation. The anti-trust lawsuit that resulted in the breakup of AT&T in 1984 is a good example. Fiber optic and lightwave communication, first test signals sent through AT&T's field test system in Chicago's Loop district on April 1, 1977, increased transmission capacity and reduced unit cost to the extent that the natural monopoly assumption had to be challenged for long-range transmission (AT&T Labs - Innovation - Technology Timeline, www.att.com/attlabs/reputation/timeline/77fiber.html, 02/26/04). As a consequence regulators established a competitive long-distance telephony market.

Copyright laws and jurisdiction are evolving. For excerpts of a debate on "The War Over Music" between Professor Lawrence Lessig, Stanford University, and Hillary Rosen, the former CEO of RIAA please visit: http://www.ebizstrategy.org/Events/events.htm.

Key Regulations
- Digital Millennium Copyright Act (Cheeseman 2004, 339)
  - o Prohibits unauthorized access to copyrighted digital works by circumventing the wrapper or encryption technology that blocks the intellectual property.
  - o Prohibits the manufacture and distribution of technologies, products or services primarily designed for the purpose of circumventing wrappers or encryption protection.
  - o Imposes both civil and criminal penalties for violators
- The No Electronic Theft Act (NET Act) (Cheeseman 2004, 339-340)
  - o Prohibits any person from willfully infringing a copyright for the purpose of either commercial advantage or financial gain, or by reproduction or distribution even without commercial advantage or financial gain, including by electronic means, where the retail values of the copyrighted work exceeds $1,000.
  - o Imposes criminal penalties of imprisonment for up to 1 year and fines of up to $100,000. Previously a plaintiff could only sue for civil damages.

Key Lawsuits
- A&M Records v. Napster, Inc., 239 F.3d 1004 (9th Cir. 2001) (Cheeseman 2004, 336)
  - o Napster held liable for contributory copyright infringement in violation of federal copyright law.

- o Napster required to block users from swapping copyrighted songs when music companies notify Napster that the songs are copyrighted and should be blocked.
- United States v. Levy (D. Or. 1999) (Cheeseman 2004, 340)
  - o Jeffrey Gerald Levy, a 22-year old University of Oregon senior, pleaded guilty to criminal copyright infringement in violation of the NET Act because he was caught maintaining a Web site on the university's server where the public could make copies of thousands of software programs, movies and musical recordings.

3.4.3 Economics – Business Strategy (Pricing, Differentiation, Bundling)

Experts' Comments

ψ "Piracy is one of the things that made Windows and the PC so successful, because it was so easy for people to pirate applications and games from other people. […] even though those took away revenue from the software manufactures or software publishers […] it served to […] make the PC more popular."

ψ "In a convergent industry I'm not going to get 90% [share of all revenue] anymore, I'm going to have to share it with other people."

ψ "If you want consumers to pay for contents you have to prevent third parties from giving away content or circumventing the commercial system."

ψ "The subscription model and illusion for cable TV model is inhibitor to growth of mobile entertainment market. Content market in Europe is big because it employs transaction based charging via Premium SMS."

ψ "Super distribution is an example of a revenue model that could emerge. It's a complex problem to solve. We are still working on a simple distribution model. A simple model that works is better than a complex model that doesn't work or not terribly reliable."

Synopsis

Wireless is seen as somewhat unique relative to the Internet due to the following:
- customers are accustomed to paying for content
- carriers have relationships with customers
- it's a controllable environment relative to the Internet where is currently is much easier to redistribute content compared to a wireless device
- users are not anonymous
- wireless customers interested more in personalization
- on Internet initially there was no legal way to download music. As wireless moves forward, there will be authorized channels

Analysis

3.4.4 Consumer Behavior – Education, Advertising

Experts' Comments

ψ "We've been having our subscribers pay for content from the get go and they've always understood that mobile services are different."

ψ "Speed is one of the key features and it's gotta be deployed broadly enough so you don't drop the signal when you walk around the corner. That's where the U.S. is so screwed because right now I can't even keep my cell connection up."

ψ "You've got to figure out how to get professional content distributed from your network somehow to give people a sense of what the streaming media can do. Where it gets even more interesting though is when people, who have these phones that have cameras on them, are starting to create their own content, on the fly."

ψ "There has to be a good user experience and good understanding of the used case. Good user experience and good DRM are mutually exclusive events. Bad user experience and good DRM has no revenue. I don't know if good user experience and NO DRM will work."

Synopsis

It is widely recognized in the industry that consumer education is vital and yet it has been insufficient in making customers aware of data services for the phone. There is still a large percentage of mobile phone users who are focused primarily on the price of calls and network coverage.

Making it possible for the customer to send content to another user and pay for it or give the recipient a chance to pay is a potentially promising model for the mobile content industry. It is a kind of wireless marketing essentially. The individuals we interviewed noted that when there is interoperability and a critical mass of mobile devices with DRM technology, Super Distribution could take off.

This is an exciting concept and many interviewed expressed expectations that Super Distribution can happen if the DRM and interoperability challenges are met.

4. Contributors & Acknowledgements

Dr. Elizabeth Fife (CTM), Prof. Francis Pereira
and Prof. Chris S. Langdon   Principal Investigators

David Yates (Ph.D. Student, USC Marshall School)   Interviews

Meera Pisharody. (USC Marshall MBA student)   2-3-6 Competencies Evolution
                                                        Diagram

Ashwin Rao, (USC Engineering Graduate Student)   Compilation of Interviews

Raymond Almond. (USC Marshall MBA student)   Market size, growth, DRM laws
                                               & lawsuits

Prof. James Kwok (Hong Kong University)   DRM technology scenario
CTM   Administrative assistance,
                                           interview processing

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Appendix A: 2-3-6 Framework for Digital Content and Electronic Channel Systems

In 1992 the FCC's so called "video dial tone ruling" slightly lifted the barrier between communications and video services allowing for competition between local and long distance phone companies as well as cable TV multiple systems operators and content providers. Many executives and observers saw it as the beginning of the conflict between "content" and "pipes". And indeed the early 1990s say a flurry of cross-industry M&A, joint ventures, trials, etc. (e.g., Bell Atlantic's proposed acquisition of TCI in 1993; TeleTV, a joint venture between the three Regional Bell Operating Companies of Bell Atlantic, Nynex and Ameritech with Hollywood's Creative Artist Agency). However, 2-3-6-based analysis suggested and history proved otherwise. Instead of "content" versus "pipes" the lessons learned are a bit more complicated. Most importantly the role of the computing industry and particularly it software makers has been underestimated or overlooked. 2-3-6 reveals how computing plays an important role. Instead of a confrontation between "content" and "pipes" struggles emerged in three different areas:

(1) "Content" is fighting companies such as Kazaa, which are in essence computing systems.
(2) "Pipes" are competing with new entrants such as Vonage, which are also essentially computing systems.
(3) Finally, there is a history of battles of computing systems themselves: America Online's user interface and system versus Microsoft's MSN platform, Microsoft's Explorer Web browser versus Netscape's Navigator, Microsoft's Mediaplayer versus Real's RealPlayer and Apple's Quicktime, and Yahoo's search engine versus Google.

A.1a. Evolution of Digital Communications

However, the transition from a digital narrowband plant to a digital broadband infrastructure, is not new. Therefore, it may be possible to leverage "lessons-learned" from similar events in the past. For example, wire line infrastructure is evolving from dial-up Internet access to "always on" DSL or Internet cable services. This trend has already changed business on the Web and competition in the convergence industries of communications, media & entertainment and computing. And before the Web emerged as the universal digital wire line delivery system, a few consumers and industry executives could learn from the failure of "video dial tone" or interactive television trials built on competing proprietary digital communication technologies in the early 1990s (see Figure 9).
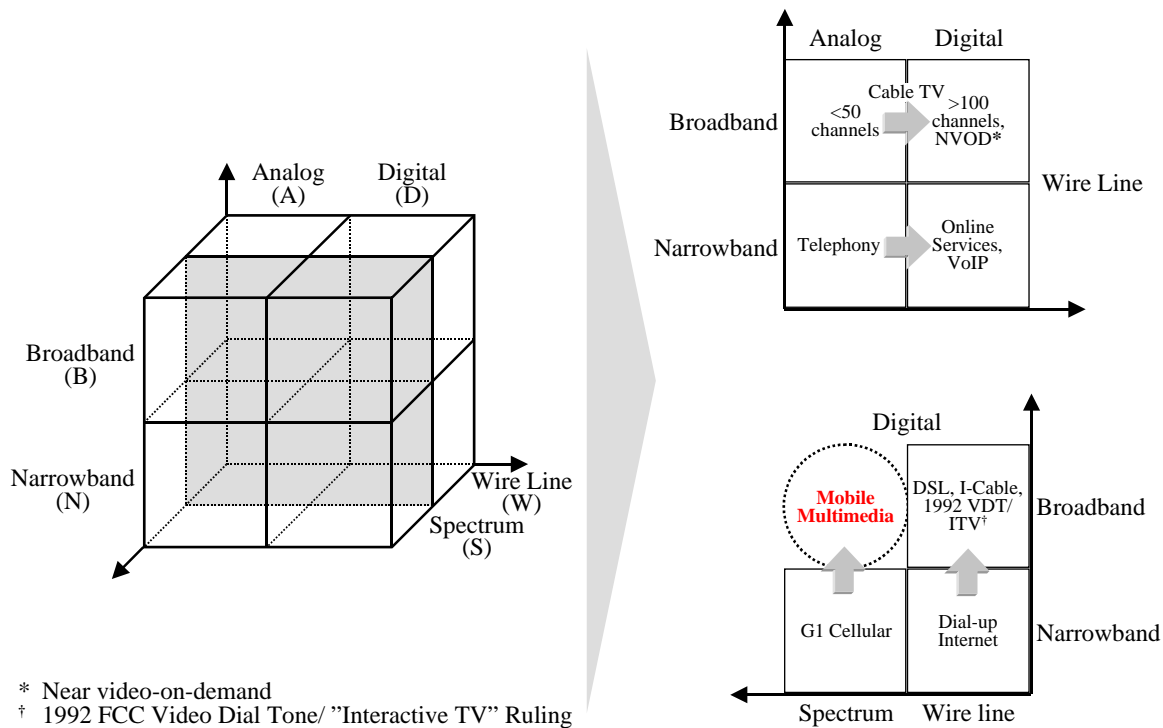
Figure 9: The Digital Business Transformation Cube™

This discussion of "The Emerging Mobile Entertainment Ecosystem and Its Digital Rights Management Challenge" uses concepts that have a successful track record in the study of ecosystem formation processes[2] and digital business transformation paths.

Appendix A1aa

While mobile entertainment is new similar conditions can be noted in other technology-enabled services and their business ecosystems which exhibit the similar characteristics.
Examples include:

(1) The emergence of U.S. cable television in the 1980s (a success; see Eisenmann 2000).
(2) The first consumer online services such as Prodigy, CompuServe and America Online (and France Telecom's Minitel and Deutsche Telekom's BTX in Europe) in the 1980s, which required the commercialization of the Internet and another decade to grow into a transformational force (EU 1996; Schlueter Langdon 1999, 20-41) (a move from A-N-W to D-N-W, see Figure 1).

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[2] Ecosystem formation studies include the Santa Fe Institute's Anasazi Village formation model (http://www.santafe.edu/projects/swarm/users/Pages/Village/village.html); the analysis of the 13th to the 15th century "Hanse" organisation of Dutch distant merchants, which encompassed approx. 70 big and 100 to 130 smaller towns in seven European countries (http://www.h-w-k.de/english/fsengl.htm); Porter's study of the phenomenon of "clustering," in which related groups of successful firms and industries emerge in one nation to gain leading positions in the world market (Swiss textile equipment and pharmaceuticals, Swedish mining equipment and truck manufacturing, Italian fabric and home appliances, and American computer software and movies) (Porter 1990).

(3) Interactive television as a response to the FCC's 1992 so called "video-dial tone ruling" (a failure; Schlueter Langdon and Shaw 1997) (a move from A-B-W to D-B-W, see Figure 9).

We propose an analytic framework that has been successfully used for competitive analysis in the aforementioned areas. It is called "2-3-6" (see Figure 10). Its 2 strings of business activities in 3 stages of value-added create a classification system with six Core Processes, which represent the fundamental building blocks of a digital interactive service. Any digital interactive services, such as broadband wire line Web and broadband wireless, is composed of all six building blocks.

Digital Content & Electronic Channel Systems
– Who captures value and how? –

Internet Disruption	Content / Delivery Infrastructure	Content Creation & Programming / INFORMATION & SOFTWARE SYSTEMS / Communications	
New information technology (IT) has triggered many transitions: Analog -> digital Narrowband -> broadband Wire line -> spectrum These processes coincidence with the success of open over proprietary systems.	"2-3-6", the analytic tool for digital value system analysis, recognizes the importance of **dual access competition**—access to content and delivery infrastructure—in the struggle of rivals to secure the **customer relationship and interface** supremacy.	• "2-3-6"-based analysis reveals generic threats for incumbents: (1) Margin squeeze, (2) new entrants • It aids identification of new business segments (portals, communities of interest) • It highlights the role of industries and migration paths	3 **integration conflicts**: • Content vs. IS (studios vs. Napster, Kazaa, etc.) • Communications vs. IS (switched networks vs. VoIP and WiFi hotspots) • IS rivalry (the browser war, media player competition, search engine game, etc.)

Adapted from: Schlueter Langdon, C., and M. J. Shaw. 2002. Emergent Patterns of Integration in Electronic Channel Systems. *Communications of the ACM* 45(12): 50-55; and Schlueter, C., and M. J. Shaw. 1997. A Strategic Framework for Developing Electronic Commerce. *IEEE Internet Computing*, 1(6): 20-28.

Figure 10: Generic Threats and Opportunities in Digital Content and E-Channel Systems

The concept distinguishes between a business process layer (the 6 building blocks) and the enterprise layer on top of it,. Conceptually, enterprises are composed of combinations of Core Processes. While Core Processes are static the shape of enterprises can change over time as companies add capabilities or reduce their degree of integration. This structure—static Core Processes and dynamic Enterprises—has allowed for the systematic identification new business segments (such as portals, communities of interest, etc.; see Figure 11), integration trends (horizontal portals versus vertical ones; see Figure 12) and the analysis of economic incentives that underlie such business strategies.

1. Online Networks

Content Creation	Content Packaging	Market Making
Transport	Delivery Support	Interface and Systems

Infrastructure Content

- Reduction of buyer and seller transaction cost (i.e., search cost)
- Integration of community services, delivery technology, full service spectrum and competing products
- Example: America Online

2. Community Organizers

Content Creation	Content Packaging	Market Making
Transport	Delivery Support	Interface and Systems

- Fulfillment of primary need
- Creating and keeping different communities of interest
- Focus on regional, functional and cultural specialties
- Examples: www.wsj.com

3. Platform Providers

Content Creation	Content Packaging	Market Making
Transport	Delivery Support	Interface and Systems

- Integration of technology for transparent and reliable use
- Becoming technology platform of choice
- Example: Uunet

Source: Adapted from European Commission —DG XIII/E. 1996. Strategic Developments for the European Publishing Industry towards the Year 2000: Europe's Multimedia Challenge. Brussels –Luxembourg: 318.

Figure 11: Generic Business Segments in Electronic Channel Systems
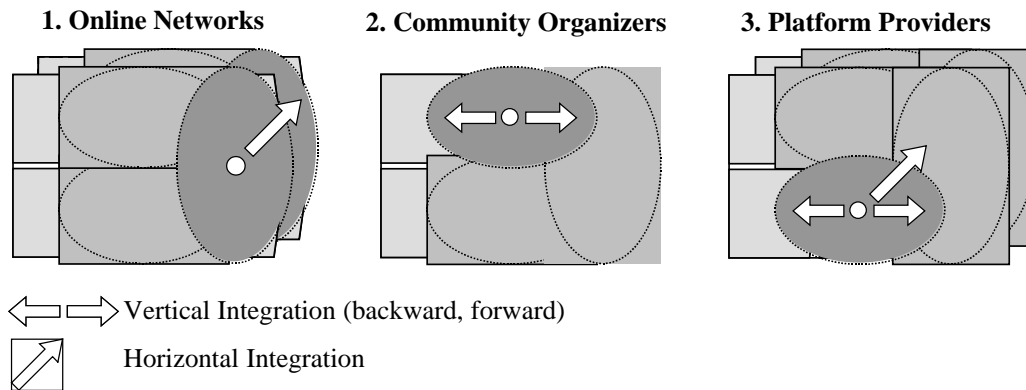
1. Online Networks   **2. Community Organizers**   **3. Platform Providers**

⇐ ⇒ Vertical Integration (backward, forward)

Horizontal Integration

Source: Schlueter Langdon, C., and M. J. Shaw. 2002. Emergent Patterns of Integration in Electronic Channel Systems. Communications of the ACM 45(12): 50 -55, 54.

Figure 12: Integration Patterns in Electronic Channel Systems

Figure 13: Emerging Mobile Entertainment Ecosystem

Positions tend to change over time. Companies evolve organically or through M&A, joint ventures, and partnerships. To illustrate changes in ME we've compiled a "Competencies Evolution Diagram" for one carrier (see Figure 13; Verizon has been randomly selected; result are preliminary only).
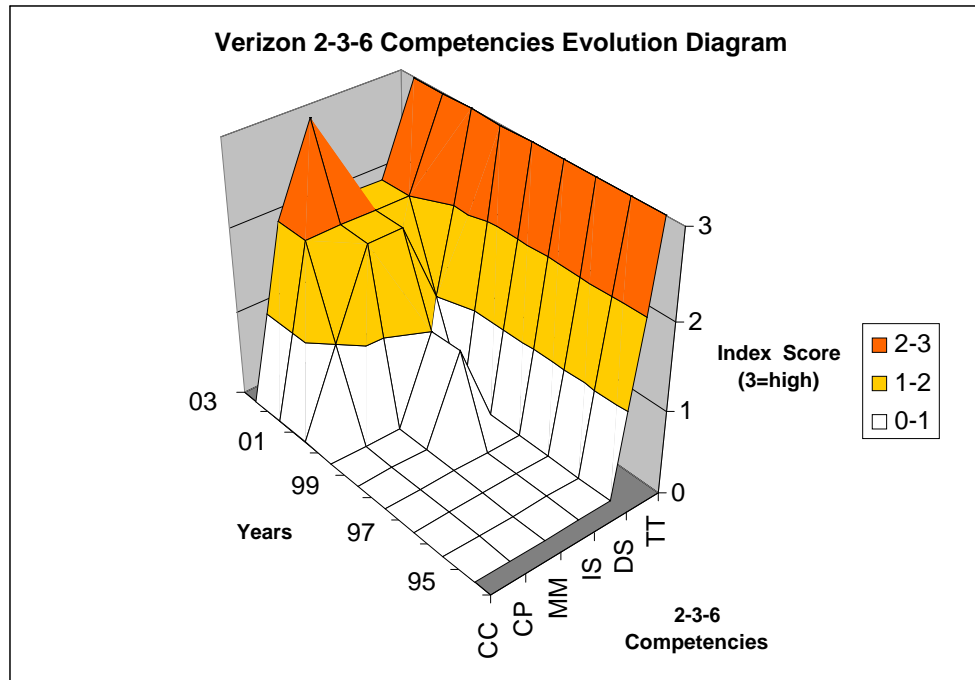
Verizon 2-3-6 Competencies Evolution Diagram

Figure 13: Verizon "2-3-6 Evolution", U.S., 1995-2003 (preliminary assessment only)

(ADD Description)

A.1 Core Building Blocks of Digital Content and E-Delivery System

Core processes are defined as the fundamental building blocks of any digital interactive service. They have been chosen at a high enough level of abstraction so that their boundaries and existence are not affected by new information technology. For example, technology won't make a core process obsolete.

Content Creation *(CC)*	**Content Packaging** *(CP)*	**Market Making** *(MM)*
Main value-added activities: • Original content creation • Writing, composing, scripting, directing, etc. Output (examples): q Text/audio/picture/video material, multimedia assets	• Digitization of content • Editing, layout design • Customization • Content-based software development q Cable TV channels (MTV), video/PC games (Sega), online service channels (Finance on AOL), Web sites (www.wsj.com)	• Program development, full service delivery, catalogs, competing content • Original programming • Customer access mgmt. • 24/7 customer care: help desk, directory services, anytime and anywhere availability q Online services (AOL), portal sites (home.netscape.com, 1st "portal" in 1995; Yahoo!)

Figure 1: Content-related Building Blocks and Key Activities

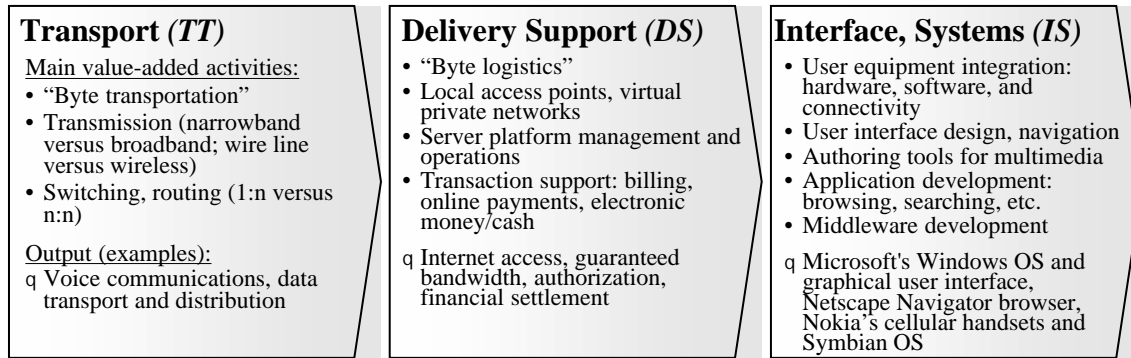| Transport *(TT)*	Delivery Support *(DS)*	Interface, Systems *(IS)*
<u>Main value-added activities:</u> • "Byte transportation" • Transmission (narrowband versus broadband; wire line versus wireless) • Switching, routing (1:n versus n:n) <u>Output (examples):</u> q Voice communications, data transport and distribution	• "Byte logistics" • Local access points, virtual private networks • Server platform management and operations • Transaction support: billing, online payments, electronic money/cash q Internet access, guaranteed bandwidth, authorization, financial settlement	• User equipment integration: hardware, software, and connectivity • User interface design, navigation • Authoring tools for multimedia • Application development: browsing, searching, etc. • Middleware development q Microsoft's Windows OS and graphical user interface, Netscape Navigator browser, Nokia's cellular handsets and Symbian OS

Figure 2: Delivery Infrastructure-related Building Blocks and Key Activities

ψ "On mobile devices you need to be able to keep track of what people have bought when it expires, because sometimes they'll loose it on their phones, sometimes they have limited memory on their phone and they'll delete things on their phones but they'll still want it. Not making them pay again, allowing them to download again and knowing the right to do that is an important piece to it. And then once it gets to a device, making sure that it can only be played on that device, it cant' be transported to another device that's kind of a key piece" (EL304-13_Ts, 7).

A.2 Emerging Strategic Positions and the Role of Industries

Strategic roles are defined as strategically distinct categories of business opportunities in emerging electronic channel systems. Any strategic role and the businesses constituting it are typically composed of combinations of core processes.
While boundaries of core Processes are static, the shape of strategic roles can change over time.

In order to identify emergent business segments and industry migration paths multiple steps of analysis would be required. Just as a medical doctor would not write a prescription without first examining a patient and making a diagnosis, we rely on theory and research-based analysis to generate findings.

(1) First, several case studies would have to be prepared to identify conduct trends.
(2) Second, theory would have to be used to develop hypothesis to explain observations. Example: The sophistication of database-driven cross-selling applications increases the horizontal scope advantage relatively more than vertical scale advantages; which would create a bias for "portal" business models. (ADD more ECON analysis GoTo Ds99)
(3) Third, hypothesis would have to be tested in order to extrapolate observations into the future and determine the spectrum of likely outcomes.

Due to the limited scope of this paper we can only depict the current position of several of the participating companies.

Appendix B: A Conceptual DRM Technology Scenario for Mobile Entertainment

A mobile DRM framework for mobile multimedia is derived from (Kwok 2002). The framework is a closed system that hosts all DRM operations within its center and provides a platform for mobile service providers to conduct business with their customers. Apart from rights insertion and enforcement operations, the center can handle transactions with a highly secure payment scheme. It is assumed that the central party is mutually trusted by both the businesses and consumers. A trustful center can be a mobile operator. The distributed multimedia content between the center and the mobile users are rights-protected with a digital license and watermarking, while the multimedia contents transferring to the center do not require rights protection.

Figure 17 presents the mobile DRM framework for multimedia distribution in a mobile environment. The center of the framework is a mobile operator that manages information to and from mobile devices, mobile service providers and other concerned parties. The principal components include (1) a mobile network infrastructure, (2) a DRM system, (3) a payment system, and (4) a database. There are three types of parties involved in this framework: the mobile service providers (both official and unofficial sites), the bank, and the mobile users. The communication channels between different parties and the mobile operator are different from and independent of each other depending on the required security level. For example, a virtual private network (VPN) is used between the bank and the mobile operator, since highly confidential information is transferred through this channel, whilst the mobile operator relies on the packet network for multimedia content distribution, and the mobile service providers transfer multimedia contents to the mobile operator using the ordinary Internet.
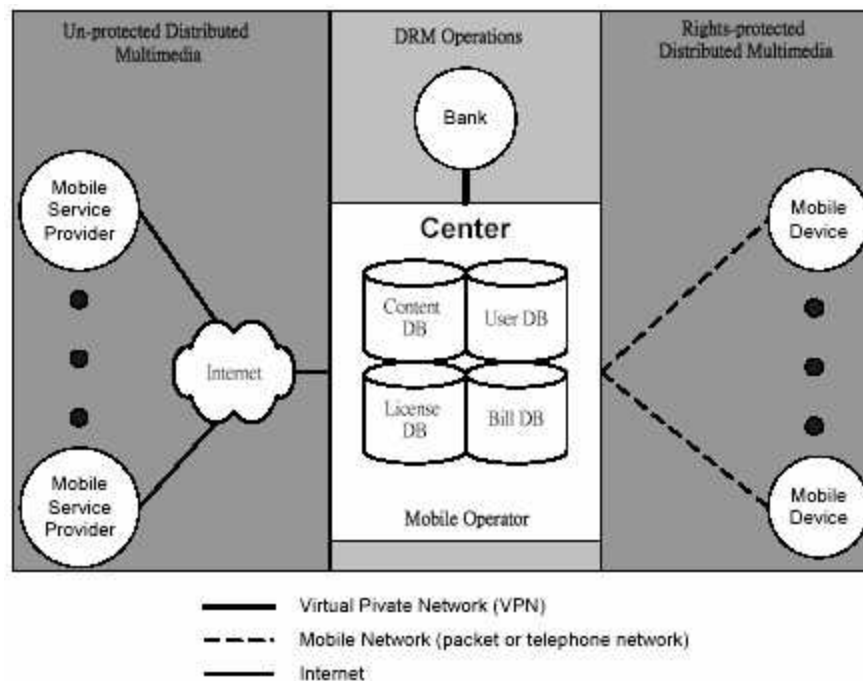

Figure 3: A DRM Technology Framework for Mobile Multimedia - Overview

The distinct features of the proposed framework include the following.

1. DRM operation: All DRM operations are performed by the center. It shifts all the processing and storage requirements to the center and relieves the burdens of the mobile devices and service providers.

2. Independence of mobile devices: The center can tailor the format of the distributed media for a specific mobile device. Besides, streaming technology is used in order to overcome the problems of processing power and storage requirement in the 2.5G mobile devices.

3. Independence of mobile technology: The framework can be applicable to 2.5G, 2.75G, 3G, 4G, and even higher because it does not depend on any specific mobile standard.

4. Standardized rights expression language: Since all DRM operations are managed by a single party – the mobile operator, the rights expression language can be standardized.

5. Sharing and trading: It facilitates media sharing and trading between users. Detail may be referred to (Kwok 2002).

6. Payment: Transactions and payments are handled centrally through a secured channel.

7. Ease of use and user satisfaction: All DRM operations are completely transparent to mobile users and the mobile service providers.

Appendix C: DRM Terms and Definitions

Identifiers and Metadata
Identifiers (unique labels for entities) and metadata (structured relationships between identified entities) are prerequisites for DRM. The essence of DRM is the control (licensing, etc.) of copies of entities; the identifiers and metadata are then essential to the management of this process, and to distinguishing and expressing relationships such as replicas and derivations (Paskin 2003).

Watermarking
Watermarking is a technique for media authentication and forgery prevention and it is viewed as an enabling technology to protect media from reuse without adequate credit or in an unauthorized way (Trowbridge 2003). A watermarked media, M' can be mathematically represented as $M'=M + W$ where M is the original media content and W is the embedded watermark. It is common that the extracted watermark, W' could be different from the original watermark W because of the intentional or un-intentional attacks or post processing. To detect the watermark, a watermark detector is used to evaluate the similarity between W and W'.

Rights Insertion
Rights insertion is an operation to embed the identities of the concerned parties and assign business rules and conditions to the distributed multimedia content (Kwok 2002; Kwok, Cheung et al. 2003; Kwok, Lui et al. 2003).

Rights Enforcement (or Verification)
There are two types of rights enforcement: namely active enforcement and passive enforcement. The active enforcement takes place within the media player as a built-in function. The passive enforcement is an offline ownership verification operation to check for the hidden owner identities (Kwok 2002; Kwok Cheung et al. 2003; Kwok, Lui et al. 2003).

Digital License
A digital license can be a separate file or message embedded in a media file. The license document states all the terms and conditions concerning the use of the licensed media file. These terms and conditions can be static or dynamic depending on the payment scheme (Kwok 2002).

License Management:
License management is a mechanism to execute the terms and conditions stated in the license. This requires coordination among the media player, the media file, and other supporting modules; e.g., the payment module. From the technical perspective, license management refers to issuing, hosting, and verifying the license (Kwok 2002).