MOBILE GAMING

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Recent technological advances in mobile devices have produced powerful mobile phones and personal digital assistants that come with ever-greater computing power, storage capacity, and graphical and audio capabilities. Playing games on them continues to attract millions of subscribers/players worldwide. For example, mobile gaming was the highlight of the 2006 Electronic Entertainment Exposition in Los Angeles, with Nokia showcasing its Next-Gen Mobile Gaming Platform and a series of new game releases. Also, several speakers at the same show cited numbers showing that an increasing percentage of users of mobile devices use them to play games.

Tens of millions of users worldwide play games, as well as make phone calls, on their cell phones and other handheld devices.

A 2004 In-Stat/MDR study said that about 6.5% of U.S. mobile-device subscribers were "extremely interested" or "very interested" in purchasing mobile game services [9] and projected that by 2009, 78.6 million people in the U.S. would be playing mobile games; it also said downloads of mobile games will have increased tenfold compared to 2003. Zelos Group found that in the U.S. alone, mobile games could generate $1.5 billion annually in revenue by 2009. In Europe, a 2003 study by Frost & Sullivan reported that revenue from mobile games would rise from just under $0.8 billion in 2002 to $7 billion in 2006 [1]. In the Asia-Pacific region, IDC reported that the wireless gaming industry is growing 40% annually and expects it to reach $1.3 billion annually by 2008.

Demand for mobile games is fueled by three main factors:

- Increasing mobile device penetration rates in many countries, especially Finland, Japan, Korea, and Sweden; many users of mobile devices are potential consumers of mobile games;
- The ability of mobile devices to deliver quality video and audio continues to improve significantly, making such devices suitable for playing mobile games; and
- The improving ability of wireless networks to handle broadband transmission, allowing users of mobile devices to download larger and more compelling mobile games.

They represent both business opportunity and threat for wireless carriers, application developers, and content providers. Indeed, they are happening so quickly that industry observers believe they can alter the basis of competition in the computer gaming industry. Key players have expressed a desire to exploit it. For instance, mobile device manufacturer Nokia launched gaming communities to build awareness and use of mobile games. As a major game publisher in Japan with 2.5 million subscribers for its mobile game services, Sega hopes to achieve similar success in the U.S. In its 2004 study, In-Stat/MDR said that mobile gaming would continue to increase in importance as a contributor to telecom industry revenue. A that 114 million people worldwide would be playing online games by 2006, most in the form of mobile games [6]. While industry analysts would not dispute the significance of the trend toward mobile gaming, many questions remain. Here, we examine key technology factors behind the trend and analyze the opportunities for and threats to key players (and potential new entrants) in the computer gaming industry.

The mobile gaming technology platform typically comprises a network linking a server and numerous clients (mobile devices). Through the server, which stores and controls game services, game providers are able to publish and distribute mobile games for players to download on their mobile devices. Some such devices may be gaming enabled (such as the Nokia N series). When mobile gaming users connect to the server, they are able to join multiplayer games, download new games, and view their scores. In online-game-play mode, players access the server to play mobile games with other players. In offline-game-play mode, players use Bluetooth-enabled mobile devices to form local area networks with other players (within a distance of about 10 meters) to play mobile games. Recent advances in wireless technology (in terms of speed and bandwidth) provide practically instantaneous data transfer, thereby enabling millions of people to play mobile games on the go (see Table 1).

Platform	Characteristics	Implications for Mobile Gaming
3G	Broadband, packet-based transmission of text, voice, video, and multimedia Data rates up to 2Mbps	Quality graphics and sound, enhancing gaming experience Bigger games downloaded in less time
4G	Interactive multimedia services with greater bandwidth, digital elements, global mobility, service portability, and network security Data rates up to 100Mbps	High-quality multimedia and 3D games with greater speed and efficiency Bigger games downloaded in less time More players "Global" multiplayer gaming
GPRS	"Always-on," higher-capacity data services (such as email, Internet browsing, multimedia messages, visual communication, and location-based services) Data rates up to 171kbps	Mobile games played "on the move" Colorful images Multiplayer games (such as Nokia's Pathway to Glory)
Bluetooth	Short-range wireless networks within 10 metres inexpensive and easy to connect Data rates up to 2.1Mbps	Local-area multiplayer games (such as N-Gage by Nokia and Zodiac by Tapwave)

Table 1. Wireless communication platforms for mobile games.

To support the explosive growth in the mobile gaming market, technology platforms are being created for the development of the games. Sun Microsystems' Java 2 Platform Micro Edition, or J2ME, and Qualcomm's Binary Runtime Environment for Wireless, or BREW, are the most prominent technology platforms used in the industry. Each offers an

ity on small screens, and the ability to create games that can be run offline, eliminating the need for a constant network connection. Other promising technology platforms include Mophun (from Synergenix Interactive), ExEn (an execution engine from In-Fusio), and XNA (from Microsoft) (see Table 2).

The convergence of technology platforms is an opportunity for mobile-game content developers to target a worldwide market. They can develop mobile games for common platforms (such as J2ME and BREW). They can also quickly adapt existing mobile games for the common platforms. Given such benefits, different mobile-game content developers are likely to create mobile games that are compatible (based on the common platforms).

Platform	Characteristics	Devices
J2ME (Java-based)	Enables Java-based games to be played on mobile phones and PDAs Allows mobile device makers, wireless carriers, and enterprises to quickly develop, install, and run new games on wireless networks Widely accepted standard that works with multiple platforms Improves graphic and multimedia capabilities to suit mobile devices	Nokia Series 40 and 60 devices, N-Gage, Motorola T720
BREW (C-based)	Optimizes memory allocation, making it suitable for mobile devices with limited resources Supports game operators with such capabilities as secure over-the-air distribution of applications, billing and payment, and service monitoring and support Allows games to be played more quickly because it runs on C rather than Java	Motorola T720, Samsung A530, Samsung A610
Mophun (C-based)	Enables rich gaming experience with advanced 3D graphics, enhanced audio, and multiplayer capabilities	Sony Ericsson, Motorola, N-Gage
ExEn (Java-based)	Provides good graphical capabilities and fast processing speeds Enables additional game-development capabilities (such as sprite zooming, parallax scrolling, ray casting, and rotations)	Philips, Alcatel, Mitsubishi, Panasonic

Table 2. Technology platforms for development of mobile games.

Major producers of mobile devices aggressively try to alleviate the related technology limitations. For instance, the Nokia N81 handset (released in 2007) comprises a 16.7 million-color screen with integrated stereo speakers and full support for Java ME gaming applications. It can also switch effortlessly between portrait and landscape modes for playing games. Faster processors are also being used to enhance mobile devices for playing games. For instance, the Nvidia GoForce 3D (the world's first 3D wireless media processor, introduced in 2004) offers a level of processing not previously possible on mobile phones, PDAs, or other mobile devices. Mobile game developers are thus able to harness this powerful technology to create rich, dynamic, lifelike worlds and characters. Another example is the Imageon 3200 chip (from ATI) that allows higher-quality graphics and video to be displayed on standard PDA displays, thus boosting the quality of the gaming experience.

2010, mobile gaming will overtake both console and personal computer gaming in terms of market value. As new entrants challenge incumbents for this growing slice of the gaming industry pie, there is likely to be fierce competition by "content aggregators, publishers, handset manufacturers, resellers, and network operators" [3]. Key players in the gaming industry must position themselves to be able to exploit the new opportunities that are likely to follow.

The development and marketing costs for a console or personal computer game may run in the millions of dollars. In comparison, such costs for a mobile game are typically $100,000 to $200,000 (2006 estimates); for details, see www.aniway.com/flash_lite_for_mobile_game_developers/?p=35. Moreover, development kits for mobile games are widely available from phone manufacturers, including Nokia, helping mobile-game content developers create content for their phones. The low entry barriers for mobile games have helped spawn a proliferation of small mobile-game content developers.

A challenge confronting these developers, which typically lack strong marketing and distribution networks, is getting their products to consumers. Two possible solutions are:

Partners. Content developers can enlist mobile device manufacturers and network operators to distribute their products; for example, in 2004 Jamdat Mobile signed a series of agreements with network operators to make its products available to 880 million mobile device users worldwide. In Singapore, Gameloft (an emerging mobile-game-content developer) signed agreements with three major network operators—SingTel, Starhub, and M1—to distribute its products; and

Mergers and acquisitions. Content developers can enhance their long-term prospects through mergers or acquisitions. A larger mobile-game-content developer is more likely to survive than its numerous small mobile-game-content-developer counterparts. An example is Mforma, which went on an aggressive acquisition spree 2001–2004 [4].

Mobile-game content developers can also focus on

ment of the gaming industry. Men generally prefer sports, shooter, and other action-game genres. Women are more likely to play puzzle and role-playing games. The focus of the gaming industry has historically been male players. But now mobile games are being developed to appeal to both genders. For example, The Sims is a runaway success in terms of revenue among both men and women. The trend seems sustainable because women tend to spend more on services related to mobile devices than do men. An article [2] highlighted the significant growth in the number of women worldwide eager to play and willing to pay for mobile games. Mobile-game-content developers can exploit such opportunities by developing mobile games specifically for women.

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As of January 2008, the use of 3G services is still much less than anticipated by industry analysts, mainly due to the prohibitive cost of 3G licenses and potential 3G implementation problems. Likewise, multimedia messaging has not taken off as predicted. Therefore, the current strategy of network operators is to try to derive more revenue from nonvoice services (such as downloading ring tones and pictures). Network operators increasingly look to sell services for downloading mobile games. Unlike other players in the industry, this should not be such a problem for network operators since the downloading of mobile games is like other nonvoice services.

The network operator Vodafone took such an initiative in 2002, launching the Vodafone Live! suite of services to integrate services like picture-sending, Java games, mobile Internet, and ring tones into a coherent package accessible over the general packet radio service network. In doing so, Vodafone was able to capture a good slice of the fast-growing mobile-gaming market. The strategy of integrating services is also being practiced by the Japanese network operator services. Network operators are generally not strong in content creation, so a collaborative strategy would be useful. As an example, T-Mobile (a network operator) and Sony Pictures (a content creator) collaborated in 2002 to create "film-themed games for T-Mobile's wireless subscribers" [8]. Such a strategy builds on interest created by movies while encouraging nongamers to try out mobile games.

Another potentially lucrative business that network operators may also be able to exploit is massively multiplayer online games (MMOG). Unlike mobile games sold as a product that generates one-time revenue, MMOGs can provide network operators with an ongoing subscription-based revenue stream. As MMOG players subscribe in order to play with thousands of other players worldwide, they provide a self-generating revenue stream for network operators in the form of monthly subscription charges and data-transfer fees. Thus, network operators can link up with MMOG developers to create and market such games while providing potentially lucrative network support. A successful example is Botfighters, a mock combat game in which players use their cell phones to locate and "kill" opponent robots (released in 2000 by Swedish mobile-game developer It's Alive). This MMOG (which has since undergone numerous revisions) is played by tens of thousands of gamers in Finland, Ireland, Russia, and Sweden. In 2004 the game generated more than one million short messages per week in Moscow alone.

Manufacturers of mobile phones regularly introduce new models in a bid to attract new customers or get existing customers to upgrade their handsets and hasten the replacement cycle, as well as renew their contracts with their existing service providers. One way to do this is to exploit the growing interest in mobile gaming. For instance, in 2002, Nokia introduced the N-Gage (which has since undergone several improvements), combining the features of a mobile phone, an MP3 player, and a mobile gaming device. The N-Gage continues to be positioned as a direct competitor to the dominant mobile gaming devices—Nintendo's GameBoy Advance and Sony's PSP. Some PDA manufacturers have adopted a similar strategy. For example, Tapwave's Zodiac (released in 2004 in Asian markets) has received positive reviews as a PDA/mobile gaming device hybrid. In 2003, Sprint PCS released its Game Pad controller, which works with the Samsung A600 cell phone (introduced in 2003) to add console-like control to mobile games. The Sony Ericsson P800 combines a PDA and mobile-game device [5].

These innovations have generated profits over the

tendo has generated in sales of handheld gaming devices, including the Wii video game console (introduced in 2006). However, as new entrants, mobile-device manufacturers may indeed face formidable challenges from incumbents as they try to capture market share. Nevertheless, as they enhance the gaming capabilities of their products, mobile-game-content developers can create more vivid and faster-paced games to entice mobile-phone subscribers to play mobile games.

Console manufacturers have traditionally provided the platforms for computer games. But with the rising tide of mobile gaming, console manufacturers would face tough competition from new entrants (such as mobile device manufacturers). Mobile devices in the near future should be expected to have better processing power, enhanced 3D graphics performance, and better audio capabilities. Meanwhile, Intel and Hitachi have developed specialized microchips for mobile phones to improve the quality of mobile gaming. In addition, improved network bandwidth and storage capacity have begun to put mobile devices on par with consoles. Indeed, the very existence of console manufacturers is threatened by such devices.

It is thus essential that console manufacturers improve their product appeal by combining gaming and general electronics functions. An example is the Sony PlayStation 3, with high-definition DVD and HDD recording capabilities, a product positioned as an integrated entertainment system, transcending the idea of mobile gaming. Microsoft's Xbox platform has also followed this trend by incorporating Internet, video, and photo-editing functions into the latest Xbox 360 console. Console manufacturers should also view backward compatibility as an important feature in future console development, protecting gamers' investment in earlier games while giving them access to the latest ones. Indeed, the success of Sony's dominant PlayStation 2 was due largely to its ability to allow gamers to play games made for its predecessor, the original PlayStation.

Traditional game-content developers have provided games for arcades and personal computers since the 1970s. Games now considered classics include Pac-Man, Donkey Kong, and FIFA Football. These developers have positioned themselves to create versions of their existing games for the emerging mobile-gaming context, thereby allowing gamers to play the classics anytime anywhere. For instance, Electronic Arts (an established game developer with much success in both console and personal computer games) has ramped up its effort to extend the highly popular FIFA Football and Tiger Woods Golf games to mobile gaming platforms [7].

and immobility, arcade games have experienced a steady decline in recent years. The emergence of mobile games further threatens this business. Hence, arcade-game-content developers must focus on games that cannot be played in a mobile-gaming context. They must design and develop new games with unique characteristics (such as those that involve body movement). Through props (such as motorcycles, dance pads, race cars, and musical instruments), these developers have managed to create several arcade games (such as Initial D Arcade Stage 4, released in 2007) that offer a more realistic experience (that cannot be replicated in a mobile gaming context). They are also exploring the possibility of incorporating network capabilities into arcade games by enabling players to engage in Web-based interactive arcade gaming.

As mobile devices become an indispensable component of everyday life, the market for mobile gaming is likely to continue to increase well into the future. Incumbents in the computer gaming industry must adapt to remain viable. New entrants to the industry can exploit the many new opportunities that are still emerging. C

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