

Assessing Legal Challenges on the Mobile Internet

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ABSTRACT: This article describes some legal challenges related to information products and services on the mobile Internet and the World Wide Web. Using a scenario-based methodology, it describes the future mobile Internet and explains how information products and services would be used on it. A systematic method is used to build the scenarios. As the problems likely to emerge are very complex, the scenarios take into account several major factors that delineate the mobile Internet and its use—not just technological changes and economic factors, but societal issues and how individuals feel and behave. The scenarios make it possible to identify the kinds of legal challenges that are likely to emerge. Analysis of the scenarios indicates that intellectual property rights, privacy, and contracts are the legal areas most likely to involve challenges on the mobile Internet.

KEY WORDS AND PHRASES: Contracts, digital rights management (DRM), information product, intellectual property rights (IPR), legal issues, mobile Internet, privacy, scenario methods, societal aspects of information technology.

The mobile Internet will probably be the next major generation shift in computing. Fueled by the introduction of ubiquitous wireless access through wide-area networks (e.g., 2.5 and third-generation mobile telephony), local-area networks (e.g., wireless LAN [WiFi]), and proximity networks (e.g., Bluetooth), the mobile Internet will cover perhaps a billion users by the end of the decade. For many of them, it will be their first and only connection to the Internet.

In addition to ubiquitous access, the mobile Internet will offer functionality and application enablers that set it apart from the wired Internet. These functionalities will include service roaming, terminal positioning, presence service, context management, and, ultimately, the “disappearance” of computing into both everyday surroundings and the users themselves.

These characteristics of the mobile Internet will enable many new business opportunities for telecom operators, media firms, financial service companies like banks, industrial companies, and a great variety of other services from travel and tourism to education and cultural services. Just like the wired Internet, the mobile Internet may also offer a rich set of tools and platform services that will enable end-users and user communities to create their own services.

While certainly very attractive, the new services made possible by the mobile Internet will be vulnerable to legal risks and challenges, such as unauthorized use of information. One of the most important ways for companies to utilize the mobile Internet will be to commercialize their intangible assets. Companies have learned methods for doing this on digital markets, but how they can extract the most value from the information they possess is still uncertain [18, 20]. The fact that entities do not yet know what kind of legal challenges they will face on the mobile Internet is a major concern and business obstacle. For example, peer-to-peer network services are very effective for distributing

information products, but recent examples (e.g., Napster) beginning in late 1999 in music and movie products suggest that it will be difficult [13].

The legal challenges considered in the present discussion include difficulties in legal reasoning and outcomes of the legal process that are unsatisfying in some way. In general, legal structures are intended, among other things, to facilitate business—they diminish risks, encourage trust formation, and thus enable business methods. In a novel business environment, however, existing legal structures may be outdated or contradictory. Even when sound rules exist and can be found, it may be difficult to apply them to complex new situations. This increases transaction costs, and slows down the development of value networks and the market in general. At worst, companies become vulnerable to risks that could be avoided or contained if the legal challenges were better understood [15]. Failure to understand legal challenges may also lead governments or standards bodies to regulate markets in an unsatisfactory way, and even to create obstacles to services that could be important and useful both for users and society. This article examines these challenges from the standpoint of content providers, operators, device vendors, and end-users.

The research reported in this article identifies and explores some of the most likely legal challenges related to information products and services on the mobile Internet and the Web. Instead of formal completeness based on a well-formed theory, it has the more pragmatic goal of identifying challenges that companies and policy-makers should concentrate on so as to avoid the worst legal barriers. The analysis, it is hoped, will suggest some possible legal, technical, and economic solutions to these challenges.

Research Method

The study described below seeks to identify legal challenges that may arise in conditions that largely do not yet exist. Mainstream legal science uses court cases, statutes, and precedents as its sources, and derives theories by analyzing them. Thus, conventional jurisprudential methods are not suitable for predicting the future. More suitable methods are available in the area of futures research. Scenarios are a useful tool when one wants to describe what a future world may be like and what kinds of challenges may occur. Scenario-based methods offer a scientific basis for describing future states and evaluating them from the present-day perspective. Whereas the scenarios used in other fields of science are typically quite broad, the ones in this study are relatively narrow—they merely describe a possible service or use-case [6, 22].

No claim is made that the scenarios outlined below will actually be realized. They are intended to form a holistic picture of possibilities and concerns that may exist in the future. From the scientific standpoint, there is a serious concern, since as Popper would put it, there is no immediate possibility of subjecting the conjectures to refutation [16]. Nonetheless, it should be possible to test the validity of the scenarios in later research with true use-cases or prototypes derived from the scenarios [7].

The major problem is how to create scenarios that will adequately cover the possible situations. If they are created randomly, it will be impossible to



Figure 1. The Steps of the Research Method

claim that they embody important issues in sufficient breadth and depth. To avoid such biasing, the scenarios have to be created in some systematic way. This requires an understanding of the underlying factors and attributes that influence legal challenges on the mobile Internet.

Specific *factors* and *attributes* can be identified because the legal challenges they pose are implied by their interaction with the existing law. The research method is outlined in Figure 1. Based on the literature cited below and discussions with the domain experts named in the note at the end of the article, *technology*, *economy*, and *society and individuals* are the most important factors related to the deployment and use of emerging mobile Internet services from the standpoint of this article. Based on the literature, the discussion identifies and summarizes the *attributes* of each of these factors that are most relevant to the mobile Internet. Currently weak signals and trends are included as attributes because the research is focused on the future. Each attribute occurs in at least one scenario. The analysis then identifies legal challenges involved in the scenarios and also directly in the attribute list. The legal challenges are classified by legal areas, assessed, and prioritized. The outcome is a list of legal areas that present significant challenges. A plausible rationale and mechanism is presented to explain why and how these challenges emerge. This suggests further work, including structural innovations and changes in value networks and their legal rules [14].

The method poses some noteworthy threats to *validity*. One may define factors incorrectly, choose the wrong attributes, create scenarios that do not

adequately represent future situations, analyze the scenarios superficially rather than in depth, draw erroneous conclusions, identify legal challenges incorrectly or insufficiently, and finally, assess and therefore prioritize the issues erroneously. The study was designed carefully, however, to limit such threats to its validity. Confidence in the study was further strengthened by ongoing discussions of the relevance of the scenarios with technology experts in leading technology companies and research institutions in the field. They were invited to comment on the study even in its early stages, and their observations helped to improve the scenarios and the analysis [4, 6, 7, 16, 23].

On the other hand, the question is not so much about the validity of the research as about its *relevance*. Indeed, from an interpretive/critical perspective, it is not possible to create an accurate model of reality. Instead, the reality is interpreted and reinterpreted in various social contexts, aiming at exposing relevant aspects and views of the reality for a particular discourse in a particular context. Therefore, instead of formal validity, what matters is the pragmatic and operational relevance of the results to the stakeholders and the context [3, 22].

The mobile Internet

The sense of *mobility* depends on one's standpoint. On the protocol level, a significant property of mobility is that the access point of a user's terminal is not fixed. Therefore, packet routing to the terminal must be dynamic and may change during a communication session. This perspective does not necessarily imply that the terminal should be wireless or portable.

On the service level, however, "mobile" refers to the ability of users to move. Therefore, to be mobile in practice, terminal devices must be wireless and portable. The focus in this article is mainly related to the service level. Therefore, the wireless and portable properties of terminal devices are emphasized. Some of the issues, however, also pertain to the protocol level. For the purposes of this article, a *mobile Internet* is a computer network to which end-users connect using mobile wireless appliances. The *mobile Web* is the universe of information that users are able to access through the mobile Internet [24]. An *information product* is a set of valuable information technically delineated in a form that can be controlled and transferred between entities. It may include content, metadata, and computer programs.

Mobility has a number of fundamental qualitative consequences. First, unlike its wired predecessor, the mobile Internet and its services have the potential to penetrate the kaleidoscopic richness of the everyday life of their end-users. No matter where we go, what we do, or what time it is, the services will be there with us, for better or worse. The relation of user and services is likely to be intimate and personal, and thus the services should respect the infinitely varying use contexts and roles played by the user. Moreover, since users are likely to consider their terminals and services as part of their lifestyle, even as an expression of how they perceive themselves (or wish to be perceived by their peers), they are willing to invest in personalizing them.

A second consequence is that many mobile Internet services are likely to relate to shared cognition, socialization, entertainment, and plain fun. Indeed, service designers should focus on the total *user experience* of the services. Apart from utility and usability, this term also includes the emotional tone of service use in a certain social, situational, and physical context. Contextual awareness, gained perhaps from some form of adaptive machine learning, is a key characteristic of such services.

These qualitative characteristics have a direct and deep influence on the topic matter of the study. To see how, recall that the wired Internet is largely based on the *end-to-end principle*: The network itself is neutral to the content of the packages it delivers, and whatever “intelligence” there is resides in the endpoints. Effectively, the Internet is a big pipe that is agnostic to their meaning.

The mobile Internet will necessarily depart from this long-honored and very successful architectural principle. Indeed, the combination of such characteristics as service adaptation, context-awareness, and deep (automatic) profiling and personalization seems to require an overall architecture where the service platform and the underlying network must be aware of the content of the communication in order to facilitate service delivery and respect quality-of-service commitments. Even worse, the required “intelligence” cannot be localized in some distinct protocol or middleware level, but must penetrate all levels of the architecture.

Thus, we seem to be holding a ticking bomb. On the one hand, we are expected to create services that infiltrate even the most private and emotionally loaded realms of their users’ lives, but on the other hand, the delivery of these services seems to require the involvement of the entire contributing value network. This combination is fraught with ethical, societal, and legal challenges.

This dilemma can be resolved by building the mobile Internet from ground up, while observing and enforcing some yet-to-be-formulated rules of conduct that encourage, facilitate, and provide incentives for honoring certain fundamental principles, such as privacy, security, and trustworthiness in the mobile Internet. At the same time, the rules should balance the contradictory interests of end-users and the various stakeholders in service creation and provision. This big picture also motivates the research reported in this article.

Factors and Attributes

To be pragmatically useful, the abstract concerns expressed in the preceding section must be mapped into terms that are more concrete. The present research does this by considering three *factors* interacting with the legal challenges of the mobile Internet: technology, economy, and society. Each factor, in turn, is characterized in terms of its most significant *attributes*.

The factors and attributes are derived from the current literature and from discussions with experts, as described above. The list is not intended to be exhaustive, but it represents the factors and attributes of the deployment and

use of emerging mobile services that are most significant from the perspective of this article. Table 1 summarizes the list of attributes per factor.

It should be stressed once again that this analysis does not claim to be complete, nor does it suggest any simple causal relations between the factors and the issues discovered. The goal is simply to establish a framework for discourse that can facilitate the resolution of the issues.

Technology

Many interesting and important fields of technology related to computer networks are under rapid development. Many of them are still hidden in the laboratories of universities and in the R&D departments of companies. Still, some of the major attributes of the mobile Internet oriented to future technologies and their use are already visible.

The first of these is the concept of *mobility*. Wireless and portable devices make it possible for users to move around while having access to the Internet. This includes both the ability to access the Web in different places (*nomadic usage*) and the ability to use the Web while moving. Generally, this requires the capability of fluent *handoff* between access networks and their access nodes. A related but distinct concept is *roaming*, the capability of maintaining uninterrupted service sessions independent of the present point of access to the network. Because of *handoff*, this generally requires the maintenance and mobility of some session-state information.

The second attribute is *context-awareness*. Context includes all the circumstances and facts that surround a particular situation or event. If a system is aware of the context, it may adapt its behavior accordingly. Typically, context includes facts like location and proximity, user and device identity, time, history, and activity [9]. Location information is one of the most important pieces of context information. Computer networks have generally released people from the boundaries of the physical world, but the mobile Internet can make use of locations, obtaining the benefit of their inherent characteristics and constraints.

The third attribute is *content adaptation*. There are several reasons for manipulating content information. These include device features, user profiles, context information, and the content's own characteristics, as well as service properties. In particular, the characteristics of the wireless link between the wireless terminal and the access node should be taken into account in content adaptation.

The fourth attribute is *ubiquitous* or *ambient* computing. This concept extends the reach of computation and information beyond the traditional framework of a computer application running on a fixed set of hosts. The extension may be physical, breaking the ties of the wired desktop computer. Alternatively, the extension may be in scope, providing information services to the public in a form that does not require technical expertise [11]. Ultimately, this attribute may lead to the disappearance of computing into a fixed infrastructure and environment, or into the users themselves in the form of computing-enhanced clothing or ornaments.

Factors	Attributes
Technology	Moving user Roaming Context-awareness Content adaptation Ubiquitous computing
Economy (entities) (economic environment)	Dynamic capabilities Intangible resources Low hierarchy Network economics Lock-in Branding
Society and individuals	Globalization Market culture Changing work Challenges to political systems Changes in minds and behavior

Table 1. Factors and Attributes.

Economy

The fast pace of technological progress often makes people forget that the laws of economics do not change easily [18]. The study maps the key economic attributes. They are separated in two categories: those describing entities and those describing their economic environment. Then three major attributes are identified in both groups.

The *dynamic capabilities* of the organization become increasingly important [15]. In firms, this means a strong change culture through specialized scope and focus on innovative niche products and markets. In the mobile Internet, the niches are likely to become ever more fragmented and transitory. Teece has described dynamic capabilities as the ability to sense and seize new opportunities and manage intellectual assets [21]. By contrast, static capabilities focus on the efficiencies of existing procedures.

Second, the *resources* become intangible. Intangibles may be turned into value not only through traditional income from licensing and sales, but also from strategic positioning. Entities use more efficient licensing strategies based on detailed product differentiation [18, 20, 21].

Third, organizational entities and internal processes become more integrated with *low hierarchy*. The lifetime of a low hierarchy may be very short, as new ad hoc hierarchies emerge for specific purposes, such as providing a contextual service for a unique event [2, 11, 21].

On the environment level, mainly in the markets, *network economics* and network effects are perhaps the most determinant attributes. Firms build alliances and partnerships for strong external relations. Products and services that rely on demand create economies of scale that turn out to win [18].

Second, *lock-in* has become a key term in describing information economy. The most profitable products are those that can be turned into long-term services. Lock-in situations are self-feeding because the information exchange can be tailored according to the needs of the parties [18]. In the mobile Internet, the intimate relation between the user and the user's personalized terminal and services may strengthen the lock-in effect.

Third, the networked economy strengthens the importance of *branding*. The holder of a strong brand may also franchise or license it to enable growth in new markets. Brands break ground in society. Sports, music, and movies are already commodified into brands. On the other hand, existing brands do not automatically guarantee success in the digital environment [17,18]. Brands also contribute to trust formation and maintenance.

Society and Individuals

Globalization, one of the most discussed attributes, describes the fundamental societal change in the information age. Although only vaguely defined, globalization is a complex set of economic, technical, cultural, and political processes taking place all over the world. Global capitalism is taking over nation-states and local political systems. The global institutional infrastructure lags way behind the power and movement of financial capital. According to Soros, this creates a fundamental instability that may lead to financial crises that can shake the foundations of society. In addition, globalization contributes to value fragmentation by strengthening cultural and fundamentalist local communities that reject common values and build their own. Globalization also influences the everyday life of individuals, for as Giddens observes, people ranging from cosmopolitans and fundamentalists are obliged to try to live together [2, 5, 19].

The attribute *market culture* aims to convey how social interactions of all kinds are increasingly being broadly and deeply commodified. At the level of individuals, clear monetary incentives lead to the building of networks for every imaginable individual interest. Digital computer technology and computing networks lower the entry barriers for new products and services. Meanwhile, at the firm level, producers of cultural products rely more on market analysis than artistic taste. Individuals in the information society seem to consume faster and become bored more easily [17].

At the level of individuals, the changing concept of *work* is affecting daily life. This change is illustrated by the emergence of networkers, fleximers, and e-lancers [2, 12]. Flexibility in working arrangements is bringing about new work-life policies that allow employees to have more control over their jobs and personal lives. Many traditional work environments are bound to change—more offices will go virtual, more employees will telecommute, and nontraditional work schedules will be the norm [2]. As Himanen explains, a *hacker ethic* is challenging the “Protestant ethic” that was formerly the basis of the individual's obligation to work [8].

Information technology may introduce serious *challenges to political systems*. According to Castells, the collapse of the Soviet Union was largely due to its

inability to assimilate informationalism [1]. Himanen illustrates the role of information technology in the Kosovo crisis of 1999 [8]. Several countries, for political reasons, are currently trying to limit their citizens' access to the Internet. Mobile technologies make the future even more challenging for any political system based on limiting its citizens' access to information.

As information technology affects people's lives in many ways, there may be significant changes in their *minds and behavior*. At worst, this can appear as an addiction, but there are many other possible phenomena. It remains to be seen how people react to increasing telecommuting and virtual working communities. Restructuring their social identities can affect how they feel about themselves. Ever increasing surveillance and ubiquitous computing change notions of privacy. In general, there are many important issues on the individual level yet to be researched.

Scenarios

General

A total of twelve scenarios were created and carefully analyzed. To keep this article focused, the discussion will center on the three scenarios that best illustrate the factors and attributes discussed above. The scenarios that were left out did not affect the results qualitatively. Table 2 illustrates how the sample scenarios cover the attributes. Abandoning any of them would leave some attributes uncovered. Thus they constitute a minimal cover of the attribute space.

All three scenarios are quite positive in tone and give an attractive view of the future that will be enabled by the mobile Internet. In order to avoid the lure of techno-optimism, the dark side of mobile technology and the related problems was considered in some of the other scenarios.

Weather Service

In this scenario, the user has a service agreement with a mobile Internet Service Provider (MISP) including a weather service that is actually provided by a Weather Service Provider (WSP). A user who moves beyond the geographical area covered by the MISP connects to a local access operator. The service should adapt to the local context and give information about local weather.

Where does the adaptation take place? From a technical viewpoint, it might make most sense to adapt the weather service as near the user as possible, that is, by the access operator. Only the access operator (and, of course, the user) knows the location of the user for sure. However, the access operator does not necessarily know enough about the service to make the adaptation. Therefore, it may be necessary to move the adaptation of the service up to the Weather Service Provider, which, on the other hand, probably does not have information about the user's location.

Scenarios	Factors and attributes															
	Technology					Economy			Society and individuals							
	Moving user	Roaming	Context-awareness	Content adaptation	Ubiquitous computing	Dynamic capabilities	Intangible resources	Flat hierarchies	Network economics	Lock-in	Branding	Globalization	Market culture	Political systems	Mind and behavior	Changing work
Weather service	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shared pictures	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Health monitor	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 2. Attribute Coverage of Scenarios.

Contracts

Who is authorized to adapt the content? Perhaps the access operator does not have an agreement with the user or with the MISP or WSP. Perhaps, too, the context information is transferred from the access operator to either the MISP or WSP and it adapts the content.

If the access operator does not have an agreement with the user, it may not be permitted to disclose the end-user's location and other information. If the end-user's mobile device has information about its location, it is possible to make the end-user disclose the position info directly to the MISP or WSP. In that case, user's privacy is a less important issue. However, technically, it is not optimal to adapt content that far from the terminal.

The problem could be at least partially solved using metadata. For example, the WSP could send the access operator metadata on what kind of information is available. Based on the metadata, the access operator requests information that is appropriate for the context. The WSP could also send metadata describing how the information can be adapted. Legally, however, it is how the parties can make sure that all their rights are respected if there are no appropriate contracts.

In general, the way information flows from a sender to a recipient on the mobile Internet is not quite deterministic. Since there is no way to precisely predict which parties will take part in the chain, making agreements in advance can be difficult.

Intellectual Property Rights

Although basic weather information is hardly subject to copyright, it might be covered by database protection in some countries. The service itself and especially certain edited parts of the information it embodies can be copyrighted. The more original the information a service provides, the stronger the legal protection it can obtain. A service can also be trademarked, thereby preventing adaptation on the grounds that it comes from the original source. Some parts of the service could be patentable as well.

International Law

It can be difficult to predict which jurisdictions are involved in a transaction on the mobile Internet, but the legal interpretation of the transaction depends on the jurisdictions involved.

Shared Pictures

The second scenario is about sharing pictures between users (*see Figure 2*). Imagine digital cameras with wireless Internet connections or indirect connections via a proximity network such as Bluetooth technology. One can al-

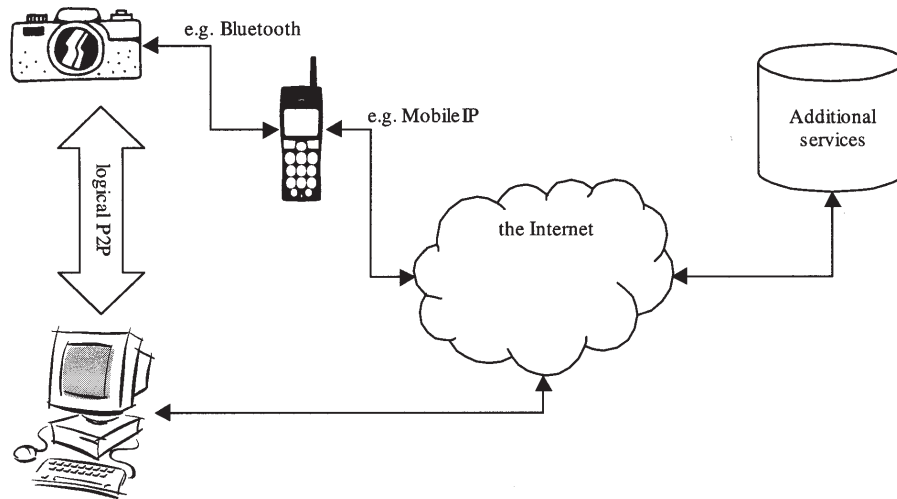


Figure 2. Digital Camera and Shared Pictures

low others to access pictures inside one's camera. The only services needed for this are the file-sharing software in the camera and the basic network infrastructure.

Jaakko takes a trip to Mexico. He can immediately publish some of the pictures he takes with his camera. His friend Gina can access the pictures instantly. Jaakko is interested in birds. His pictures of rare birds quickly spread on the Internet in a peer-to-peer-fashion (P2P). However, it is possible to also include value-adding third-party Internet services. For example, a user could order paper copies of pictures by sending them to the printing service on the Internet. Cameras only have limited picture-editing capabilities because editing requires computing power and sophisticated applications. These could be accessed through the Internet using the camera as a user interface. The business opportunities seem endless, which suggests that this kind of mixed P2P and B2C (business-to-consumer) model may become common.

Professional photographers may also find P2P models changing the way they work. José is a professional photographer. He entered this field as a hobby but soon began to commodify the pictures, and now makes his living by traveling from one crisis area to another around the world, taking news pictures in distant locations. Occasionally, he also takes pictures of events or famous people. The mobile Internet will change his work in many ways. He will not need a large organization or a back-office. He will be able to sell his pictures directly from his camera to the public. He may join with other photographers to form a loose peer group that will enable them to coordinate their work and, especially, build a brand for marketing purposes. The group could harmonize its infrastructure and offer customers access to a larger number of photos using the same system.

If José is not only a good photographer but an idealist, he might be able to shake up the political system. His pictures of unjust conditions and situations might make people realize how poorly they are treated. The borderless mo-

mobile Internet will be a difficult challenge for autocratic governments that want to censor such information.

Legal analysis raises a few issues. First, depending on the content of the pictures there can be identified several kinds of legal challenges.

Fine Art

A picture as such can be valuable. It may be creative and original, or it may include important information. If it is original, it can be copyrighted. Some jurisdictions give specific rights to photographers (e.g., Finnish Copyright Act 49 a §). The photographer may decide who can copy and distribute the pictures and on what conditions. Sharing pictures on the Internet would make it difficult to enforce these rights.

Event

Photographing and televising of certain events, such as concerts and sports competitions, is often restricted. This is because the organizers want to obtain revenue from selling rights to photograph and televise to media companies. Interestingly, these rights are based on contracts, not intellectual property law. If a consumer goes to an event and takes pictures, it may be difficult to show that a binding contract forbids photographing. On the other hand, if a person takes pictures of the event and shares them directly on the mobile Internet, it may be difficult to find out who the photographer is. The legal challenge here is to manage photographing and televising rights in the new situation.

Intimacy

People are willing to pay for candid photographs of celebrities. The legal challenges in this area are not different from those currently pertaining to paparazzi, but they will become more serious. Pictures in great demand, such as pornography, are a special case. Their economic value means that commercial publishers have an interest in managing the rights for them. In the scenario, however, the photographers are not likely to sell porn pictures. Instead, the pictures may be of private occasions or may include private information (e.g., places where someone has been or illustrating someone's habits). The legal challenge is to make sure that no one's moral rights and privacy are infringed.

Birds

Many documentary pictures are related to hobbies and do not represent a great monetary value but may be important in a certain social context. For example, a picture of a rare bird can prove to the bird-watcher community that the photographer actually saw the bird. The legal challenge is related to

moral rights—the photographer should have a right to be recognized as the person who took the picture.

Pictures of Other Works

A picture may be a copy of a copyrighted work. Digital cameras make it very easy to copy and distribute any work of visual art or literature.

The legal challenges in this scenario can be grouped according to legal areas. In each area, the challenges are analyzed from the perspective of the different actors.

Copyright

Copyright issues are most important to those who want to get a return of some kind from information. In this scenario, the professional photographer is the most interested in copyright. The issue includes the photographer's exclusive right to make copies of pictures and distribute them. In addition, moral rights can be important, especially for an art photographer. Intermediaries are careful not to be liable for copyright infringements. Other actors, like device manufacturers and service providers, can find business opportunities by enabling copyright protection.

Privacy

Privacy is very important for private persons. In this scenario, it mostly concerns amateur photographers.

Labor Law

Labor law affects professional photographers and their employers. In many countries, labor laws are badly outdated in respect to this kind of scenario. They are hard to apply in situations where working hours, company or group formation, and other conditions are extremely flexible. In addition, international issues will be significant.

Tax Laws

Tax laws face challenges similar to those pertaining to labor law. Traditional tax laws are hard to apply in the new kind of transactions that take place on mobile networks. Moreover, it is not clear what fiscal entity has jurisdiction to tax any given transaction.

Contracts

Contracts affect everybody in the photography scenario. As the law in this area, by and large, is outdated and cannot be revised quickly enough, most of the legal problems that arise must be solved by means of contracts. However, actors on the mobile Internet do not know one another. It may even be impossible to predict who will be the other parties in a transaction, because they may be on the move and the connections are changing. Therefore, the challenges in contract law will affect everyone on the mobile Internet.

Criminal Law

Criminal law is the ultimate legal protection system. Typically, photographers do not face criminal law in their everyday life, but it remains the eventual legal solution.

Health-Monitoring Service

People who want to be aware of the state of their health will be able to buy a health-monitoring service. The basic service includes a set of wearable sensors that send information about the customer's vital functions through the mobile Internet to a control center. Optionally, some of the sensors can be installed inside the customer's body. The service sends customers reports and instructions on how to improve their health. In an emergency, the service can also call an ambulance, a doctor, or other help, provided it gets the customer's location information. The customer could even be equipped with a dosage device, so that a physician in the control center can remotely administer, say, insulin, vitamins and micronutrients, or heart medicine when needed.

The capabilities of the service are heavily based on information. First, a good deal of information is extracted from the users and stored in the service. Second, a large computerized knowledge base is used to help the doctors make decisions and even automate some choices. Third, the doctors and other professionals in the service obviously use their own knowledge to help the customers. All this information can be very valuable, and therefore the service operator may be interested in selling it to other entities.

Health services have traditionally been local. However, the service described in this scenario is not geographically limited.

This scenario represents a sample application of ubiquitous computing. New business models are also involved. Some important psychological aspects should be considered, like how users will feel if an unknown person in a control center, a "big brother," even with their permission, is continually monitoring them and knows better than they how they are doing. This might also be an example of changing work conditions. A doctor can be sunbathing on a beach while on duty. In an emergency, the doctor gets all the information on the patient, including medical history and current condition, and is able to interview the patient using a mobile terminal while still lying by the sea [4].

International Law

If the service is provided globally, or if a customer travels abroad while using the service, international aspects become vital. Laws concerning health services are quite different around the world.

Intellectual Property Rights

In this scenario, intellectual property rights do not protect much of the information. They certainly do not protect data on a customer, advice from a physician, or a control message from the control center, however, important these may be. Intellectual property rights will take on more significance if the service is developed toward a more mature system that not only transfers data but also stores and distributes refined information.

Privacy

A large part of the information managed in this scenario is private by nature. People do not want information about their health to be spread around. Therefore, the system must support privacy and confidentiality extremely well. On the other hand, many companies and public agencies would be very interested in accessing these data. For example, a commercial company would be able to target direct marketing quite accurately at the right individuals if it knew as much about their habits and health as this system knows. Some customers might be willing to benefit from the situation, but others would be so concerned about their privacy that they would not dream of letting the service sell the information.

In the European Union, the data-protection directive sets quite strict rules for applications such as this scenario, but in the United States, for example, the issue of privacy protection has not led to comparable statutes so far. It remains to be seen which approach ultimately proves to be more attractive. Privacy is very important and must be protected, but overly strict privacy protection may have the unintended result of preventing the development of useful services.

Professional Negligence and Torts

The scenario presents a situation where physicians and other experts have a remarkable liability for people's health and life. It is extremely difficult to make a system of this kind completely reliable. In some countries, the damages from medical malpractice or product liability could be enormous. In general, entities that offer expert services via the Internet are liable for professional negligence. The legal risk may prevent services of this kind from coming into being, even if both customers and service providers want them. In addition, many countries have strictly limited who is allowed to give medical services

in their jurisdictions. A service like the one described here might be in conflict with such rules.

Conclusions and Future Work

Which legal challenges are most important depends on the viewpoint one takes. The discussion here focuses on four viewpoints, those of content provider, operator, device vendor, and user, because they satisfactorily represent different entities on the mobile Internet. Based on the three scenarios analyzed in this article, one may conclude that intellectual property rights, privacy, and contracts are the legal areas that pose the greatest challenges on mobile Internet.

Intellectual property rights, and copyright especially, is the legal area where most of the challenges will arise. This is not surprising considering that the article focuses on information products, which are often protected by intellectual property rights. The interesting point, however, is that new kinds of challenges are emerging. In particular, issues related to content adaptation will be more problematic on the mobile Internet than before. In addition to legal protection, future information products will be increasingly protected by digital rights management (DRM) systems and other technical measures. On the other hand, it should be possible to provide high-quality service by flexibly distributing content and adapting it based on context. Fitting these different aspects together will be a remarkable challenge.

Privacy will also be a very important legal area. Mobility, context-awareness, and ubiquity will bring computer networks into even the most intimate places and lifestyles. Context-awareness becomes most beneficial if context-information can be used on the fixed-network side of the wireless link. However, users do not necessarily trust the access provider and do not want to disclose context information that may impart private matters. Challenges to privacy are much greater on the mobile Internet than ever before.

There will also be major challenges related to contracts. On the mobile Internet, it will not always be easy to find out who the contracting parties are and to state what the subject of a contract is. Determining when the parties have committed to the contract may also be difficult. A further problem may arise when trying to decide what body of law governs and what authorities have jurisdiction over disputes. The fragmented structure of the mobile Internet is the fundamental reason for all of these contractual challenges.

There will be noteworthy challenges in other legal areas too. For example, international law will be important, because of globalization and the fact that users are moving from place to place. Labor law will face challenges because of changing work conditions. Tax laws will be challenged by new kinds of transactions, resources, and incomes, as well as user movement, globalization, and changing work. Criminal law will be challenged not only by the emergence of new kinds of international and computerized criminals, but also because it will be very difficult to decide whether some objectionable act in the new environment is punishable under existing law. Constitutions can face challenges as political systems are challenged. Nevertheless, based on the sce-

nario analysis, those other areas do not seem likely to raise problems as crucial as those presented by the first three.

The work presented in this article is clearly incomplete, and several avenues for further study are open. First, the research method is still immature, and should be extended both in scope and in depth through the inclusion of further attributes and analysis viewpoints. Its unorthodox character raises issues that remain to be fully addressed. On a more pragmatic level, it is also necessary to decide how to more fully integrate external experts in the analysis and discourse that forms an essential aspect of the method.

The research could be extended in a constructive direction through some form of business method prototyping. Role-playing games are one alternative, and they have already been experimented with separately. They would be especially useful for studying mobile users' roles and perceptions of a service, and they might be generalized to also cover other stakeholders and viewpoints [10].

Finally, the authors intend to export the findings from this study to a related research effort at the Helsinki Institute of Information Technology concerned with horizontal service management in the mobile Internet. This project will focus on the creation of value networks, and in particular on automatically created and enforced contracts between the nodes of a network. The longer-term aim is to understand how (and to what extent) a service infrastructure can embed legal rules related to the provision of a particular service.

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