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Herwig Unger (Eds.)

LNCS 3908

Innovative Internet Community Systems

5th International Workshop, IICS 2005
Paris, France, June 2005
Revised Papers

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Library of Congress Control Number: 2006924583

CR Subject Classification (1998): C.2, H.3-5, D.2, I.2.11, K.4.1

LNCS Sublibrary: SL 3 – Information Systems and Application, incl. Internet/Web and HCI

ISSN 0302-9743
ISBN-10 3-540-33973-6 Springer Berlin Heidelberg New York
ISBN-13 978-3-540-33973-1 Springer Berlin Heidelberg New York

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 11749776 06/3142 5 4 3 2 1 0

Preface

This volume of *Lecture Notes in Computer Science* contains all accepted papers of the 5th International Conference on Innovative Internet Community Systems (I^2CS), which was held at the Sorbonne in Paris, from June 20–22, 2005.

The previous four conferences in Ilmenau, Rostock, Leipzig (Germany) and Guadalajara (Mexico) developed the profile of this event. Traditionally, there are topics discussed in three main aspects. All of them must be considered in a united manner in order to investigate and understand the emergence and evolution of communities in the Internet: knowledge about networking, content and text processing as well as theory. The goal of the I2CS workshop is to bring researchers from both industry and academic fields together to discuss current progress and future developments in these areas and to eliminate the gap between theory and application.

At this point, we want to express immense gratitude to all the authors of the submitted papers and to the members of the international Program Committee for their contribution to the success of the event and a program of high quality. In a peer-to-peer review process, 17 papers were selected out of 27 submissions. Three reviewers evaluated all the papers and sent the authors comments on their work. The three invited talks discussed the innovation process revisited by the Internet, GRID computing and aspects of learning in communities. These talks were given at the beginning of each conference day, which provided a great framework for the following presentations. Sorbonne, one of the oldest and most famous universities in this world, as well as Paris gave us an inspiring environment for intensive and fruitful discussions.

Our next conference, the I^2CS 2006, will take place in the charming city Neuchatel in Switzerland. We hope that most of our former and present participants as well as many new colleagues will take this opportunity to continue exchanging their knowledge and experiences devoted to the development and use of Internet communities.

June 2005

Alain and Marc Bui
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Innovation Processes Revisited by Internet

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Abstract. Internet, far from being a simple technology, is truly changing our way of life. Just as the invention of the alphabet, or the printing, Internet is a fundamental technology that we have designed, but which, in turn, is impacting our behavior, our relationship with the world and ourselves. By empowering ordinary citizens, it helps us to face a cognitive paradigm shift. This is deeply rooted in the design process of Internet, which has led a new way to perform innovation.

1 Some Internet Fundamentals

1.1 The Deep Roots of Internet

When trying to understand why Internet became so important, two very important quotes come to mind.

The first one is from a extremely well-known visionary, whose work was the great announcement of the Internet era: Marshall McLuhan.[1] Not only did he foresee the "global village", not only did he say this sentence, whose implications are very difficult to admit: "The medium is the message", not only he said that technologies are extensions of our bodies, but he positioned one of the fundamental revolution that Internet is helping us to achieve: to transform us from "passive" spectators into "hot" actors. This is to be seen not in the official web sites of standard media (press, TV, radios), simple transcriptions of the content from one medium to the Internet, but in the numerous personal web pages, blogs, web forums, peer to peer systems, where million of people are exchanging ideas, contents, passion, objects, or anything that can possibly can be exchanged.

The second quote, albeit close to McLuhan's ideas, is a more comprehensive highlight of the relationship between mankind and technology. It comes from a French paleontologist, André Leroi-Gourhan, who understood the co-design between the hand and the tool. As soon as the standing position was adopted by our ancestors, the hand became free to create tools, which, in turn, changed the people, and also prepared for the invention of speech, something quite fundamental for the evolution of mankind, and the importance of interpersonal communication.

Therefore, same as the crane is an extension of our arm, and helps leverage our physical strength, Internet can be viewed as one technology which is the extension of

[1] Though many high quality web sites refer to Marshall McLuhan's work, there exists an official one, which can be found at http://www.marshallmcluhan.com/.

A. Bui et al. (Eds.): IICS 2005, LNCS 3908, pp. 1 – 16, 2006.

our brain, and helps amplify our cognitive capacities. But Internet was not the first technology which helped us in such a way. Our knowledge, our interactions, have been impacted by many other technologies, of which some major one has accompanied a society paradigm shift.

We can propose that there have been three major cognitive paradigm shifts, all based on two innovations. The invention of writing, and 3000 years later, the invention of the alphabet, have been along with the transformation of a nomadic type of society, based on hunting and fishing, to a more sedentary type of society, with the development of agriculture and breeding. The invention of the book, and 500 years later, of printing, has been the necessary technological condition to create the Renaissance, the great discoveries, and the industrial world. The invention of the computer, not in the computational sense, but in the cognitive meaning, and 25 years later, of the Internet, is what we need to move from the industrial world to something else, which is usually called either "the knowledge society", or the "communication society". We shall propose, at the end of this paper, another definition: we are entering the "interaction" society, where the big issue which we need to address is complexity.

Table 1. The three major knowledge manipulation paradigm shifts

	Knowledge representation shift	**Knowledge broadcast shift**
Farming societies	Writing	Alphabet
Industrial societies	Book	Print
Interaction societies	Computer	Internet

It is important to stress the fundamental innovation which is the alphabet. Without the alphabet, abstractions are more difficult to represent. It is a fact that the explosion of knowledge, in many fields such as medicine, astronomy, mathematics, physics, philosophy, that the ancient Greeks have created was based on the usage of an alphabet. More important for the creation of the Internet, without the alphabet, there is no code; the computer simply could not exist.

We may say that the deep roots of Internet shall be found in those innovations: the writing, the alphabet, the book, the printing. The same debates, as the one we experience nowadays about the real importance of Internet, existed during all those transition times. The most famous one is probably the denegation of writing by Socrates, who used to say that "writing does not convey knowledge, but the illusion of knowledge". A sentence that we have heard so many times about Internet...

1.2 Three Industries

It is important to recall how the Internet was built, from an industrial perspective. Its very innovative building mechanism had many consequences on the usage of Internet,

of its rapid acceptance among people, and was the basis for its tremendous power of transformation.

It is usual to present the Internet as a result of a question about how to design a network which could resist a nuclear attack. This issue was raised at DARPA, the US defense agency, but it is only a minor element on the construction of the network, and brings no real clue about the fast acceptance of this network.

It must be kept in mind that the two founding papers, as quoted on the Hobbes Internet timeline[2], were the Kleinrock article [1] written in 1961 which describes packet switching communication and the Licklider & Clarck paper written in 1962 about a network encompassing social interaction [2].

The explanation of the fast growth of Internet can be found in the remark that is the result of a confrontation between three major industries: Information technologies, Telecommunication, and Media.

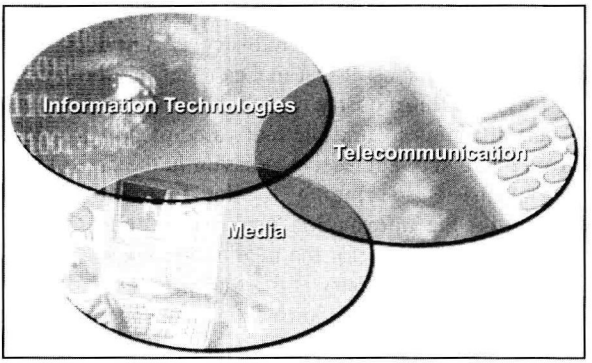

Fig. 1. The three industries which have prepared the path to the emergence of Internet

Those three industries have their own characteristics, their own culture, and they have all brought to the construction of the Internet a unique know-how.

The Information Technologies industry is composed of hardware manufacturers, software vendors, developers. It is a recent and very fast changing industry. Companies who were leaders, or well-known, have died in a few years, such as Digital, bought by Compaq, itself almost absorbed by Hewlett-Packard. IBM was on the edge of dying, and recovered by abandoning part of its hardware manufacturing. On the other hand, Microsoft and Intel have been for ever flourishing, to such a point that it is difficult to imagine what could happen to them, even though it is clear that companies die one day or another. Others, like Apple, are still searching for their market. It is an industry very much based on trial and error culture for defining its champions. The digital world is the basis for this industry.

The Telecommunication industry is made of telecommunication operators, incumbent or newly born, and the companies which they have generated, such as Lucent, Alcatel, Nortel, Siemens, Nokia, and Ericsson. It was built owing to the tax payer money, and faced the difficult technological challenge to create a network. Its

[2] http://www.zakon.org/robert/internet/timeline/

culture is very military oriented, traditionally composed of big corporate players, with an engineer type of management: a strong belief in the technology as superior, and a product based marketing rather than a service based one. All players in this industry have recently suffered, but their cash flow is so big that they have been able to survive, at least up to now. The digital world is just a technology like another for the telecommunication industry, which has not always been good to promote it into social values. A good example of this is the ISDN invention[3], which never found its market.

The media industry includes press, radio, TV, music, movie industry. It is composed of big major players, such as Sony, Time Warner, Universal, Murdoch, and Hollywood. It has a trend to always absorb little players to create big empires, at the image of William Randolph Hearst, whose life is beautifully told by Orson Welles in the movie "Citizen Kane". It has a real power, the one which is called the fourth power. In 1898, the Maine battleship was blown-up. One theory was that the Spanish did it, to start a war with the US. Hearst sends two photographers, who, seeing nothing serious, mailed a message to Hearst quoting this. The answer from Hearst was "You furnish the pictures, I'll furnish the war." The culture of this industry is based on the assumption that possessing the content is a unique asset that makes it above all others. The digital world is considered as the Devil for this industry, which is not able right now to understand the value beneath it. Their difficulty to find the real value of peer to peer systems was unfortunately transferred into a very aggressive behavior in the face of this phenomenon.

Each of these industries is bringing to the Internet world a unique value proposition: interaction for the Information Technology Industry, peer to peer for the telecommunication industry, content for the media industry.

The Information Technology industry is the one which has the done most research and explored a lot of new ideas in knowledge management and man machine interfaces. From Database manipulation tools to natural language query, from XML standards to hypertext ones, from keyboard to mouse, the constant quest for better interaction led to a huge richness in the interaction between human and the machine. The other two industries have not so far achieved such a level of interaction; plain old telephones, as well as TV remote controls, are probably amongst the worst machines in terms of interaction.

The Telecommunication industry has invented the peer to peer, this extraordinary facility to hang up your phone, to dial in a number, and to be connected with another person even on the other side of the planet is so usual that we forget the beauty of it. The funny thing is that, when the telephone was invented, one of the main purposes was "to listen to the music from home without the need to physically go to the concert hall". It is a constant in the telecommunication industry to invent beautiful technologies without guessing the extraordinary social impact it may have. Telephone was one, SMS another one. On the opposite, it took a long time before networking was introduced in our personal computers, and in our homes. And we shall even not mention how the media industry is considering peer to peer...

The Media industry is bringing content: meaning, beauty, pleasure, which is unique. This is not to be found in the other two industries. Internet is bringing a lot to the media Industry: content archiving, content retrieval, CD indexation systems such as cddb, Imdb, etc...

[3] "Innovation Subscribers Don't Need", as it was quoted.

Interactions between the industries have occurred in the past. In the years 1980s, Bulletin Board Systems (BBS) were combining interaction and some limited local peer to peer capacities. In the years 1990s, CD-Rom was combining content and interaction. But we had to wait until 1995 for the real combination of the three Industries into the expansion of Internet into wide audience.

The past 10 years have been extraordinarily rich, in terms of the explosion of Internet usages, as we all experienced it. As an example, considering recent major political issues, such as the war in Iraq, or the European constitution, it became obvious that all traditional media companies were biased, and that Internet was the only media where debate took place, where different ideas could be expressed, and confronted, seen by millions of people, with their participation.

Before moving along, we should not forget one point: there is still one huge part of our world which is not connected to the Internet; there is a huge part of mankind which does even not have access to electricity. The following figure, which it is the submarine bandwidth capacity, is a good illustration of where the interactions are located. It is one of the most efficient lessons of geopolitics that we can dream of.

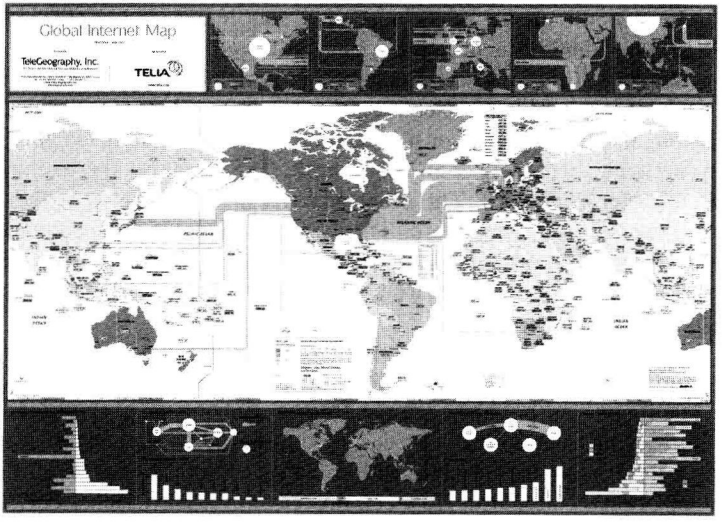

Fig. 2. The global Internet map, from Telegeography, http://www.telegeography.com/maps/

2 Four Major Disruptions

We propose that the construction, and the expansion of Internet, is based on four paradigm shifts. One is about the technology, which was designed with the idea of going totally reverse from what the telecommunication operators were promoting at that time. The second one is about funding, and how the entrepreneurial spirit of the Silicon Valley has played a key role. The third one is about Business Model, and how moving to an intangible economy is important. The last one is about the usage, and is

the key point to understanding why Internet is more than a technology, and has a real sociological impact.

2.1 Technology Disruption

It is always difficult to define what really an innovation is. However, we may say that Internet, both in its construction process, and its technological choices, is a real breakthrough. We must understand Internet as a complex system based on three pillars: a network of networks, a set of protocols, and a bunch of different services, of which many of them have not been invented yet.

The fast growth of the network is explained by the founding choice to go for a packet switch network rather than a traditional commutated network. The best analogy to explain this is to compare train versus road. A commuted telephony network is a little like a train network: the bandwidth is allocated for the phone call, same as the tracks are allocated for the train. If there is congestion, the phone call cannot be placed, such as trains don't leave if the track is not open. On the opposite, in a packet network, content are placed in packets which can go through different routes to reach their destination; just like a car drivers who wants to go from one place to another has the choice of the road. Just like if the road traffic is heavy, the journey can be very long, if the network is busy, transmission time is high.

The first innovation that packet circuit brings is that it allows for an exponential growth of the global network. Connecting one more network to the Internet is simply done by building a gateway, whether it is a corporate network, a metropolitan network a university network, or simply a home network. This explains the explosion of the number of computer connected. The other advantage is a global cost reduction: the same architecture applies everywhere. The last advantage is independence between the protocol and the transport layer, whether it is copper, cable, fiber optic, or wireless. The astronauts in the space shuttle are connected to the Internet and can read their email sent by their relatives.

Along with the packet-switch network, the other big innovation was the RFC mechanism for the definition of standards. Few managers, even in 2005, believe that something intelligent can possibly emerge from a decision process based on voting. But this is how all Internet norms were designed: published "Request for Comments", followed by a discussion, then a vote, with the only constraint that there must exist a first implementation of the norm. How can this have produced such a complex object which is the Internet, without any major bug, is fascinating. But it worked.

The third innovation was the difficult choice to give up with total quality, but rather to rely on best effort strategy. This was the main concerns that telecommunication operator had towards voice over IP at its beginning: how a network based on best effort can possibly transport voice with the same quality as telephony. Again, in 2005, the voice over IP market is booming, and becomes more and more a standard offer, including from the incumbent operators themselves. The proof has been done that a best effort strategy was working.

The fourth innovation resides in the independence between services, and network. As long as a service respects the norms and protocol of Internet, no one cares about which type of network topology it is going through. This, combined with the usage disruption, has been key to the explosion of Internet.

2.2 Financing Disruption

At a time when there seems to be a debate about liberalism and a global economy, Internet is a perfect example of a good combination of both government, and private funding. At the very first period of time, Internet was funded by DARPA, the US Defense Advanced Research Projects Agency. This has worked for nearly 30 years, allowing the growth of the network to a "pre-commercial" status.

This funding could not be allowed for more commercial usage. The famous Al Gore white paper about a "National Information Infrastructure", published in 1993, started the beginning of the commercial Internet. It deliberately stated "a combination of public and private effort". But the true story is to be found in the history of Silicon Valley, and even further, in the Gold Rush.

In XIXth century, there were people in California, who had influence on the choice of the location of the train coming from the east coast, through the Rocky Mountains. They were buying such lands at low price, and reselling them to the government, making very high profit. They were called "the robber barons". One of them, after the tragic loss of his only child, decided to invest his money into a utopia, more precisely a University that would be totally different from East Coast Universities: women would be allowed, as an example; but also, the entrepreneurship would be encouraged. His name was Leland Stanford.

California has always been a land of utopia. The Gold Rush was more than just looking for riches; it was a utopia for people "disappointed by the European revolution outcome": to build a different type of society, more global. This utopia is also in the principle that were introduced in building Stanford University, the idea that technologies should not remain pure laboratory ideas, but that they should be made useful for the people. This was the basis for the creation of a system to finance the inventors. Among the first ones, the most famous where two engineers who, in their garage in Palo Alto, designed a brand new oscilloscope, two people by the name of Bill Hewlett and Dave Packard. And, later, the personal computer industry happened, which created and popularized the name of the "Silicon Valley".

However, back in the 1990s, the Silicon Valley was in a bad mood. Innovation seemed to have vanished, issues were mostly industrial, and Venture Capitalists were seeking for new fields of opportunity. And there was Internet, already widely deployed, which had successfully passed its technological proof, and offering one killer application that was just invented, the word wide web. Moreover, all our three major industries had not understood the Internet. The telecommunication industry simply ignored it, the computer industry did not understand it, and the media industry did not care. AOL and CompuServe were supposed to be the only model for interconnecting people. This situation was a dream for the Venture Capitalists. With the help of Al Gore, the network was opened, and Internet phase II could start, with the success that we know.

Just a look at those two following figures is quite illustrating. The European Commission, which had launched multi-annual R&D framework programs, was spending 16 billion Euros over a 5 year program. At the peak of the venture capital, US ventures were spending over 25 billion dollars per quarter. The Internet is truly a modern venture story.

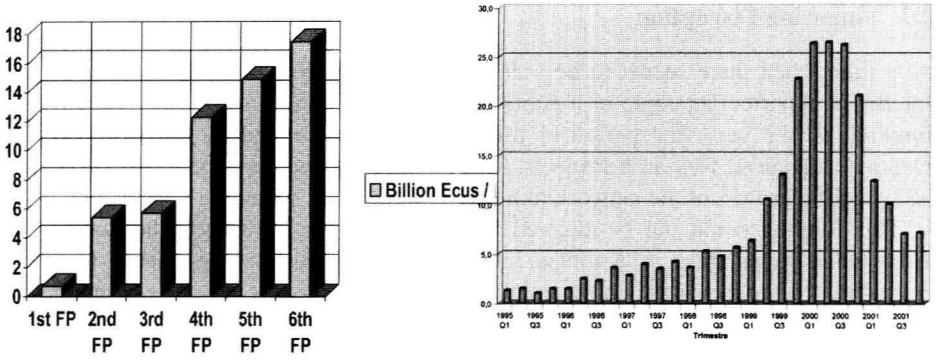

Fig. 3. Comparison between European R&D Framework Programs and US Venture investment

2.3 Business Model Disruption

Funding a company is not sufficient. It has to gain money, and for this to attract customers, and to sell them product and services.

Here comes one of the most intriguing paradoxes for many people: how come the Internet can be even more than a business, a real industry, but carrying ideas of "free" access to content or services. Of course, users need to pay for their access, but news is free, weather is free, telephony is free with VoIP, content is free with peer to peer systems. On the other side, many companies have tried to transform the value carried by Internet into profit. Some have been successful, like the three major Internet companies, often quoted for their success: Amazon, Ebay, and Google. Some others have failed, and have not survived the bubble explosion, like Altavista, who was the very first plain text search engine, many years before Google.

In fact, Internet is not a free system; it relies on the business model of an intangible economy, while many people still think of the economy of a tangible one. Internet was not the first industry to make this move: the airline industry has shown the path, some 20 years ago. Let us describe those two models.

An intangible economy is an economy of scarcity. It was the post-war economy, when everything was ruined and had to be rebuilt. It is also the economy of luxury. In an intangible economy, there are more potential buyers than products. The first consequence is that the buyer has to prove the feasibility of the transaction, and he has to compete with other buyers. The transaction is based on tangible criterions: people were opening the hood of a car to check the engine. People were buying things that would first of all last a long time. In this economy, *the value is in production.*

Then people, at least in occidental world, became richer. And slightly, the economy shifted to another model. An intangible economy is an economy of abundance. There are more products than buyers, and therefore the proof of the transaction is now on the seller side. As products tend to more and more look alike, the seller has to attract customers through intangible criterion: when buying a car, the financing scheme is now more important than the engine. In this economy, *the value resides in transactions.*

It has two impacts: first the information, and the knowledge, becomes the fundamental for the transaction to happen; second business models become instable, but it is structural, and we have to live with this.

Moreover, the rules that govern the tangible economy are not the same as the ones which govern the intangible economy. This can be illustrated through four different aspects: the price computation, the value distribution, the payer determination, and the transaction roll-out frequency. It is important to mention that all those rules are not independent one another; they altogether create the conditions to switch to a intangible world. Let us focus on each of them.

Price Computation: We have learned at school the supposed fundamental rule of economy, "price is equal to a cost plus margin". This is quite true in a tangible economy, but we are now facing a lot of cases where this rule is no longer valid, where there is no longer relation between the manufacturing cost, which becomes more and more difficult to determine, and the final price. Two examples can illustrated this: airlines seats can be very cheap at the day of the departure if the plane is not full, so the price is much lower than the marginal production cost; but people can pay more than one euro for a SMS whose production cost is virtually zero. The rule in an intangible economy becomes: "price is what people are willing to pay at the time of the consumption". Is it not what Shakespeare foresaw, when King Richard III begs "my kingdom for a horse"? Surely, the production cost of a horse is not at the same level as the value of a kingdom; in this precise case, we may suggest that the value was probably in the transaction.

Value Distribution: There was a single relationship between a buyer and a seller. Airline tickets were bought directly from Air France, Lufthansa, British Airways, KLM, etc; telephony systems were bought directly from the telecommunication operator. In a service world, what is wanted is an aggregation of services: people who want to spend a week-end in a European city do not want to bother about aggregation of services. They want a single place to get the air ticket, the airport transfer, the hotel, the restaurant, the museum entry, etc. Companies must therefore partner together, and create business eco-systems, a much more sophisticated answer than linear value chains, in order to meet the customer needs. As an example, a single ring tone download may need an eco-system of up to 8 companies dealing together, with money flows circulating sometimes both ways between them. Those complex eco-systems will be increasing in the future.

Payer Determination: Normally, the consumer should be the payer. Again, this becomes less and less true. People can watch TV, or listen to radio, for free. One of the greatest shifts when GSM was invented was to make incoming calls free for the GSM owner, and charging a lot the caller. Basically, this means that all people calling someone were in fact paying for his GSM phone. In an intangible world, the consumer is no longer the only payer. Sometimes he does not pay at all. At the beginning of Internet, Yahoo let us believe that third-party payer (mostly advertisement) was the unique model of the Internet. In fact, it was a very good model at the beginning of the Internet, when Venture Capitalists did not care about revenues, and when yahoo's main competitor was AOL. The situation is now somehow different,

though we could still argue that people will never pay for content. The most profitable newspapers nowadays are free ones, such as Metro.

Transaction Roll-Out Frequency: Financial compensation were done "later", people would not count their working hours. At the beginning of airline code sharing, compensation was done once a month, and, as tickets were not at all electronic, using a very simple protocol: tickets from each airlines were physically weighed, and compensation was done according to the respective number of kilograms... Now, compensation must be done in real time and for each transaction. This is not easy to do, as not all information systems are able to provide the proper information in real time. As an example, many web sites use an overcharged number, or a SMS, to have people paying for some content. But the relationship between the content and the payment is not always done, and the revenue comes globally at the end of the month. In the music industry, as an example, this global repartition prevents from paying back the right amount to the proper artist.

In the Internet world, the key success is to position the company in an intangible economy. Internet has grown because it has positioned itself at the articulation between free and charged [3]. The Information Technology industry traditionally prices per license. The media industry uses widely third party (mostly advertisement) business model, and the telecommunication industry is very good at pay per use. But, in the Internet world, dynamic business model becomes the rule. Business models are structurally instable, and we may argue that, in the Internet world, the "killer app", which everyone is looking after, is the business model. And, in order to determine the proper business model, the best way, as there are no rules, is constant trial and error. Above all, it is important to constantly keep an eye on the business model and to be able to change it rapidly when necessary.

The best example of this structural instability of business models may be found in the very high potential threats that each of the three major industries is facing: WiFi and free IP telephony for the telecommunication sector, open sources for the IT industry, and Creative commons for the media industry...

2.4 Usage Disruption

Telecommunication operators were providing very simple and basic services. The first one, by far, is to simply make a phone call. It still remains a very fundamental usage of telecommunication.

Internet, on the opposite, offers a wide range of services. Web surfing, email, chat, radio, TV, search engines, messages board, telephony integrated with other services, e-commerce, airplane train and bus schedules, hotel reservation world-wide, parcel shipping monitoring, price comparison, meteorology, access to databases, satellite images, etc. Even the simple content offering is huge: Google is proud to announce more than 8 billion indexed web pages, but the invisible web, those pages that have never been indexed by any search engines, is much larger. A recent survey[4] showed that the 60 largest databases on the internet contain a total of more than 40 times the known web.

[4] http://www.brightplanet.com/infocenter/largest_deepweb_sites.asp