Taxonomy of Digital Economy Business Models

Marko Jurišić, Dragutin Kermek
University of Zagreb, Faculty of Organization and Informatics, Varaždin, Croatia
{marko.jurisic, dragutin.kermek}@foi.hr

Abstract - Availability of high speed Internet connections, micropayment and credit card infrastructure has introduced new business models for vendors and enabled average consumers to use the Internet for shopping. Today it is possible to buy anything on the web with just a few clicks of a mouse, from groceries and gadgets to music and software. Penetration of smartphones and similar devices such as Internet tablets and e-book readers has greatly increased the percentage of general population which shops online.

This paper presents various business to consumer (B2C) business models, from traditional off-the-shelf selling in stores, online ordering and subscription models to pay-what-you want model, open source business models and cloud computing with hardware and software as a service approach. The paper assesses current business models' potential and rates them according to recent trends.

I. INTRODUCTION

During the last decade digital content has become an inseparable part of our everyday lives. Advancement of technology has made it possible to carry a lifetime's collection of music in your pocket on a USB thumb drive. Availability of high-speed Internet connections and micropayment and credit card infrastructure has changed the way we think about digital products and the way we procure them. Today it is possible to buy everything from groceries and gadgets to music and software from neighborhood store or the other side of the globe indiscriminately with just a few mouse clicks and have them delivered to your home without ever leaving the comfort of your living room.

Today's smartphones are more powerful than most desktop computers were just a few years ago with gigabytes of memory and processors faster than 1 gigahertz and most of them support high-speed 3G Internet connection or Wi-Fi which has facilitated development of ever better looking and feature rich applications and games with user interfaces which were before seen only in science fiction shows.

E-book readers have already changed the way many people read and buy books and on Christmas 2010 more e-books were sold than hardcover books [1].

Media tablets are forecasted to be the next big thing in the computer world with ideal fit between smartphones and computers featuring good battery life, great user interface and immense number of applications and games. Predictions are that they will push out other similar devices such as e-book readers or media players [2].

Every major company has adjusted their business model to make advantage of new information and communication technology and infrastructure. Completely new business models emerged which were inconceivable before the Internet era and new models are emerging every year.

This paper systematically describes business to consumer business models from the distribution and revenue source perspective.

The paper is structured as follows: Section II shows related work and gives definitions of business models and digital content. Section III gives a list of most used business models for distribution of digital content. Section IV assesses current models potential and rates them according to recent trends and Section V concludes the paper.

II. RELATED WORK

A. Digital product

Digital product is a bundle of properties comprised of information that is either digitized or produced electronically [3]. Traditionally one would go to the store and pick the product from the shelf, whether it is a music CD, movie DVD or specific software. Nowadays most users buy digital products online and download them anytime and anywhere they want. Biggest advantage of that approach is that the store is no longer necessary and the products are available for 24 hours a day, 7 days a week and 365 days a year.

One of the biggest problems with digital content is the ease with which those products are copied. Digital copies unlike analog contents have the same quality as originals and are subject to much abuse. Several forms of digital rights management (DRM) are used to prevent users from copying digital contents but without ultimate success.

Software copyright infringement or software piracy is an extremely common occurrence. There are multiple theories that describe piracy from aspects of moral development, equity theory and moral intensity [2]. Piracy is especially common in countries with low per capita income [3].

Digital rights management is an important issue ever since digital data entered mainstream [4]. Problem is to find optimal level of protection where too sophisticated protection model can prevent legal users from using their legitimately purchased software [5].

B. Business model

There has been much research about business models especially in the last decade because of emerging Internet business models of which many brought great success but there is no common definition or understanding of business model and its elements [6, 7, 8, 9, 10, 11].

In the industrial era it was simple to describe a company's business model, most companies operated in well known and established ways [12]. Internet changed all that as it expanded companies' reach worldwide and enabled personalized shops for every client [13]. Most authors refer only to parts of business model relevant to their point of view and some authors view business models in a broader perspective as a coupling between strategy, revenue stream, technology and surroundings, there is also a systems dynamics approach presented in [14] and ontology approach presented in [15]. We focus on definitions by authors who also proposed taxonomies for business models in the digital economy.

Most cited definition is by Timmers who defines business model as a conjunction between product and service architecture with description of business actors and their roles, benefits for all actors and description of the sources of revenues. Timmers also gives one of the first taxonomies with eleven internet business models in the same paper [8].

Alt and Zimmerman define six generic elements which are present in most of definitions: mission, structure, processes, revenues, legal issues and technology [7].

Mahadevan defines a business model as a blend of three streams that are critical to the business: the value stream for the business partners and the buyers, the revenue stream and the logistical stream and gives taxonomy of models according to each stream [9].

Linder and Cantrell give definitions and examples for components of business models, operating business models and change business models with emphasis on change business models which deal with how organization changes business models over time [6].

Rappa defines a business model as a method of generating revenue. Nine categories of business models on the web are defined which are further discussed in detail with specific examples [10]. Rappa's list is very detailed but it lacks several business models which appeared in the last few years such as mobile stores and cloud computing models.

Applegate introduces a business models framework consisting of three components: business concept, organization capabilities and value and gives taxonomy based on that concept [11].

Bartelt and Lamersdorf offer a detailed classification of business models through a two dimensional matrix with subjects and their behavior as dimensions [16].

In the following section we present taxonomy of models based on the way businesses distribute digital goods and on fundamental element of business model: “Business model is a statement of how a firm will make money and sustain its profit stream over time” [17]. We shall analyze most frequently used business models in the digital economy for businesses that deal with digital content in any way. This list is not nearly exhaustive or definitive but gives overview of recent trends and developments in the field.

III. BUSINESS MODELS

A. Off-the-shelf procurement

The most commonly known model is off-the-shelf procurement where customer goes to a store and picks the product in shiny package from the shelf, regardless whether it is a software package, music CD, movie DVD or a video game. Main characteristic is that the digital product is recorded on some medium and the buyer must be physically in the store to shop. Literature usually refers to this model as bricks and mortar [6, 15, 17] business opposed to clicks and mortar or brick and click [6, 7] for physical stores that also have a possibility of online shopping.

Digital products are usually copy protected in some way. There are numerous types of copy protection, most advanced are used for protection software and games. Most of copy protection methods involve physically different mediums or constantly checking whether the original application has been modified and/or checking whether the medium (CD or DVD) has been copied in PC systems. Some of these methods are quite successful but there are shortcomings such as enabling malicious software to run under the protection’s cloak or degrading complete system’s performance [5]. Other methods of protection involve online product activation which is easily cracked but creates numerous issues for legitimate users such as in case if they have problems with internet connection.

Advantages of this model are that there is a tangible product, usually with added value content such as lyrics brochure with music or printed manuals with software and games, which may lead to customer’s greater perception of value of the product. Special case are collectors edition game packs which include collectable figures, books, posters and similar items which raise the pack value and can achieve several thousand dollars on auctions (some collectors editions of World of Warcraft game auction for 2-3 thousand dollars on eBay).

Obvious disadvantage is that user buys the medium and if it is damaged or lost, so is the digital product. Some states allow copying of content “for personal use” but copy protection mechanisms often hinder that right and make it impossible for average user to copy rightfully bought content for protection.

B. Online procurement

Broadband development together with micropayment and credit card systems has made online digital product procurement a trifle; users can buy new products with just a few clicks. If there is no tangible product, after the transaction's completion customer is given the right to download the selected product, usually via a link that is tied to that customer. Products marketed this way usually have a lower price than the same products sold in retail

form in stores because of lower running costs. Obvious advantage is that the customer can download the product anytime anywhere and use it without the need to preserve the packaging. Downloaded software usually involves online activation of the product or the product can only be used through the software that was used for procurement and downloading, two successful examples of this approach are iTunes used for buying of music and movies and Steam which allows its users to buy and launch over 1200 game titles. Other examples are Windows Marketplace which allows buying and downloading Windows programs and Ubuntu Software Center which runs on Ubuntu Linux and enables users to search for, install and remove applications of all kinds from one centralized application.

Advantages are that there is no physical medium which allows users to access their content anytime anyplace with given credentials.

Disadvantage is that user is required to have Internet access to download the purchased content which can be a big problem for users without broadband connections because software packages have a tendency to be larger with each new version.

Special cases are time limited offers, usually tied to holidays such as Christmas or Thanksgiving or special events like the FIFA World Cup where customers are encouraged to buy the products at significantly reduced prices during specified period after which the prices return to normal.

Mobile phones have gone a long way since offering just phone calls and short text messages, modern smartphones have capabilities which are near those of desktop computers. Todays smartphones feature gigabytes of memory and processors faster than 1 gigahertz and most of them support high-speed 3G Internet connection or Wi-Fi which has facilitated development of ever better looking and feature rich applications and games with user interfaces which were before seen only in science fiction shows. Nature of mobile devices and the fact that they are bound with mobile network operators makes buying content online and downloading a straightforward solution. Almost every major phone manufacturer has launched an application store where users can browse and download programs, games, ringtones and videos. Most notable are Apple's AppStore, Google Android Market, Nokia's Ovi Store, RIM Application Store and BerryStore. Currently Apple's AppStore is the leader with over 350 thousand applications, 160 million users who made 10 billion downloads [18], followed by Google's Android Market with about 200 thousand applications which were downloaded more than 3 billion times [19]. Stores have two choices: either require users to give their credit card information or rely on mobile network operators to handle the content billing.

Tablet computers are currently the hottest gadgets with 2011 being named "The Year of the Tablet" [20] and new business models are being introduced to make advantage of the tablet hype. AppStore already has more than 60 thousand native applications for Apple's tablet – iPad [18] and recently a whole newspaper was launched exclusively online for the iPad by Rupert Murdoch [21].

C. Subscription model

Subscription model means that a user must pay a yearly, monthly or weekly fee to use the product, regardless whether the digital content was procured in bricks and mortar store or downloaded from the Internet.

Simple example is paying a monthly subscription fee to listen to high quality internet radio stream without commercials or to play an online game.

Advance of cloud computing has made it possible to rent virtual machines with desired specifications and operating systems as well as single programs and to pay only for what was used which has enabled some new business models among which the most prominent are Software as a service, Platform as a Service and Infrastructure as a Service [22].

Software as a service – SaaS model was the first cloud business model, it enables users to use applications which run in the cloud with no need for end users to download and install or update them. Application and data are stored transparently in the cloud and can be accessed regardless the location or configuration of the current client's host computer. Examples are Salesforce and Google Apps on enterprise level or Facebook, Dropbox and Gmail as personal applications.

Platform as a service – PaaS model enables development and deployment of applications without associated underlying platform costs. Examples are Microsoft's Azure, Amazon's Relational Database Services and Google App Engine.

Infrastructure as a service – IaaS model allows using data and computational abilities as a service. Price is usually calculated according to processor power and usage, memory usage and data storage requirements.

There are some other less known models such as Data as a Service, Communications as a Service, Video Surveillance as a Service, Gaming as Service with OnLive just to name a few. We are moving to a world of Anything as a Service – XaaS.

Obvious advantages of cloud computing is that users do not need to worry about all hardware and software issues that normally appear during application development, deployment and running such as scalability, operating system updates, failing hardware and incompatible software versions. Applications and data in the cloud are accessible anytime anywhere, from any spot that has Internet connection, no specific hardware is necessary.

Main disadvantage is concerned with security; users are giving up control over their data which can pose a great problem for sensitive data. Another issue can arise in case of problems with Internet connection because application and data are in the cloud and not available offline.

D. Free access

"Free is almost a default business model on the Web" [23] Most content available online is available without any charge. Some businesses give users the possibility to

use the products – web pages, radio streams, software or games completely free of charge, financing through advertisements or sponsorship. That is the well known model used in classical over the air TV and radio broadcast where show is interrupted with commercials which are sold on per-second basis. Today it is most often used in web pages of any kind, internet multimedia streams and games, most often in form of banner ads but there are more and more infomercials and ultramercials [10] which prohibit user's access to content prior to watching the advertisement and appropriate action or answer. Contextual advertisement is based on current content that the user is viewing or on users overall preferences, data and history which is the initial business model of Google and Facebook, two largest Internet companies today. Income is usually calculated either by number of advertisement displays (cost per thousand views – CPM) or by number of clicks on the advertisement.

Content is sometimes provided only after user registers with the site, giving some personal information such as age, sex and location which gives better possibility of successful targeted advertisements. Most users find this annoying and multiple sites appeared which offer temporary or bogus email addresses which can be used only for registration on such sites and later dismissed which makes this business model questionable. Still some users gladly offer all their personal information on social networking sites such as Facebook or MySpace which is then used for displaying precise aimed contextual advertisements.

Free games usually work in a way that the user downloads a free game which during its execution downloads and shows predefined adverts at specific points in game, e.g. before the game starts or between levels or even on in-game posters. There are even entire games that serve as advertisements for a physical product such as a new drink or a movie.

A new model used mostly in games involves microtransactions and allows paying users to gain access to some features which are not available to non-paying users such as new areas or items which usually give them great advantage and enable much faster progress through the game.

Standish Group report states that adoption of open source software has resulted in savings of about $60 billion per year [24]. Free software and open source software are often confused; open source software can be marketed like conventional closed source software with the difference that the user who purchases or downloads open source software gets the right to study, alter and further distribute copies with or without changes. Freedom is what matters, not the price with 'free' as in "Freedom of speech" not in "Free beer" [25]. Traditionally software is shipped in compiled, closed and obfuscated form so that users can not modify it in any form. Free and open source gives the possibility and even encourages users to study the code and play with it. Official adoption and support of free and open source software is greater by the day by public institutions and even entire states – Russia is on the way to replace all proprietary software by 2015 [26] and quality is comparable with proprietary software, often more stable and with less bugs: "Given enough eyeballs all bugs are shallow" [27].

There are many licenses which regulate the use of free and open source software; differences are mostly in rights they give their users regarding extending components and later distribution. BSD license allows anybody to use, modify and distribute binaries and source code in original and modified form as long as the original author is given credit. GNU GPL forbids forking and closing the code as it requires all software based on GPL components to be released under the same license. Proprietary components are not allowed. Apache and MIT license are similar to BSD license and are also widely used.

Two most successful examples of open source approach are Linux and Apache [28], many big companies have started to release their products as open source such as Nokia QT (released under LGPL and commercial), Google's Android OS and Oracle's OpenOffice and MySQL.

Open source software projects are usually supported through big companies which see strategic advantages in close ties with the community or they are financed through selling of support. Such example is the Canonical Ltd. which supports development of Ubuntu Linux and markets commercial support.

E. Pay-what-you-want

Pay-what-you-want is a recently introduced model which allows customers to set the price for the product themselves, usually with some minimum limits. One example is the band Radiohead who released their album "In Rainbows" in 2007 online allowing the users to pay how much they thought it was worth, the site only advised "it's up to you" [29]. The band refused to release any figures that would indicate the success of that experiment, complaining that they speak more about the merchandising of music than of the music itself which lead to conclusions that the experiment was a failure. Figures published later have shown that the experiment was a great success: with more than three million sold copies both physical and online (their previous albums sold in low hundreds) [30].

Another example is the Humble Indie Bundle – collection of five small games made by independent developers which was offered at the same principle. Download was time limited and the users were able to set which amount would go to the game developers and two charities: Child's Play and Electronic Frontier Foundation. First edition of Humble Indie Bundle netted over $1 million and the second over $1.8 million.

Great success of both bundles shows that there is a great potential in letting the users decide for themselves how much a product is worth, charity purpose also gives users greater sense of value for their money.

IV. TRENDS

Recent trends show great growth of mobile devices usage and new business models are emerging to make use of the media tablet hype. Gartner predicts further growth

of mobile phone market, especially smartphones as they are getting more affordable through mobile operator subventions. Among the Top 10 Strategic Technologies for 2011 [31] cloud computing is on the first place followed by mobile applications and media tablets with social communications and collaboration on the third place which also can be viewed as one aspect of cloud computing.

New ways of distribution such as pay-what-you-want model and application stores which simplify buying and downloading eliminate intermediaries between the producers of content and end consumers. Until recently there has been no simple way for individual programmers to offer their solutions to the masses, application stores and popularity of new smart devices such as media tablets and smartphones give them the possibility to harvest unprecedented success [32]. Such great successes drive even more developers to creating new content for application stores and even the appearance of parallel stores which fight for users by offering more applications, more categories and greater freedoms and revenues for developers.

Open source software is viewed as a long-term strategic decision which would greatly cut down total cost of software and giving away the software for free and charging for support is proving to be a viable business model. Recent research shows that total number of open source projects as well as total amount of source code doubles every fourteen months [33].

Cloud computing together with smartphone and media tablet platforms and open source is becoming the way to go, all major software manufacturers are turning to those technologies and adapting their business models to cope with changes in society and technology. Off the shelf procurement will always exist but it is rapidly being replaced by new business models which offer reduced costs for the seller and the buyer as well as other afore mentioned advantages.

Table 1 shows current trends and predictions based on current and past growth rate, although there are significant differences all predictions agree on very fast growth of new technologies and associated business models.

TABLE I → BUSINESS MODELS GROWTH TRENDS

	Current state	***Predictions***	***Compound annual growth rate***
Cloud Computing	$58.6 bil (2009)[a] $16 bil (2009)[b] $47bil (2008)[c]	$148.8 bil (2014)[a] $55.5 bil (2014) [b] $126 bil (2012) [c]	**20%**[a] **27.4%** [b] **28%** [c]
Multimedia tablets [d]	7.6 mil (2010)	46 mil (2014)	**57.4%**
Smartphones	246.9 mil (2010)[e] 173 mil (2009)[f]	506 mil (2014) [e] 619 (2014) [f]	**20%** [e] **24%** [f]
Open source software[g]		$8.1 bil (2013)	**22.4%**
Tranditional IT Products[b]			**5%**

Sources: a - Gartner Research [34], b – IDC [35], c – IBM [36], d – IDC [37], e – iSupply Corp.[38], f – Coda Research Consultancy[39], g – IDC [40]

V. CONCLUSION

We have presented a brief overview of current trends and most prominent business models in digital economy from end user's point of view. Complete and exhaustive list is impossible to compile because many models are intertwined and used simultaneously because they naturally evolved to coexist.

Given that entire public administrations are switching to free and open source software and industry leaders supporting open source software in various ways (IBM, Google), we can expect to see more business models revolving around those concepts, whether it is supporting the development of open source software and charging for technical support or financing of open source projects as a form of marketing.

Penetration of smartphones and similar devices along with integration between application stores and network providers and credit card companies have made it possible for small companies and even individuals to offer their products directly to the consumers and sometimes achieve great success which leads to even more content producers and wider possibility of choice for end users.

Off-the-shelf procurement will always be present but advance of cloud computing, mobile platforms and associated business models and open source will surely mitigate and even marginalize it for some purposes.

New technologies inevitably bring new business models and companies who ride the hype usually yield great results but it must be said that new technology application without sound business foundations and steady revenue stream can not guarantee success and can even mean failure for the organization as we have witnessed during the dot com boom and later burst.

REFERENCES

[1] News Release: Amazon Kindle is the Most Gifted Item Ever on Amazon.com, Amazon.com Media Relations, Internet: http://phx.corporate-ir.net/phoenix.zhtml?c=176060&p=irol-newsArticle&ID=1369429 [Feb. 05, 2011]

[2] C. Milanesi, R. Cozza, H. J. De La Vergne, T. Huy Nguyen and A. Zimmermann, Forecast: Connected Mobile Consumer Electronics, Worldwide, 2008-2014, Gartner, 2010

[3] L. Yung-Ming, L. Chia-Hao, Pricing schemes for digital content with DRM mechanisms, Decision Support Systems, Volume 47, Issue 4, Smart Business Networks: Concepts and Empirical Evidence, November 2009, Pages 528-539

[4] C. W. L. Hil, "Digital piracy: Causes, consequences, and strategic responses", Asia Pacific Journal Of Management, 2007, Volume 24, Number 1, 9-25

[5] I. Ahn, I. Shin, On the optimal level of protection in DRM, Information Economics and Policy, Volume 22, Issue 4, Special Issue: Digital Piracy, December 2010, Pages 341-353

[6] Linder, J. and Cantrell, S., Changing Business Models: Surveying the Landscape, Working Paper, Accenture Institute for Strategic Change, 2000

[7] R. Alt., H. D. Zimmermann, Preface: Introduction to Special Section – Business Models. Electronic Markets 11(1):3-9. , 2001

[8] P. Timmers, Business Models for Electronic Markets. Electronic Markets 8(2), 1998, 3-8,

[9] B. Mahadevan, Business models for Internet-based eCommerce: an anatomy. California Management Review 42(4), 2000, 55–69.

[10] M. Rappa, Managing the digital enterprise – Business models on the Web, Internet: http://digitalenterprise.org/models/models.html [Feb. 05, 2011]

[11] A. G. Pateli, G. M. Giaglis, A research framework for analysing eBusiness models, European Journal of Information Systems, Vol. 13, No. 4, 2004, pp. 302-314.

[12] L.M. Applegate, M. Collura, Emerging networked business models: lessons from the field. Harvard Business School No. 9-801-172, 2001, Harvard Business School, Boston.

[13] J. Ben Schafer, Joseph A. Konstan, and John Riedl. 2001. E-Commerce Recommendation Applications. Data Min. Knowl. Discov. 5, 1-2, January 2001, 115-153.

[14] O. Petrovic, C. and T. Kittl and Teksten, D. Ryan, Developing Business Models for Ebusiness, International Conference on Electronic Commerce 2001, Vienna, October 31. – November 4.

[15] A. Osterwalder, Y. Pigneur, An e-Business Model Ontology for Modeling e-Business, In proceedings of 15th Bled Electronic Commerce Conference, e-Reality: Constructing the e-Economy, 2002

[16] A. Bartelnt, W. Lamersdorf A multi-criteria taxonomy of business models in Electronic Commerce. In Proceedings of the IFIP/ ACM International Conference on Distributed Systems Platforms (Middle-ware 2001), WS on Electronic Commerce (FIEGE L, M G and WILHELM U,Eds), Springer, Berlin, 2001

[17] D.W. Stewart, Q. Zhao. Internet marketing, business models, and public policy. J Public Policy Mark 2000;19(Fall):287 – 96.

[18] Apple's App Store Downloads Top 10 Billion, Apple, 2011, Internet:http://www.apple.com/pr/library/2011/01/22appstore.html [Feb. 04, 2011]

[19] Androlib statistics, Internet: http://www.androlib.com/appstats.aspx, [Feb. 04, 2011]

[20] In the "Year of the Tablet" What Do Marketers Need to Know?, Emarketer.com, http://www.emarketer.com/blog/index.php/year-tablet-marketers?utm_source=twitterfeed&utm_medium=twitter [Feb. 04, 2011]

[21] T. Stevens, The Daily iPad 'newspaper' launches, Endgadget.com 2nd Feb 2011, Internet: http://www.engadget.com/2011/02/02/the-daily-ipad-newspaper-launches/ [Feb. 04, 2011]

[22] S. Marston, Z. Li, S. Bandyopadhyay, J. Zhang, A. Ghalsasi, Cloud computing -- The business perspective, Decision Support Systems, In Press, Corrected Proof, Available online 24 December 2010

[23] S. Alsop, You can trust me on this – really, Fortune, March 15, 1999.

[24] R. Rothwell, Creating wealth with free software, Free Software Magazine, 2008

[25] R. Stallman, Viewpoint: Why Open Source misses the point of Free Software, Commun. ACM 52, 6 (June 2009), 31–33.

[26] E. Morozov, A Walled Wide Web for Nervous Autocrats, The Wall Street Journal, January 8, 2011 Internet:http://online.wsj.com/article/SB10001424052748704415104576065641376054226.html[Feb. 07, 2011]

[27] E. S. Raymond, The Cathedral & the Bazaar. O'Reilly, 1999

[28] P. B. de Laat, Copyright or Copyleft?: An analysis of property regimes for software development, Research Policy, Volume 34, Issue 10, December 2005, Pages 1511-1532

[29] J. Tyrangiel, Radiohead Says: Pay What You Want, Time magazine, Oct. 01, 2007, Internet: http://www.time.com/time/arts/article/0,8599,1666973,00.html, [Feb. 3 2011]

[30] D. Geere, Radiohead "pay what you want" numbers released, TechDigest.com, October 16, 2008, Internet: http://www.techdigest.tv/2008/10/radiohead_pay_w.html [Feb. 3 2011]

[31] Gartner Identifies the Top 10 Strategic Technologies for 2011, Gartner Research, Internet: http://www.gartner.com/it/page.jsp?id=1454221[Feb. 04, 2011]

[32] B. X. Chen, Coder's Half-Million-Dollar Baby Proves iPhone Gold Rush Is Still On, Wired.com, Feb. 12 2009, Internet: http://www.wired.com/gadgetlab/2009/02/shoot-is-iphone/ [Feb 11 2011].

[33] A. Deshpande, D. Riehle, The Total Growth of Open Source, In Proceedings of the Fourth Conference on Open Source Systems (OSS 2008). Springer Verlag, 2008. Page 197-209.

[34] Gartner Says Worldwide Cloud Services Market to Surpass $68 Billion in 2010, Gartner Research, Internet: http://www.gartner.com/it/page.jsp?id=1389313 [Mar. 27, 2011]

[35] Through 2014 Public IT Cloud Services Will Grow at More Than Five Times the Rate of Traditional IT Products, New IDC Research Finds, IDC - Press Release, Internet: http://www.idc.com/getdoc.jsp?containerId=prUS22393210 [Mar. 27, 2011]

[36] IBM Opens Cloud Computing Laboratory in Hong Kong, IBM Press Release, Internet: http://www-03.ibm.com/press/us/en/pressrelease/29013.wss [Mar. 27, 2011]

[37] L. Whitney, IDC: 46 million media tablets by 2014, cnet News, Internet: http://news.cnet.com/8301-13579_3-20005489-37.html [Mar. 27, 2011]

[38] Zacks Equity Research, Smartphone Growth to Accelerate, Internet: http://www.zacks.com/stock/news/35221/Smartphone+Growth+to+Accelerate [Mar. 27, 2011]

[39] I. Mansfield, Sales of Smartphones to Total 2.5 Billion During 2010 to 2015, cellular-news, May 14 2010, Internet: http://www.cellular-news.com/story/43304.php [Mar. 27, 2011]

[40] S. Dean, IDC: Open Source Rising, Set to Go On a Tear, July 20 2009, Internet: http://ostatic.com/blog/idc-open-source-rising-set-to-go-on-a-tear [Mar. 27, 2011]