New Digital World

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Introduction

Digital technologies have made a significant difference to our life. Digital contents will be the next wave that changes our life. For example, over the past decade, many people got used to using mobile phones. Some of us even have two or more mobile phones. Today, mobile phones are designed to take pictures or listen to MP3. Some mobile phones even have color screens that can play multimedia games or watch video. This is just a simple example that digital technologies have changed our life in many ways.

The society has evolved from an agricultural society to an industrial one, and now to an informational community. Some people predict that it will be a content society in the future. In that society, contents instead of technology are the key differentiator between products. Let's take shoe products for example: technological level is a secondary concern to the price of the shoes. If we can combine shoes with the NBA super star Michael Jordan's performance, then the value of Jordan's shoes is priceless [12]. In the future, technology is no longer the key to success because the technology across the industry is similar. Contents which include story and/or dream will play a more important role.

Let's take a closer look at the trend in Silicon Valley after the past three-year downturn. High-tech giants (such as Intel, Microsoft, Hewlett-Packard, Apple, etc.) tout digital entertainment as their next big buzz. The buzz is about iPod or portable media player, rather than a simple PDA. It is about networked entertainment, rather than networked computers. For example, on the Consumer Electronics Show this year, Intel Corp. announced its plan to invest $200 million in companies developing new types of hardware, software and networking products for the digital home. Its goal is to accelerate the convergence of PCs and consumer electronics equipment by making it easier for consumers to "play music, video and other digital contents on devices around the home" (Source: IDG News Service).

Furthermore, networked media contents today are enormous and growing. While 13% of web-connected U.S. homes had music files on their PC's 5 years ago, 63% of web-connected homes have music stored on their PCs today (Source: Jupiter). By 2006, online music subscriptions and downloads will account for 10 percent of the $12.8 billion music industry, and by 2008, one third of music sales will come from downloads (source: Forrester Research).

Digital content markets will continue to grow in the U.S. as well as in Taiwan. According to data released by Science and Technology Advisory Group of Executive Yuan, Taiwan's digital content industries had revenue of 15.4 trillion NT dollars in 2002, and had revenue of 18.9 trillion NT dollars in 2003. It is projected to continue to grow at its 22~25% compound annual growth rate for the next 3 years [6].

To share/exchange knowledge and experiences among digital-content experts from Taiwan and U.S., North America Taiwanese Engineers' Association (NATEA) organized a US-Taiwan High-tech Forum (UTHF) on Sept. 11, 2004. We had distinguished speakers, such as IEEE Fellow, IEEE Distinguished lecturer, former White House advisor, venture capitalist managing $1 billion funds, industry representatives from Intel, Microsoft, and Cisco, etc. About 300 people participated in this forum.

This article is an attempt to summarize what I have learnt from this forum about technology/application trends and business opportunities in the new digital world.

Definition of New Digital World

New digital world can be characterized by the following 5 technology/application trends.

- Higher fidelity in content creation [2]: One example is that movies nowadays use a lot of special effects, e.g., Matrix, iRobot, etc. Sometimes, it is so real that we cannot notice the special effects. Another instance is the eyevision in Super Bowl. We can now enjoy the football game in 3D space, esepcially in a critical play. The huge amount of computational power today has driven many advances in image/signal processing, computer vision, and computer graphics. As these fields converge, we will enjoy more visually-exciting contents (mixed from real and synthetic digital data).
- Higher fidelity in compression [3,7]: High-quality information is one of the important factors in new digital contents. Compression is to represent the high-fidelity contents by using the small amount of information. Technologists always look for better

compression algorithms to represent higher quality of contents by using more computation power. For example, from H.263 to MPEG-4 and to H.264, the compression efficiency has increased to 1.2x and 2x while the computational complexity has increased to 1.4x and 3.5x. As we can afford more computational power, compression technology will continue to enhance.

- More content storage space everywhere [9]: According to Gartner Dataquest, the midrange PC will have greater performance and more hard drive space, but lower prices. In 2004, the average selling price of a midrange PC is $932 and has 120GB of hard drive storage. While the average selling price drops to $809 in 2007, the hard drive space will increate to 350GB. For another instance, the amount of flash memory for a digital camera continues to increase while the price is dropping.
- More contents/services any time and any where [11]: Thanks to the advances in wireless home networking and the wide penetration in broadband, devices are connected everywhere. Moreover, devices/ interfaces are seamless integrated via interoperable standards. Gradually, we can "transparently" access all the contents and services whenever and wherever we want.
- Contents/services are more interactive [1]: One of the most important characteristics in the new digital lifestyle is two-way interaction. The “old-age” contents (like movie or TV) are distributed by one way; have no or limited interactivity. In the new digital world, the user is in control (Interactive TV program, Game, education learning, etc.).

Challenges for Us:

In the new digital worlds, we have the following four challenges:

- Cyber security [4]: Almost all computers are connected to the cyberspace. While it brings us a lot of benefits, one challenge is the security in the cyberspace. Various cyberspace attacks cause person/company loss, for example, virus, spam, fraud, spyware, “phishing”, etc. On the average, it only takes 20 minutes to attack an unpatched PC connected to the internet in 2004, half of the time in 2003 (Source: PC Magazine, Aug 2004). Moreover, next war or terrorism may strike at the cyberspace (that is, using bytes instead of using bullets). “War in the cyberspace did not happen” does not mean “it won’t happen”. We should be prepared for these potential threats, by understanding the issue and by implementing better security measurements (such as, firewalls, virus/spyware detector, smartcard for access control, etc.).
- Piracy [10]: While consumers really like to enjoy free stuffs, content creator/providers must protect their profits. Thus, new technologies have been emerging for digital right management and intellectual property protection. However, there have been no obvious success due to many obstacles, e.g., ease-of-use, cost, privacy, etc. To succeed, we still have to find schemes that are easy to use, are applicable to multiple types of contents, are able to integrate with existing systems, can support for flexible business models, have strong security, and are able to recover from being hacked. Despite disagreement over how and who can solve piracy, all affected parties can benefit from mutual cooperation.
- Standard and royalty [3]: While compression technology will continue to enhance so that we can enjoy higher quality contents, one unintended result is intellectual property battles waged by companies and other legal entities. Unfortunately, high royalty fee or intellectual property rights (e.g., in MPEG-4) may prevent the standard from being widely adapted. (Because of this issue, it is predicted that H.264 will take off much faster than MPEG-4.) This also provides interesting challenges for engineers to solve.
- Digital equality [5]: Taiwan ranks #9 worldwide in networked readiness index today, and Taiwan plans to have broadband connection to 600 million families by 2008. This means that Taiwan is moving toward knowledge based economy and information driven society However, a social challenge arises in Taiwan: aboriginal group, rural areas, blue collars, senior citizens are marginalized, deprived, underprivileged, or excluded. As Taiwan is moving toward an e-state, it is important that we (academia, industry, government, and everyone together) can address this social equality.

Business Opportunities Forward:

There are many business opportunities in the new digital world. Besides the solution for afore

mentioned challenges, the following areas also have a lot of business opportunities in the next couple of years.

- Innovative products in new digital home [8]: Portable media center, portable game platform, and electronic pictures are some examples of the past innovation. The demands in innovative products (in TV-centric entertainment, PC-centric business, telephone/internet-centric communication) will continue. (Additionally, devices must be easy to use [1,11]. While consumers are more educated to use slightly more complicated devices, ease-of-use is still a critical component for a consumer electronic device to be widely adopted. TV remote controller is the most popular human-machine interface. Thus, we see TV is still the center of home entertainment.) According to In-Stat/MDR, the market for smart appliances in digital home will experience a 71.9% compound annual growth rate from 2001 to 2006 (to more than 9 million units).
- Software that manages contents [9]: In 2004, digital camera owners keep an average of more than 250 images per year (source: InfoTrends). One of the challenges is how to manage them. Therefore, computer softwares that find the pictures that we want quickly or summarize a trip's picture/video into a couple of minutes become very helpful. IDC forecasts that digital asset management software market will grow to $1.22 billion in 2008, at a 40% compound annual growth rate from $211 million in 2003 (this is five times faster than the overall software market).
- Home networking facilitator [9]: Home networking is to connect multiple stand-alone devices together to exchange and share information (including digital contents and services). It creates opportunities to extend services beyond the primary PC at home. Consumers will soon adopt networking technologies over which they enjoy their contents and/or services. According to Jupiter, by 2006, approximately one-half of all broadband households will have home networks. In-Stat/MDR predicts the global market of home networking to grow from $1.8 billion in 2002 to $5.3 billion in 2007.

Conclusions:

The year's UTHF covered many technologies trends, challenges, and business opportunities of the new digital world. First, many things will be digitized in the future (including content and terrorism/war). In the new digital ear, digital contents are the core of many emerging consumer electronics devices and services. In the mean time, we need better security and digital right management. Second, everything (content/service) will be networked. First digital age started from the debut of computer, but at that time, computers were isolated. When everyone can access digital contents from the Internet, the digital world really starts. As we would like to enjoy everything anytime and anywhere, the business opportunities in (home) networking are still growing. Third, human factor is still the key. We will enjoy higher fidelity and more interactive contents. More innovation (e.g., new applications, ease-of-use) and creativities (e.g., seamless integration, more computer intelligence) will bring new products (contents and services) for us to enjoy.

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