



Trends in Video Games and Gaming

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Video gaming is a global phenomenon, a fast-moving multibillion dollar business, cutting across all age groups and gender. This ITU-T Technology Watch Report surveys some of the latest developments in the world of video games, describes the most common gaming platforms and terminals and highlights new technologies enabling a better gaming experience and associated standardization activities.



The rapid change of the telecommunication/information and communication technologies (ICT) environment requires related technology foresight and immediate action in order to propose possible ITU-T standardization activities as early as possible.

ITU-T Technology Watch surveys the ICT landscape to capture new topics for standardization activities. Technology Watch Reports assess new technologies with regard to existing standards inside and outside ITU-T and their likely impact on future standardization.

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Please send your feedback and comments to tsbtechwatch@itu.int.

The opinions expressed in this report are those of the authors and do not necessarily reflect the views of the International Telecommunication Union or its membership.

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Cover picture: Jemma and Alice competing in a Nintendo tennis match.

Technology Watch is managed by the Policy & Technology Watch Division, ITU Telecommunication Standardization Bureau.

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Experts from industry, research and academia are invited to submit topic proposals and abstracts for future reports in the Technology Watch series. Please contact us at tsbtechwatch@itu.int for details and guidelines.

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Trends in Video Games and Gaming

I. Introduction

Over the past 30 years, video games have become an important part of contemporary global entertainment and media. Games and gaming have evolved from dedicated, single-game units to massively multiplayer online role-player games with millions of players. Today they are a huge media business worth billions of dollars, and its bestsellers – rather unnoticed by the public – continuously beat blockbuster movies in first week sales revenue.

The ever increasing expansion of the Internet has significantly contributed to the growth of gaming on dedicated video game consoles and PCs, and the possibility to compete with other players around the world is taken for granted by most players. Mobile broadband and a growing penetration of smartphones brought further movement into the gaming ecosystem. Independent developers and small start-up companies were able to compete in the market and deliver their games to huge audiences. The latest step is the rise of social network games on platforms with hundreds of millions of users. These transformations have not only changed the way games look today, they have also influenced the audience and the business models of the gaming industry.

Gaming was the domain of young men and boys and the industry focused on this target audience almost exclusively. Mobile games and social networks have added players to include children, women, parents and even senior citizens who enjoy playing puzzle games, quizzes, arcades or educational games. Quite surprisingly, women players now outnumber men in some age ranges by a considerable margin.¹

Game development studios give away their applications free-to-play in the hope the player buys virtual goods in the game, upgrades or game extensions. Virtual goods have become part of the virtual economy in Asian developing countries where industries have been built up around gaming phenomena such as gold farming. Some of the most popular games are subscription-based similar to one's daily newspaper or a phone subscription.

Games and gaming are an extraordinarily fast-moving domain. At the time this ITU-T Technology Watch Report was being written, a gaming company hitherto unknown to many has filed a USD 1 billion initial public offering; a "traditional" manufacturer of gaming equipment and services has lost some USD 171 million during an almost one month-long outage; a social network site has established its own currency to buy virtual goods in games; and the term *gamification* has enjoyed rising popularity.

These and other facts and trends (see [Figure 1](#)) are further discussed in the report, which also describes the most common gaming terminals and platforms and different categories of games, and looks at new technologies enabling a better gaming experience and associated standardization activities.

¹ Flurry Blog: *Mobile Social Gamers: The New Mass-Market Powerhouse*. 22 Feb 2011, <http://blog.flurry.com/bid/57219/Mobile-Social-Gamers-The-New-Mass-Market-Powerhouse>

Figure 1: Characteristics of video gaming then and now

	Then	Now
Audience	Mostly young men and boys, hardcore gamers	Across all age groups and gender, casual and hardcore gamers
Business Model	Physical distribution, box sales	Physical distribution, subscription, cloud gaming, app stores, virtual goods, in-game advertisement
Platform	Console, handheld console, PC	Console, handheld console, PC, mobile phone, tablet, social network websites, instant messaging clients
Interactivity of Games	Limited: single-player, LAN (local area network)	High: Internet enables MMOGs (massively multiplayer online games), social network games, etc.

Source: ITU adapted from [Cartagena Capital](#)

2. Terminals and platforms

Video games have come a long way, with terminals often reflecting the state-of-the art in consumer electronics of the era. From single-game units (pong machines) in arcade halls in the 1970s and 1980s, to console or PC games transported on ROM cartridges, tape cassettes, discs, CD-ROMs and DVDs, to gaming on the smartphone.²

While this evolution happened quickly and was rich in new features, the lack of interoperability, incompatibility of games and accessories for terminals and the associated vendor lock-in have not improved much. While this situation may change slightly with the advent of mobile gaming and games in social networks, which are playable on different terminals, the disadvantage of platform lock-in still exists.

² InformIT: *A History of Home Video Game Consoles*. 1 Apr 2005, <http://www.informit.com/articles/article.aspx?p=378141>

Console and handheld console

Many parents are familiar with Microsoft, Nintendo, Sega, Sony and their lines of gaming products which have taken their children by storm. They, too, have evolved considerably over the years with networking capabilities, input devices (including steering wheels, guitars, natural user interfaces) and graphic capabilities to enhance the gaming experience. Each brand has created its own gaming ecosystem to retain customers. These walled gardens of hardware, games, accessories and online gaming communities make it impossible for consumers to use third-party equipment or just to export scores or achievements from one console to the other.

Personal computers (PCs)

Computer games have contributed to the success of home and personal computers since the early days. Atari and Commodore are mentioned as two successful companies in this context, which were first successful in the arcade and game console segments, and then introduced 8-bit home computers for gaming, programming and other applications. Although system requirements may vary from game to game, the latest titles often recommend high graphics and processing power, broadband Internet connection for online play, etc. Similar to other types of contemporary media, in particular music and movies, traditional physical distribution channels tend to have become less important in comparison to online delivery, direct download or streaming.

Mobile phones and tablets

“Games are an exciting way to communicate and connect with a larger community of likeminded people. Rich mobile games, combined with connected near distance multiplayer gaming over Bluetooth and wide area gaming using cellular networks, opens the door for totally new gaming concepts. Mobility will add a whole new dimension to innovative and creative games concepts and will provide opportunities for the games and telecom industry alike.” (Anssi Vanjoki, former Executive Vice President, Nokia Mobile Phones, November 2002)³

In little over a decade, mobile gaming has been established as a dominant part of contemporary gaming culture.⁴ It started with simple, single-player games embedded on basic handsets, progressed to games on feature phones purchased by sending an SMS to a premium number, reaching full bloom on smartphones in the mobile app era. Compared to dedicated handheld gaming consoles, some of the latest smartphones barely lack in processing power and graphics capabilities. The communication features, especially mobile broadband, enable gamers to network and interact, to play on websites, to purchase gaming applications (apps) and virtual in-game goods.

Consulting firm Deloitte predicts that in 2011 more than fifty per cent of computing devices sold globally will not be PCs (400 million units), but smartphones (375 million) and tablets (50 million).⁵ Subscription data show that mobile telephony is becoming a near-ubiquitous infrastructure. By the end of 2010, there were an estimated 5.3 billion mobile cellular subscriptions (not handsets) worldwide, including 940 million subscriptions to 3G services.⁶

³ Nokia: *Nokia brings mobility to the Games Industry by making Rich Games Mobile*. 4 Nov 2002, <http://press.nokia.com/2002/11/04/nokia-brings-mobility-to-the-games-industry-by-making-rich-games-mobile/>

⁴ G. Goggin: *Global Mobile Media*. 2011, Routledge

⁵ Deloitte: *Deloitte analysis of top technology trends for 2011*. 14 Feb 2011, http://www.deloitte.com/view/en_UA/ua/press/ua-pressreleases-en/4944bb093042e210VgnVCM3000001c56f00aRCRD.htm

⁶ ITU: *The World in 2010 – ICT Facts and Figures*. 2010, <http://www.itu.int/ITU-D/ict/material/FactsFigures2010.pdf>

A look at the latest financial results of Nintendo and Apple reveals the shift from dedicated handheld gaming consoles to gaming-capable MP3 players, mobile phones and tablets, such as iPod Touch, iPhone and iPad.⁷

Ofcom, the UK communications regulator, found that almost half of UK teenagers and a quarter of adults now own smartphones, and that most teens claim to be highly addictive to their gadgets. Games are the most popular paid apps in a country in which half of all households have a game console.⁸

As highlighted in Figure 2, games are the most popular mobile phone application category in the US and the average mobile gamer plays 7.8 hours a month.⁹ A survey among tablet owners found that gaming was the most popular use for these devices, ahead of web-browsing, e-mailing or reading.¹⁰

Social network websites and instant messaging clients

With over 600 million active users worldwide, social network website Facebook has become a part of the everyday life of many.¹¹ Initially created by Mark Zuckerberg in 2004 (the era of PC and Internet) to find out more about female classmates, Facebook continues to reinvent itself with new applications and services addressing purposes far beyond staying in touch with one's peers. Moreover, it is increasingly accessed via mobile devices.

After opening up the Facebook platform to external developers, games that use social connections have spread very rapidly. Gaming on social network sites is becoming increasingly popular and fashionable: about 20 per cent (47% male, 53% female) of the US population has played a game on a social network, according to a three-month study undertaken by market researcher NPD Group. Of all social network gamers surveyed, over a third indicated they had never played a game before.¹²

Google has recently launched its own social network site (Google+), gained tens of millions of users and started supporting games programmed by third parties within weeks.¹³

China's leading social networking site Qzone is hardly known in the west, but it might soon surpass Facebook in number of active users (some sources report 480 million users). Qzone is a component of Tencent's QQ Internet services, which also include a range of online gaming services.

⁷ The Wall Street Journal: *Nintendo: Apple's Latest Prey*. 29 Jul 2011, <http://online.wsj.com/article/SB10001424053111904888304576473493285312436.html>

⁸ Ofcom: *A nation addicted to smartphones*. August 2011, <http://consumers.ofcom.org.uk/2011/08/a-nation-addicted-to-smartphones/>

⁹ Nielsen Wire: *Play Before Work: Games Most Popular Mobile App Category in US*. 6 Jul 2011, http://blog.nielsen.com/nielsenwire/online_mobile/games-most-popular-mobile-app-category

¹⁰ The Guardian Apps Blog: *Google survey finds games trump all other uses for tablets*. 8 Apr 2011, <http://www.guardian.co.uk/technology/appsblog/2011/apr/08/tablets-mainly-for-games-survey>

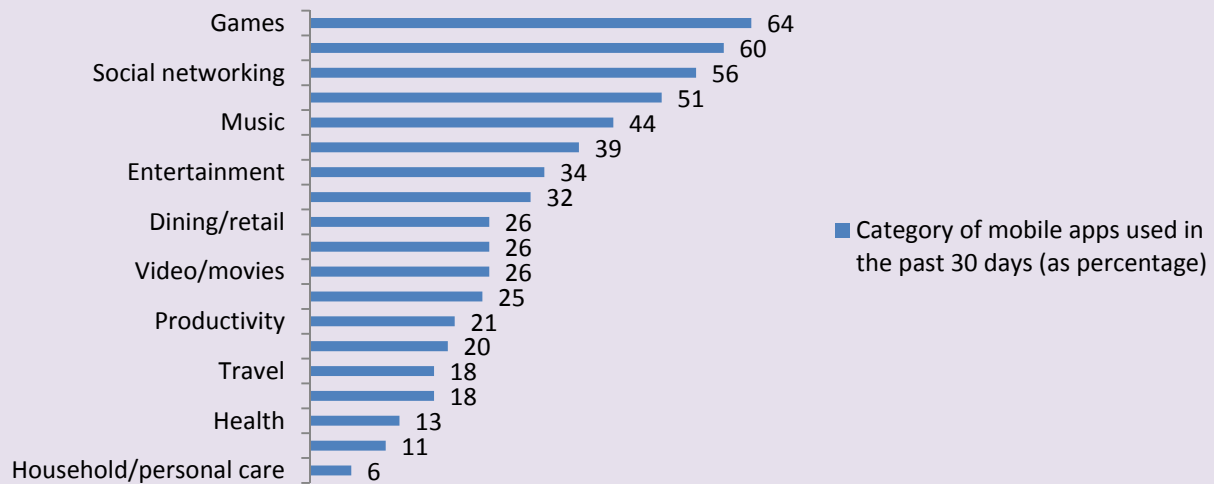
¹¹ Business Insider: *Facebook Has More Than 600 Million Users, Goldman Tells Clients*. 5 Jan 2011, <http://www.businessinsider.com/facebook-has-more-than-600-million-users-goldman-tells-clients-2011-1>

¹² NPD Group: *20 percent of the U.S. population, or 56.8 million U.S. consumers, reports having played a game on a social network*. 23 Aug 2010, http://www.npd.com/press/releases/press_100823.html

¹³ The New York Times Bits Blog: *Games Arrive on Google+*. 11 Aug 2011, <http://bits.blogs.nytimes.com/2011/08/11/games-arrive-on-google/>

Figure 2: Category of mobile apps used in the past 30 days (as percentage of smartphone users in the United States)

Games are the most popular mobile phone application in the US



Source: [Nielsen](#)

3. Games and genres

The diversity of the video games landscape is vast and elusive. The numerous genres and niches are often influenced and shaped by temporary trends. This chapter will describe five groups, which are among the most discussed and most played categories.

Massively multiplayer online (role-playing) games: MMOGs and MMORPGs

Massively multiplayer online games (MMOGs) are video games capable of supporting hundreds or thousands of players simultaneously in one or several persistent worlds. These games are played on the Internet and the users play on consoles, PCs and mobile devices.

Compared to single-player games, MMOGs enable players to cooperate and compete with each other on a very large scale, and also interact with people around the world. MMOGs include a variety of gameplay types, representing many video game genres.

A sub-genre of MMOG is massively multiplayer online role-playing games (MMORPGs). As the name suggests, players assume the role of a particular character and take control of its actions. Available for PC and Mac, Blizzard Entertainment's "World of Warcraft" (see [Box 1](#)) is currently the most played MMORPG with 11.4 million subscribers as of March 2011.¹⁴ Subscribers pay a fee for continued play, with options to pay in one-, three- or six-month blocks.

¹⁴ Curse: *World of Warcraft Subscriber Base Currently At 11.4 Million*. 9 May 2011, <http://www.curse.com/articles/world-of-warcraft-news/956087.aspx>

Box 1: World of Warcraft

“World of Warcraft [or WoW] is an online game where players from around the world assume the roles of heroic fantasy characters and explore a virtual world full of mystery, magic, and endless adventure.”

In the first- or third-person view of an avatar, players wander through the fictional virtual 3D-world "Azeroth", fighting monsters, completing missions and interacting with other human-controlled avatars and non-player characters. By doing so, players can obtain awards, experience points and in-game money, which contribute to improving the avatar's capabilities and equipment.

“In Warcraft, there are two large, opposing factions. On one side is the noble Alliance, which comprises the valiant humans, the stalwart dwarves, the ingenious gnomes, the spiritual night elves, the mystical draenei, and the bestial worgen; on the other side is the mighty Horde, made up of the battle-hardened orcs, the cunning trolls, the hulking tauren, the cursed forsaken, the extravagant blood elves, and the devious goblins.”

Some tasks and virtual opponents require players to ally with others and to collaborate in groups of up to 25. It is also possible to combat against other human-controlled avatars to gain an advantage in the game.

Experienced players customize their game interface and gameplay with modifications (mods), which can be programmed in simple scripting languages such as Lua. Lua is used in many video games, but also serves other purposes and applications, and is currently standardized in ITU-T for IPTV services.

The game was published at the end of 2004 by Blizzard Entertainment, a branch of NASDAQ-traded Activision-Blizzard. To allow for continued gaming, players pay a subscription fee. WoW is currently the most played MMORPG with 11.4 million subscribers as of March 2011.

An exchange of virtual currency and goods from games such as WoW has created a so-called virtual economy, which is further described in section 5 of this report.



Hulking tauren druid crossing virtual 3D-world in massively multiplayer online role-playing game World of Warcraft. Source: [Cedric L'Homme \(rangzen\)](#), [CC BY-NC-SA 2.0](#)

Sources: <http://us.battle.net/wow/en/game/guide/>, <http://www.curse.com/articles/world-of-warcraft-news/956087.aspx>, ITU-T Draft Recommendation H.IPTV-MAFR.14 " Lua for IPTV services", http://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=6964

A huge number of active players, high level of game detail and the sophisticated interaction features (e.g. multi-user voice chat) can pose a challenge to servers and networks. Lag is a commonly faced problem and makes constant time synchronization across users indispensable to achieve acceptable levels of quality of experience (QoE).

Ego shooters

Despite often being demonized and discredited by parents, educators and the media, first-person shooters (sometimes called ego shooters) are amongst the fastest growing and commercially most viable video game genres. Through first-person perspective the player navigates a heavily armed protagonist through various levels and accomplishes missions in solitude or in teamwork.

The first ego shooters appeared some 30 years ago; graphics and experience have steadily improved and are now 3D and close to reality. Multiplayer capabilities are a second important success factor, and were first used locally in dormitories or LAN parties (see [Figure 3](#)) and now globally via the Internet. Relevant titles include Doom (1993), Duke Nukem 3D (1996), Quake (1996), Half-Life (1998), Half-Life 2 (2004), Unreal Tournament (1999) and Halo (2000). During its peak Counter-Strike, a Half-Life modification, was played online by more than 90,000 gamers simultaneously.

Casual games

Pong and Pac-Man belong to the category of casual games. These time-fillers cover different genres (puzzles, card and board games, strategy games, arcades), have simple rules, do not require any particular skills and are targeted to a mass audience. When they first appeared, computer hardware was not powerful enough to deal with more complex graphics and algorithms.

Even with processors becoming faster, casual games have remained a relevant category of games. Shipped with each Windows installation, Solitaire and Minesweeper are incredibly popular casual games and so is Tetris, which experienced its breakthrough as a free pack-in game of Nintendo's first Game Boy.

People began playing casual games online from the early days of the Internet. Again, low data rates only allowed for limited gaming experience and degree of detail. Most of the games (web-based Java applets or Flash files) were played in single-player mode to fill a free minute or two.

However, the combination of Internet and casual games also enabled smaller and innovative game studios to enter the market. Casual games are very attractive to developers because of their quick nature and simplicity, allowing developers to take greater creative risks at low cost and high frequency.¹⁵ The Internet opened up new distribution channels and marketing platforms that facilitated the individual game developers to present and distribute their software to mass audiences, or to cater to niche markets not viable before.

¹⁵ Plimus: *The History of Casual Gaming*. 16 Jun 2010, <http://plimusblog.com/2010/06/16/the-history-of-casual-gaming/>

Figure 3: Students playing Counter-Strike at a LAN party in Valencia, Spain



Source: [Campus Party Valencia, CC BY-NC-SA 2.0](#)

The rise of mobile apps and associated app stores have made it easier for developers to have their products listed, found and purchased. As discussed in previous work of Technology Watch¹⁶, the lack of interoperability between application platforms (Apple iOS, Android, RIM BlackBerry OS, Symbian, etc.) requires developers to reprogram their games using the respective application programming interfaces (APIs) and software development kits (SDKs). This was the case for Angry Birds, a puzzle game developed in 2010 by Rovio Mobile, a computer game developer based in Finland. After its release on the Apple App Store, where it quickly became a bestseller, the company ported the game to other platforms and has recently reported a total of 350 million downloads.¹⁷

Social (network) games

Rovio's equivalent in terms of overnight success in social network gaming is Zynga, a company hardly known to outsiders up until recently when it filed an initial public offering (IPO) seeking to raise USD 1 billion (see Box 2). Zynga's portfolio includes Mafia Wars, FarmVille and CityVille, which are browser-games played on social networking websites. Aforesaid games have 60 million daily active users and 2 billion minutes of play per day.¹⁸

¹⁶ ITU: *Mobile Applications*. ITU-T Technology Watch Alert, July 2009, <http://www.itu.int/oth/T230100000C/en>

¹⁷ Fortune Tech: *Angry Birds: 350 million downloads and counting*. 12 Sep 2011, <http://tech.fortune.cnn.com/2011/09/12/angry-birds-350-million/>

¹⁸ U.S. SEC: *Amendment No. 2 to Form S-1 Registration Statement, Zynga Inc.* 11 Aug 2011, <http://sec.gov/Archives/edgar/data/1439404/000119312511219334/ds1a.htm>

Box 2: Social network games and Zynga's IPO

Games on social network sites represent a viable business opportunity for game developers and contribute to the disruption of the traditional game business. This is underlined in the estimation of funding and acquisition deals in 2010: with 123 funding rounds and 87 acquisitions closing in 2010, the volume of activity last year was up by more than a third from the 2009 total of 154 events. Total declared funding for 2010 reached USD 1.89 billion, up 130 per cent from USD 819 million in 2009. According to IHS Screen Digest these numbers are driven by developments in the social network gaming segment, where the total declared value of funding deals increased by nearly 300 per cent in 2010.

The growth is not limited geographically to traditional hubs of game development, i.e. the US or Europe. There are more than 120 million Chinese gamers, most of them play online games. The volume of China's online game market grew by 34 per cent in 2010 to USD 4.8 billion and is expected to continue rising to USD 5.8 billion in 2011, thanks to the social game market. Fast growing game companies have also been reported from Argentina, Mexico and the Middle East.

"Zynga tops Electronic Arts as social games spread" (Bloomberg Businessweek, October 2010)

Within four years, Zynga made it from zero to becoming the biggest player on the social games market, its estimated worth even temporarily surpassing the stock-market worth of video game top dog Electronic Arts. Zynga's mission statement "to connect the world through games" is addressed through popular Facebook games including FarmVille, Mafia Wars and CityVille, which combined have more than 230 million active users per month from 166 countries. The games are free-to-play and players can choose to purchase virtual goods to enhance their game experience (see section 5). Zynga was among the first game suppliers for the social network Google+ and launched a localized version of CityVille ("Zynga City"), which can be played through the Chinese Internet portal Tencent. On 1 July 2011, the company filed for an IPO seeking to raise USD 1 billion.



Virtual Temple of Heaven in Chinese adaptation of social network game CityVille. Source: [Zynga](#)

Sources: <http://www.isuppli.com/Media-Research/News/Pages/Video-Game-Acquisitions-and-Funding-Deals-Rise-36-Percent-in-2010.aspx>, <http://venturebeat.com/2011/05/04/chinese-game-industry-to-hit-5-8b-in-2011-thanks-to-social-game-growth/>, <http://venturebeat.com/2011/04/20/metrogames-hardcore-gamers-facebook/>, <http://venturebeat.com/2011/03/16/quirkat-hopes-to-bring-fun-to-gamers-in-the-middle-east/>, <http://www.businessweek.com/news/2010-10-26/zynga-tops-electronic-arts-as-social-games-spread.html>, <http://www.forbes.com/sites/tomioqeron/2011/07/25/zynga-launches-new-cityville-game-in-china-with-tencent/>, <http://sec.gov/Archives/edgar/data/1439404/000119312511219334/ds1a.htm>

While their simplistic appearance is similar to those of casual games, social games utilize social connections (the social graph) and customer data supplied by Facebook and other social network sites as part of the game. This makes them appealing to non-traditional players, who want to compete with their friends in trivia and like to chat or flirt with their peers while playing.

Entry costs for game developers are low and viral distribution over the social network sites can help to quickly reach out to hundreds of millions of users, as Zynga's success story tells.

Educational video games

In contrast to the genres and categories described above, educational video games have the purpose of teaching their users about a chosen subject, expanding existing knowledge or assisting in acquiring a certain skill while playing. Games can assist in the development of skills and proficiency by making users interact with digital objects and manipulate variables. Their development involves educational scientists, learning psychologists and game developers in order to state learning objectives, which can be achieved with relevant activities. Educational video games exist for children and adults alike and on different platforms.

DreamBox Learning, an educational start-up, sells licenses for its web-based Adobe Flash math application to schools, and to parents of children in the kindergarten to grade three bracket. The game adjusts to the skill level of the child; automatically adapting its difficulty level, scaffolding, sequencing, speed, and the number and type of hints given. It is hoped by many educational innovators that the application of this technology will remedy the financial constraints and performance issues in public education.¹⁹ On the downside, it is feared that attempts to replace teacher-led instruction with computers and games could stifle the development of children's social skills.

"You don't have to be a genius to understand the work of the Nobel Laureates. These games and simulations, based on Nobel Prize-awarded achievements, will teach and inspire you while you're having FUN!" (Nobel Prize Educational Games website)²⁰

The Nobel Prize Foundation has set up a website of educational games and simulations covering many scientific achievements, and allowing young and old to learn more about the immune system, lasers, DNA and many other areas.

On its website, aforementioned Zynga combines education with *gamification*, a concept described in [Box 3](#), to inform users of the company's privacy practices. A game draws more attention to privacy policies than having them hidden in the fine print.

¹⁹ VentureBeat: *DreamBox aces test: study shows edutainment program boosts exam scores*. 1 Aug 2011, <http://venturebeat.com/2011/08/01/dreambox-aces-test-study-shows-edutainment-program-boosts-exam-scores/>

²⁰ Nobelprize.org, <http://nobelprize.org/educational/>

Box 3: Gamification

The term gamification describes the broad trend of employing gameplay elements to non-game environments such as customer retention, marketing, innovation, training, health and social change.

Even for non-game-savvy people, achievement points, leader boards and other elements found in video games enter into many aspects of life. Some commentators see gamification as an evolution of traditional loyalty programmes (e.g. frequent flyer points), which reward customers in return for an actual purchase. In contrast, implementers of gamification place emphasis on 'true' user engagement with the objective of making users familiar with brands, products or other aspects, and eventually turning them into loyal customers.

Often cited as an example for gamification, *foursquare* is a location-based social network, which allows its users to "check-in" at businesses (bars, restaurants, shops, etc.). Each check-in awards the user points and trophies ("badges"). Business owners can claim and register their venues with the service to offer discounts or special offers to the most active loyal visitors.

San Francisco-based company *Basis* developed a multi-sensor watch capable of measuring body metrics including heart rate, temperature and movement and thereby monitoring the user's stress and fitness levels. Sharing some of this data with friends or trainers and being awarded for reaching a certain caloric burn, and thereby gamifying the process, can help to keep training motivation up and stay in shape.

The screenshot shows the Foursquare website interface. At the top, there is a search bar and navigation links for 'Sign up', 'Apps', 'Help', and 'Log in'. Below the search bar is a yellow banner with the text 'Join foursquare to meet up with friends and discover new places' and a 'Get Started' button. The main content area features a venue page for 'International Telecommunication Union' in Geneva, Switzerland. The venue details include the address 'Place des Nations, Genève, 1202, 022 730 51 11', social media links '@itu_news' and 'www.itu.int', and a map showing the location. To the right of the venue page, there is a summary of check-in statistics: 'YOUR CHECK-INS: 0', 'TOTAL PEOPLE: 52', and 'TOTAL CHECK-INS: 147'. Below this, there is a 'Mayor' section for 'Andrey S.' with '9 checkins' and a crown icon. At the bottom, there is a 'Tips' section with a tip from 'Mark J.' about a restaurant at the top of the ITU Tower.

Delegates checking in on location-based social network foursquare at International Telecommunication Union, Geneva, Switzerland. Source: [foursquare](http://foursquare.com/)

Sources: <http://www.gartner.com/it/page.jsp?id=1629214>, <https://foursquare.com/>, <http://mybasis.com/>

4. Gaming as showcase for new technologies and standards

After having looked at the most relevant gaming terminals and platforms and at some of the most popular genres and categories of video games in the previous sections, this section will describe associated trends in information and communication technologies which significantly contributed to the rise of video games. While the traditional video game industry may not be characterized as a promoter of standards and interoperability, there are some standardization activities related to games and their enabling technologies, as highlighted below.

HTML5

Currently drafted by the World Wide Web Consortium (W3C) and Web Hypertext Application Technology Working Group (WHATWG; a community of people interested in evolving web technologies), HTML5 adds new multimedia and graphic features to the hypertext markup language the web is built on. This open standard format is seen as a large competitor for Adobe Flash and other proprietary formats on which most casual games for mobile platforms and the web are built. An attractive feature of HTML5 as opposed to native formats is that it runs on any device with a modern web browser.

On the occasion of the game's thirtieth anniversary on 22 May 2010, Google created an HTML5-built clone of Pac-Man. Zynga launched a mobile version of Mafia Wars designed in HTML5.^{21,22} Others ported popular classic computer games including Civilization (a strategy game) and Quake (an ego shooter, see above) to showcase the power of HTML5 and other open standards.

It is likely that this new version of HTML will also influence the future of videos on the web, and therefore in web-based games. MeFeedia, a video-sharing website, found that from January 2010 to February 2011 the share of HTML5-compatible videos on the web grew from 10 to 63 per cent.²³

ITU-T's Primetime Emmy Engineering Award-winning encoding standard H.264 (used to compress billions of clips on YouTube, but also high-definition content on Blu-ray Discs and high-definition television (HDTV)) is still the most common format (see Figure 4), but facing competition from WebM, a format sponsored and promoted by Google. Video being one of the major drivers of mobile and fixed data traffic²⁴, a shift to one or the other format will be pathbreaking.

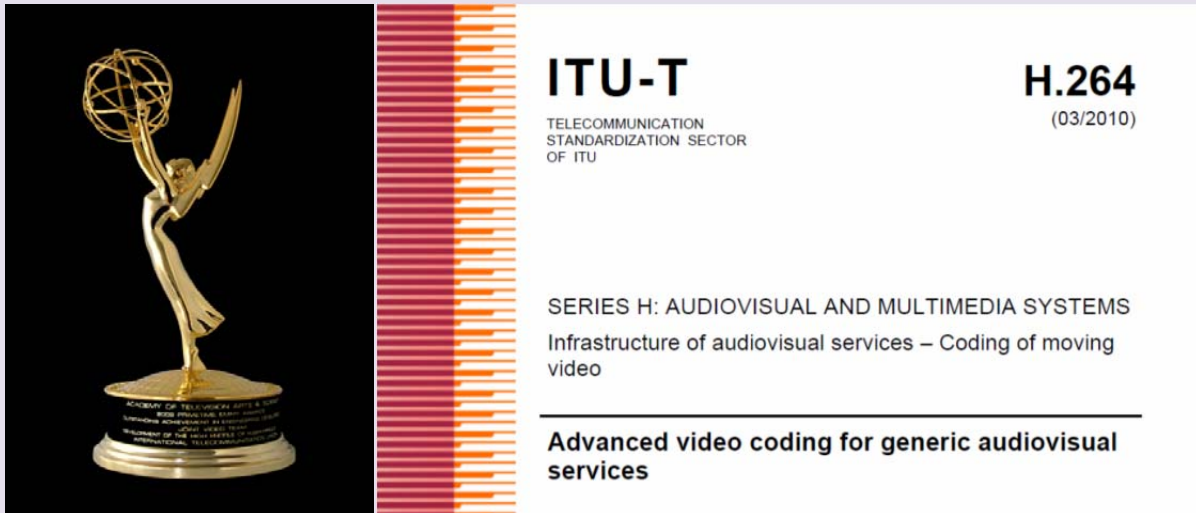
²¹ Gamasutra: *The Social Network Game Boom*. 29 Apr 2009, http://www.gamasutra.com/view/feature/4009/the_social_network_game_boom.php

²² See <http://www.google.com/pacman/>, <http://m.mafiawars.com/>

²³ MeFeedia: *HTML5 Video Available on the Web – February 2011 Update*. 1 Mar 2011, <http://blog.mefeedia.com/html5-feb-2011>

²⁴ It is expected that mobile video will make up two thirds of mobile data traffic by 2015. See http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.html

Figure 4: The National Academy of Television Arts and Science give the 2008 Primetime Emmy Award to the ITU Telecommunication Standardization Bureau for Outstanding Achievement in Engineering Development, ITU-T H.264



Source: ITU

Cloud gaming

Cloud computing and the XaaS (Anything as a Service) paradigm have been among the most discussed terms in information technology over the last years. Both have a considerable influence on gaming.

Primarily, the tremendous success of games played on the web and in particular on social networks requires game service providers to extend and manage their computing power, and in many cases this is achieved by a mixture of own data centres and cloud computing. According to its CTO, Zynga adds as many as a thousand servers per week to deliver about a petabyte of data – that's a million gigabytes.²⁵

Secondly, games-on-demand service providers such as GaiKai, OnLive or Otoy aim to shift the computing power required to play games out of homes and into their data centres. Thereby the need for consumers to buy traditional gaming consoles or spend money on game discs would be eliminated in favour of an always available, subscription-based service. Games will be streamed like a YouTube video clip to PCs, Macs, mobile devices, or to a proprietary low-cost gaming box, which can be connected to the TV. Some consumer electronics manufacturers have even started integrating the software into their TV sets and DVD players.²⁶

Low-latency video compression and connections are crucial for the gaming experience. OnLive uses virtual machines on custom-made servers with graphics processing units (GPUs) and proprietary compression algorithms, which compute two streams for each game.²⁷ While the live stream is optimized for gameplay under real-world Internet conditions, the second, media stream is a server-side full HD stream that is used for spectators or for gamers to record and review sequences of their games. The cloud gaming service requires a 3 Mb/s broadband connection or more to play games in higher definition.

²⁵ TechCrunch: *Zynga Moves 1 Petabyte Of Data Daily; Adds 1,000 Servers A Week*. 22 Sep 2010, <http://techcrunch.com/2010/09/22/zynga-moves-1-petabyte-of-data-daily-adds-1000-servers-a-week/>

²⁶ OnLive Blog: *OnLive Everywhere: HDTVs, Blu-ray Players, Tablets and Phones—and a Sale to Celebrate*. 4 Jan 2011, <http://blog.onlive.com/2011/01/04/onlive-everywhere-hdtvs-blu-ray-players-tablets-and-phones%E2%80%94and-a-sale-to-celebrate/>

²⁷ Joystiq: *GDC09 interview: OnLive founder Steve Perlman, continued*. 2 Apr 2009, <http://www.joystiq.com/2009/04/02/gdc09-interview-onlive-founder-steve-perlman-continued/>

“Latency is the enemy of online gaming”

Cloud gaming provides a challenge to equipment manufacturers and requires tight integration with network service providers. Today’s networks are not engineered to enable simultaneous cloud gaming for all. Bandwidth requirements, latency and response (distance to consumer) need to be considered when aiming at delivering gaming QoS and QoE equal to those of traditional gaming consoles.

Since cloud gaming services focus on digital distribution of games, they can disrupt retailers and put more profits in the hands of game publishers. To survive the transition from physical retail to digital distribution, GameStop, one of the biggest video game retailers with more than six thousand retail stores worldwide, acquired an online gaming service and a digital game distribution business.

As hard copies of games (on CD-ROMs or DVDs) will eventually disappear it will become more difficult to “crack” and distribute illegitimate copies of games physically or on file-sharing networks.

Security

Security is important and not limited to cloud gaming but to all forms of gaming in which user data are stored and processed remotely. On 19 April 2011, staff of Sony Computer Entertainment had to shut down their systems and servers after detecting unauthorized activity in the PlayStation Network and in Sony’s online gaming services; also, data of some kind had been transferred off the servers. The personal data of more than 100 million customers were exposed, including credit card information of 12.3 million gamers. Users were unable to download new content for their games or compete online with other gamers. Sony estimates that the almost one month-long outage has cost USD 171 million, and it expects to incur more expenses in the future.²⁸ Within two months, Nintendo²⁹ and Sega³⁰, two of Sony’s competitors, had to admit to and apologize for similar security breaches.

As pointed out in earlier ITU-T Technology Watch work³¹, standardization activities related to cloud computing are spread across a growing number of organizations, forums and consortia, including ITU-T’s Focus Group Cloud³². Security is a major area of concern in these efforts. It is likely that some cloud standards groups will include the requirements of gaming in their work programme.

Motion-sensing and natural user interfaces

Since the release of Nintendo’s Wii console in 2006, motion-sensing capabilities have become an important feature of the best-selling gaming consoles, as other manufacturers kept up with the trend: Guinness World Records lists Microsoft’s Kinect, a natural user interface (NUI) for controller-free gaming, as the fastest-selling consumer electronics device, sold at an average of 133,333 units per day, for a total of 8 million units in its first 60 days after its launch (see Figure 5).³³

²⁸ VentureBeat: *Sony’s PlayStation Network outage costs \$171M*. 23 May 2011, <http://venturebeat.com/2011/05/23/sonys-playstation-network-outage-costs-171m/>

²⁹ The New York Times: *Nintendo Is Hit by Hackers, but Breach Is Deemed Minor*. 5 Jun 2011, http://www.nytimes.com/2011/06/06/technology/06hack.html?_r=1

³⁰ BBC News: *Sega Pass customer details hacked*. 17 June 2011, <http://www.bbc.co.uk/news/technology-13815225>

³¹ ITU: *Distributed Computing: Utilities, Grids & Clouds*. ITU-T Technology Watch Report, March 2009, <http://www.itu.int/oth/T2301000009/en>

³² See <http://www.itu.int/en/ITU-T/focusgroups/cloud/>

³³ Guinness World Records: *Kinect Confirmed As Fastest-Selling Consumer Electronics Device*. Mar 2011, <http://community.guinnessworldrecords.com/Kinect-Confirmed-As-Fastest-Selling-Consumer-Electronics-Device/blog/3376939/7691.html>

Figure 5: Woman playing tennis using Microsoft's Kinect natural user interface



Source: [Microsoft](#)

While fundamentally operating differently, both devices feature a combination of sensors including gyroscopes, accelerometers, cameras and microphones that allow the system to capture the user's position and game-related activity at any time, to enhance the interaction and eventually blur the line between the real and the virtual worlds.

Outside the gaming sphere, natural user interfaces will play an important role on the path towards a world of human-centric ICT, making computing easier, more intuitive and productive. In this world the user is placed at the centre whereas virtualized networks and other IT resources, services and applications are adaptively and automatically configured to support the user in carrying out everyday-life activities.

Sensors with similar capabilities are to be found in smartphones, vehicles, home appliances and the urban space, enabling humans to interact through gestures, facial expressions and spoken commands.

Broadcom, a chip producer for set-top boxes, has recently started to integrate motion-sensing features in its IPTV chip solution, and is thereby transforming IPTV set-top boxes into game consoles.³⁴

One may consider the impact NUIs may have on accessibility and inclusiveness, in particular for the elderly or persons with disabilities. Or in other applications such as telesurgery³⁵, or the remote operation of machinery in hazardous locations or extreme environments. Microsoft Research described Kinect as *"the first*

³⁴ Broadcom: *Broadcom Transforms IP Set-Top Boxes Into Game Consoles With 3DiJoy's Motion-Sensing Technology*. 21 Mar 2011, <http://www.broadcom.com/press/release.php?id=s558909>

³⁵ Microsoft Research: *TechFest Focus: Natural User Interfaces*. 8 Mar 2011, <http://research.microsoft.com/en-us/news/features/techfest2011nui-030811.aspx>

incarnation of the next big thing in computing”³⁶ and is therefore working closely with other business units to tap the full potential of NUIs in applications beyond gaming.

NUIs are an emerging area for standards and a few groups have been established, such as the Natural User Interface Foundation³⁷, to develop interoperable frameworks, specifications, guidelines and tools. Some aspects of this discipline are linked to biometric recognition, and as in biometrics factors such as privacy and security will need to be ensured when talking about pervasive sensing.

3D

Spurred by the success of “Avatar” (2009), “Tron: Legacy” (2010), other blockbusters in the theatres and sport events such as the FIFA World Cup (2010) on the TV screen, 3D is another trend in consumer electronics starting to have an impact on gaming.

With the uptake of three-dimensional presentations of movies and modern television sets bringing 3D techniques and 3D TV content to the living room, game developers are enhancing their best-sellers to offer a more realistic experience to users.³⁸

Today’s predominant technology for 3D displays and cinemas, stereoscopy, is based on the old principle of creating depth in images, or the illusion thereof, by presenting two offset images separately to the left and right eye of the viewer. The effect generally involves the consumer wearing special spectacles, which is a barrier to acceptance of 3D displays for everyday use.

No additional eyewear is required with autostereoscopic display technologies. This “Glasses-free 3D” is based on a number of competing optical technologies, which use the characteristics and combination of the micro-optics and LCD elements.³⁹ The effect that good quality 3D displays provide today is convincing people with normal binocular vision.

Many different organizations have an eye on the standardization of 3D TV, films and broadcasting. For instance, an extension of ITU-T H.264 (MVC, multiview video coding) was selected by the Blu-ray disc association for distribution of 3D content, and 3D support will be included in the successor to H.264, working title HEVC (high efficiency video coding).⁴⁰ In ITU-T Study Group 9, which deals with broadband cable networks and TV, work is under way on 3D video quality assessment.⁴¹ A technical paper on applications for 3D IPTV is drafted in Study Group 16.⁴² The Radiocommunication Sector of ITU, ITU-R, is addressing digital broadcasting of 3D TV in Question 128/6 and published a report on the features.⁴³

Outside ITU, related work is ongoing in the Society of Motion Picture and Television Engineers (SMPTE), an international professional association, the CEA, DVB Project, HDMI Founders and others.

³⁶ The New York Times Bits Blog: *Microsoft’s Kinect: The New Mouse?* 22 Feb 2011, <http://bits.blogs.nytimes.com/2011/02/22/microsofts-kinect-the-new-mouse/>

³⁷ See <http://nuifoundation.org/>

³⁸ PlayStation Blog: *NBA 2K11 Gets Free Stereoscopic 3D Update on January 16th*. 13 Jan 2011, <http://blog.us.playstation.com/2011/01/13/nba-2k11-gets-free-stereoscopic-3d-update-on-january-16th/>

³⁹ A deeper insight in 3D display systems: <http://www.dur.ac.uk/n.s.holliman/Presentations/3dv3-0.pdf>

⁴⁰ ITU: *3D hot topic at ITU and MPEG meetings*. ITU-T Newslog, 28 Mar 2011, <http://www.itu.int/ITU-T/newslog/3D+Hot+Topic+At+ITU+And+MPEG+Meetings.aspx>

⁴¹ See <http://www.itu.int/ITU-T/studygroups/com09/sg9-q12.html>

⁴² See <http://www.itu.int/ITU-T/studygroups/com16/>

⁴³ See <http://www.itu.int/publ/R-QUE-SG06.128-2008/en> and <http://www.itu.int/publ/R-REP-BT.2160/en>

On a smaller screen size, but not less important in scale, 3D is being taken up in mobile devices including portable game consoles, smartphones and tablets. Nintendo's 3DS console was launched in early 2011 and features a 3.5-inch autostereoscopic display.

Khronos Group, a consortium focused on the creation of royalty-free open standards for parallel computing, graphics and dynamic media on a wide variety of platforms and devices, published a web standard (WebGL) which brings plugin-free 3D graphics to the web browser.⁴⁴ WebGL is a version of OpenGL, the Open Graphics Library specification developed by Silicon Graphics in 1992, and since then has been used for many video games. Using the latest version of the standard, 3D graphics can be viewed on PCs, embedded devices and mobile devices, which will promote the convergence of gaming and social media.⁴⁵

Processors

Smartphone, console or PC: the aforementioned trends in video gaming are made possible by the rapid progress in microprocessor technology. Today's chips feature multiple cores that can process many instructions at once. Many devices are equipped with dedicated graphic processors (GPUs) in addition to the CPU to calculate 3D graphics or realistic effects, such as smoke and light bursts which are essential for the gaming experience.⁴⁶

Chip makers including AMD, Freescale Semiconductor, Marvell, Nvidia, Qualcomm and Samsung are increasingly focusing on bringing PC-like processing power to mobile devices. These have their own constraints, in particular limited battery runtime, so that power consumption and heat dissipation become an issue.

5. The Gaming industry

According to Gartner research, the global video game industry – software, hardware and online gaming – will grow from USD 74 billion (estimate for 2011, see Figure 6) to USD 112 billion in sales by 2015.⁴⁷ In comparison, movie theaters around the world reported a combined total revenue of USD 31.8 billion in 2010.⁴⁸ As described in the previous sections, the industry witnesses a shift from traditional dedicated gaming devices to smartphones and tablets, from big game design companies to smaller studios offering their games in app stores. Gartner predicts that online gaming spending will pass hardware spending by 2015.

Moreover, buying patterns have changed and opened up the market for subscription-based games and the free-to-play segment, which will be described below.

Physical distribution

Despite the talk, blockbuster games, often characterized by their complex story line and high-definition graphics, are still the dynamo of the industry selling at USD 50 to 100 per unit. Since 2007, video games have consistently beaten Hollywood blockbuster movies in first-week sales revenue, see Figure 7.⁴⁹ As one commenter put it:

⁴⁴ See <http://www.khronos.org/webgl/>

⁴⁵ See for instance Zio (Colombia) <http://zio.co/>

⁴⁶ Technology Review: *Dazzling Dual-Core Phones and Tablets*. 13 Jan 2011, <http://www.technologyreview.com/computing/27055/>

⁴⁷ The New York Times Bits Blog: *Video Game Industry Continues Major Growth, Gartner Says*. 5 Jul 2011, <http://bits.blogs.nytimes.com/2011/07/05/video-game-industry-continues-major-growth-gartner-says/>

⁴⁸ Ars Technica: *Piracy once again fails to get in way of record box office*. 23 Feb 2011, <http://arstechnica.com/tech-policy/news/2011/02/piracy-once-again-fails-to-get-in-way-of-record-box-office.ars>

⁴⁹ See https://www.gplus.com/Media/Game-Over-L_1561.png

“Video games definitely offer more value to consumers [than movies]. A movie is only good for an hour and a half of entertainment while a video game can be played for hundreds of hours and still be fun. No matter how good Avatar is – it will stop being enjoyable after watching it more [than] 20 times.” (Comment on VentureBeat)⁵⁰

Major contenders on the blockbuster games market are Activision-Blizzard, EA (Electronic Arts), Microsoft and Take-Two Interactive.

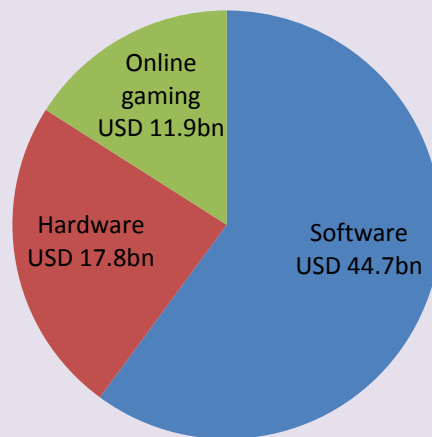
App stores and game discovery services

The market for smartphone games has been growing since the launch of the Apple App Store in 2008, and numerous game developers have been waiting for their breakthrough since. Before publishing its 350 million downloads bestseller Angry Birds, Rovio created 52 other games with, if any at all, very limited success.⁵¹

Keeping high-quality games from getting lost in the crowd of thousands of apps is one objective of mobile game discovery platforms such as Applifier, i-Jet Media, Mobage, OpenFeint and Tapjoy. These services allow users to share information about the games they are playing with their social network (word-of-mouth advertising) including the high scores achieved, and give advertisement opportunities to developers to have their games promoted. Apple, collecting a small share of whatever is purchased in the App Store, launched its own social gaming network Game Center with similar features and multiplayer functionality.

Figure 6: Global video game industry in sales (2011)

Global video game industry in sales (2011)

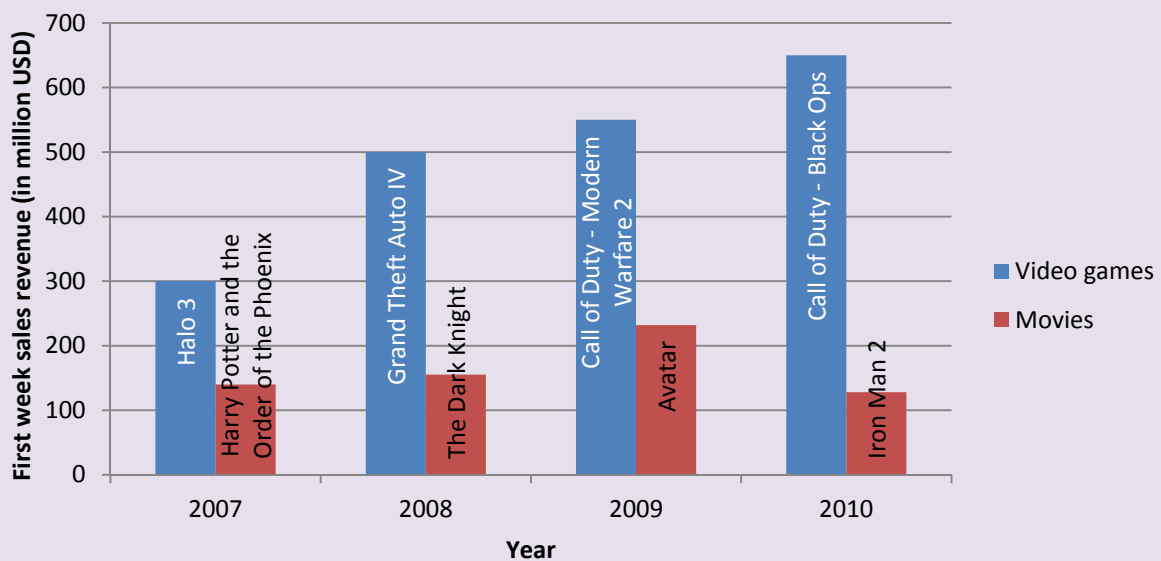


Source: [Gartner; The New York Times Bits Blog](#)

⁵⁰ VentureBeat: *Why video games are the new movies: Call of Duty Black Ops sales top \$1B*. 21 Dec 2010, <http://venturebeat.com/2010/12/21/call-of-duty-black-ops-sales-top-1b/>

⁵¹ MIT Entrepreneurship Review: *Angry Birds will be bigger than Mickey Mouse and Mario. Is there a success formula for apps?* 18 Feb 2011, <http://mter.mit.edu/article/angry-birds-will-be-bigger-mickey-mouse-and-mario-there-success-formula-apps>

Figure 7: Games vs. movies: First week sales revenue (2007-2010)



Source: [G+](#)

Freemium, free-to-play and virtual goods

While some game apps are selling in the range of USD 0.99 (Angry Birds) and USD 6.99 (The Sims 3 for smartphone), it has been reported⁵² that more than half of the game revenues made in the App Store today is from *freemium* or *free-to-play* games, meaning that players can start playing for free and can pay real money for virtual goods as they progress, for upgrades or other game-related services. According to In-Stat, the revenue generated specifically from the sale of virtual goods has increased from USD 2.1 billion in 2007 to USD 7.3 billion in 2010.⁵³ Players pay via credit cards, mobile payments, PayPal or prepaid cards which are becoming available in many countries.⁵⁴ Facebook has its own virtual currency called Facebook Credits. USD 1 is the equivalent of 10 Facebook Credits and the company retains 30% while developers receive 70% of all revenue earned through Credits.

Some mobile payment services have identified in-game purchases as a business opportunity, and developed interfaces allowing users to have purchases listed on the phone bill rather than paying via credit card. More generally, mobile payment systems are an important area for standardization, policy and regulation, and have gained enormous attention in the recent months with stakeholders ranging from the financial to the ICT sectors.

In-game advertising

An additional way to monetize free-to-play games was found in in-game advertising (IGA), which includes the display of advertisements in the background (e.g. as a billboard in a soccer game or while the game loads) or more prominently (e.g. a particular car brand the player can choose in a racing game).

⁵² Flurry Blog: *Free-to-play Revenue Overtakes Premium Revenue in the App Store*. 7 Jul 2011, <http://blog.flurry.com/bid/65656/Free-to-play-Revenue-Overtakes-Premium-Revenue-in-the-App-Store>

⁵³ In-Stat: *Virtual Goods in Social Networking and Online Gaming*. Nov 2010, <http://www.instat.com/catalog/Ccatalogue.asp?id=336#IN1004659CM>

⁵⁴ For instance Gate2Play in 16 countries in the Arab region, <http://www.gate2play.com/>

Barack Obama's 2008 presidential campaign made use of billboard advertising in 18 games, including the popular sports games Madden NFL 09, NBA 09 and NHL 09 (football, basketball, hockey), across ten battleground states.⁵⁵ Some globally recognized brands are spending a part of their advertisement budget on in-game ads: Toyota has recently signed a deal with Electronic Arts to allow players to buy Toyota Prius and Toyota Prius Eco-Greenhouse cars as virtual gifts and give them to friends playing the EA game Monopoly Millionaires.⁵⁶ To increase their own revenues some companies started giving financial incentives (e.g. Facebook Credits) to players agreeing to watch ads in some games.⁵⁷

The Open Mobile Alliance (OMA), an industry association of nearly 200 mobile companies, has released a specification providing game developers with architectural principles and requirements for IGA.⁵⁸

Gold farming

The term *gold farming* was coined when individuals began selling virtual in-game goods through markets like eBay. In some countries this kind of auxiliary income has created whole industries. *infoDev* estimated in a report that 100,000 young, low-skilled workers in countries such as China and Viet Nam earn a living by harvesting virtual goods and providing player-for-hire services (*powerleveling*) to wealthier players of World of Warcraft and similar games.⁵⁹ The gross revenue of this industry amounted to USD 3 billion in 2009, most of which remained in these economies. The study suggests that even the least developed countries could benefit from such industry, as long as the basic infrastructure (software, hardware, connectivity) is available.

An interesting insight into the gold farming phenomenon has been published by the University of Manchester's Centre for Development Informatics and is recommended for further reading.⁶⁰

Professional gaming

Professional gaming – the practice of competitively playing in video game leagues and tournaments at professional level – enjoys great attention and popularity in Korea and some other countries. Professional players are often associated with teams, which are sponsored by gaming companies, hardware suppliers and sometimes energy-drink conglomerates. They compete in different game genres including some of those mentioned in this report. USD 1 million was awarded to the winning team in a gaming tournament held at the world's largest trade fair for interactive games and entertainment *gamescom* (Cologne, Germany).⁶¹ The tournament was broadcast in four languages (Chinese, English, German and Russian) and featured Dota 2, an action fantasy strategy video game.

⁵⁵ GameSpot: *Obama campaigns in Burnout, 17 other games*. 14 Oct 2008, <http://www.gamespot.com/news/6199379/obama-campaigns-in-burnout-17-other-games>

⁵⁶ Brand Republic: *Toyota becomes first brand to appear in Monopoly Millionaires*. 12 Apr 2011, <http://www.brandrepublic.com/news/1065236/Toyota-becomes-first-brand-appear-Monopoly-Millionaires/>

⁵⁷ Mashable: *Facebook Now Pays Users 10 Cents To Watch Certain Ads*. 6 May 2011, <http://mashable.com/2011/05/06/facebookfacebook-10-cents-ads/>

⁵⁸ See http://www.openmobilealliance.org/Technical/release_program/iga_v1_0.aspx

⁵⁹ *infoDev: Converting the Virtual Economy into Development Potential: Knowledge Map of the Virtual Economy*. Apr 2011, <http://www.infodev.org/en/Publication.1076.html>

⁶⁰ R. Heeks: *Current Analysis and Future Research Agenda on "Gold Farming": Real-World Production in Developing Countries for the Virtual Economies of Online Games*. University of Manchester, Development Informatics Working Paper, 2008, http://www.sed.manchester.ac.uk/idpm/research/publications/wp/di/di_wp32.htm

⁶¹ Joystiq: *Not So Massively Extra: Dota 2 to be unveiled with \$1.6 million US tournament*. 3 Aug 2011, <http://massively.joystiq.com/2011/08/03/not-so-massively-extra-dota-2-to-be-unveiled-with-1-6-million/>

6. Conclusion

Video gaming is a global phenomenon, a fast moving multibillion dollar business, cutting across all age groups and gender. Traditional makers of video games and gaming equipment are facing disruption in particular from the advent of mobile gaming and social network games. In a similar form, such transformation has been witnessed by other traditional media such as the press and the music and film industries, which have to adapt to the new markets and competitors/players in business.

The traditional video gaming industry is not known for its passion for standardization. Lack of interoperability restricts players to one particular gaming platform with rather expensive games. There are signs that similar walled gardens are established in the area of mobile and social network games, binding users to certain mobile operating systems or social networks. In the long run, this may not be in the interest of customers, and game developers might need to develop their products for each platform separately.

To reflect market realities, all gaming-related ICT policy and standardization work must include mobile and social network gaming. Some companies have started embracing cloud computing and 3D, two areas under study in ITU-T standardization. Innovative natural user interfaces and payment mechanisms are gaining attention inside and outside the gaming world, and should be considered in ongoing ITU work (e.g., accessibility or security), or be addressed as distinct issues.

As their electricity bills rise and the space on their living rooms' entertainment racks wanes, consumers are beginning to struggle with the ever-increasing number of set top-boxes, satellite receivers and gaming consoles. The trend is thus towards a one-box-fits-all solution, run on the latest processor technologies. Such a solution will integrate audio and video streaming, gaming and other entertainment features, natural user interfaces and secure payment mechanisms.

It is a logical and certainly desirable goal to integrate these closely related audiovisual technologies, and ITU-T Study Group 16 is in fact taking similar steps in the IPTV field, advancing the technology from a TV delivery platform to a multipurpose multimedia solution. Incorporating a variety of audiovisual technologies into a single 3D TV device is understandably a task demanding a great degree of standardization work. If service and content providers, including game developers, are to have access to these devices, there is a necessity for the formation of well-defined APIs, standardized communication protocols, toolboxes, middleware and security frameworks.

Finally, as players expand in numbers, the impact of video gaming on society needs to be studied further. Aspects to be analysed include not only economic development, but also its influences on behaviour, health and education.

List of abbreviations

API	Application programming interface
App	(Mobile) application
CEA	Consumer Electronics Association
CPU	Central processing unit
CTO	Chief technology officer
DVB	Digital video broadcasting
EA	Electronic Arts
GL	Graphics library
GPU	Graphics processing unit
HD	High-definition
HDMI	High-definition multimedia interface
HDTV	High-definition television
HEVC	High efficiency video coding
HTML	Hypertext markup language
ICT	Information and communication technology
IGA	In-game advertising
IPO	Initial public offering
IPTV	Internet Protocol television
ITU	International Telecommunication Union
ITU-R	ITU Radiocommunication Sector
ITU-T	ITU Standardization Sector
LAN	Local area network
LCD	Liquid crystal display
MMOG	Massively multiplayer online game
MMORPG	Massively multiplayer online role-playing game
MVC	Multiview video coding
NUI	Natural user interface
OMA	Open Mobile Alliance
OS	Operating system
PC	Personal computer
QoE / QoS	Quality of experience / Quality of service
ROM	Read-only memory
SDK	Software development kit
SMPTE	Society of Motion Picture and Television Engineers
SMS	Short message service
USD	United States dollar
WoW	World of Warcraft
W3C	World Wide Web Consortium
XaaS	Anything as a service

ITU-T Technology Watch surveys the ICT landscape to capture new topics for standardization activities. Technology Watch Reports assess new technologies with regard to existing standards inside and outside ITU-T and their likely impact on future standardization.

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Technical Aspects of Lawful Interception
NGNs and Energy Efficiency
Standardization Activities for Intelligent Transport Systems
Distributed Computing: Utilities, Grids & Clouds
The Future Internet
ICTs and Food Security
Biometrics and Standards
Decreasing Driver Distraction
ICT as an Enabler for Smart Water Management
Using Submarine Communications Networks to Monitor the
Climate
Standards and eHealth
The Optical World

<http://www.itu.int/ITU-T/techwatch>