Future of the Game Technologies: Based on Technical Improvements of Game Services and Platforms

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Abstract

This article will predict near future of game technologies. The limiting factors for game technology are many and very hard to count all of them. The games platform in past and present will be discussed, and various technologies related to the game will be counted. The article will cover as many as possible, though the main focus of article will be based on technological improvements, which enables new game services and emerging new game platforms.

Key words: Game, Future Game, Game Technology, Game Service, Game Platform

1. Game Platforms

Windows Based Games platform

Windows based games is the ground where the game programmers work on wild frontier line, new technologies are being tested, and new genres are marching forward. Usually, a programmer learns their first program at school's lab PC. The PC is easy to access, found everywhere. Nowadays, 3D accelerating graphics cards are very common, and Micro software releases their DirectX for free.

Almost all new game technologies are tested first on PC. PC is the test-bed for next generation game console. It has multi-channel sound system, blazing fast 3D graphics accelerator with new shader. So, all the new and hot game technologies are developed for and at the PC.

The PC has hard disk which enables the programs to be installed, maintained, and modified with easy. 3D MMORPGs which need constant data and program updates are impossible to be serviced without these features. Most of the MMORPGs are based on PC platform for this reason.

The PC shows great hardware diversity. Some times, the programmers can't guarantee the resulting screen will be the same over different graphics card. Actually they show remarkable difference between different venders of graphics cards. This kind of diversity makes it difficult for PC game developers to develop and maintain games on PC platform.

Also, open architecture of PC enables crackers and software-pirates rip the game titles easily.

But the PC will always be the frontier of game technologies. May it be Apple-II, IBM-XT or something exotic and unheard of, the Personal Computer served as founding stone of game industry. It will also be the stepping stone of next generation of game technologies.

Performance and computing power of today's PC with 3G Hertz CPU, PCI-X graphics accelerator, 1G bytes of DDR memory exceeds greatly the super computers of previous generation.

The next generation of PC will feature 64-bits CPU, multi-CPU system, wide and fast bus for system and memory, more powerful shader with faster 3D accelerating speed. It will add more horsepower to every aspect of current PC and more.

Game Consoles

Xbox, PS2, and GameCube are representatives of game consoles.

Game consoles with every feature tuned for the game have very stream lined structure. For economical reasons they are designed to be light and slim without compromising gaming performance. Though the performances are fixed and do not improve, the fixed hardware specification ensures absolute compatibility within same game console.

Current generations of game consoles have 3D accelerating graphics, fast CPU, some consoles comes with hard disk and capability to connect to internet via ethernet or PSTN. Using these internet connectivity various game services such as game loby, voice chatting, match making are possible.

Future game console will feature home server capability, TIVO like features, more CPU performance with multi-CPU or grid computing, 3D graphics enhanced to match HDTV.

Mobile Game console

Mobile game consoles are machines like GBA, PSP, which are developed for the mobile entertainment. These machines are very similar to PDA and have same basic structures. The difference between mobile game console and PDA is that of game console and PC.

PSP will be released at December 2004.

PDA based Games platforms

In PC industry, MS windows and intel CPU compatible systems dominate market. Thus almost all software are developed in Windows system, and the software compatibility are usually guaranteed to some degree. But in PDA market, there is no apparent market leader.

Nowadays, XScale which is Intel's ARM-9 compatible CPU dominates PDA market. And MS' pocket Pc is now leading the PDA O.S. and PalmOS the traditional leader of PDA is falling behind.

From the view point of game developer, diversity in game platforms means bad business. Targeting and developing for single game platform is in itself very taxing task. Developing for multiple targets is hardship uncalled for. To solve these difficulties, there exist API standards for 3D graphics, multimedia, and other primitives.

Mobile phone based game platforms

Hardware and software of mobile phones are very diverse and it's very hard to keep track of. The result is incompatible systems everywhere. In general mobile phone programs have very limited compatibility, usually within same product series. Developing game titles in this environment raises developing costs, generates redundancy, and hard to maintain compatibility.

To remedy these problems, Virtual Machine based game platforms are employed. Java Virtual Machines are most general and well in use. But VM has several problems. Performance is not what expected. Additional costs of running VM decrease game performance. Some times VM does foolish thing, like garbage collection at unexpected time. Gabage collection in the middle of racing game will ruin the fun.

The API standards like OpenGL|ES and M3G solve these problems. The standardized API hides time consuming or CPU intensive process from the main program. Usually they are processed in native code, or with help of hardware accelerator. Generic game codes are still running through VM

When running games in mobile game platform, as it may be a PDA, mobile console, or mobile phone, the game consumes a lot of power, thus producing a lot of heat. Drawing 3D models in screen and calculating vector, matrix and geometric shapes are very CPU intensive job. As the battery of mobile game platform is limited, this is quite serious problem.

Two approaches exist for battery problem. First one is increasing capacity of battery. This could be done with easy. But battery is heavy, and it takes space. Second one is to reduce energy consumptions. By developing more efficient CPU and mobile system, we can increase running time of game platforms.

2. Network and Internet

Internet environment, Wire and Wireless

The xDSL technology made wired internet access very common. Nowadays, it is very hard to find who do not have broadband internet access. Every business offices are connected to internet. Anyone who have interests in internet can afford broadband connection without difficulties. Cost of internet connection is not expensive at all. These wide spread availabilities and use of internet made unconnectedness awkward condition. You just can't do without internet connection.

Now we have wireless internet. The wireless internet services come in two flavors. First one is WiFi, also called as IEEE 801.b. It is extension of wired internet connection. The WiFi clients connect to Access Point via radio, The AP is directly connected internet. It's extended form of ethernet to radio domain, basically. Second solution uses packet communication mode of mobile phone.

WiFi is designed as internet services to restricted or fixed area. WiFi client can only move within space so called hot spot You can't use WiFi client in the fast moving vehicle.

Mobile phone packet communications are derived from mobile phone services. So you can use internet connection within moving car with this technology. The drawback of this technology is it's price. The telecommunication company charges this service per data or per call and time. But usually this service costs much more compared to WiFi.

IPv6

The majority of internet services are based on IPv4. The IPv4 uses 4 bytes address space, and this address space is partitioned for easy routing. There are about 4G of address available to IPv4. That looks quite large but they are depleting very fast.

The IPv4 have other problems. The protocol does not provides adequate QoS. The IPv4 does not provides to address moving location of wireless client efficiently. There are other problems but those three are the main reason for IPv6 to immerge. IPv6 uses 128 bits address space., provides QoS, have ability to connect to moving mobile clients.

All seems too good to be true. The catch is that IPv6 is still not available for general public use. Current operating systems like Linux and Windows XP have capacity and protocol stack to handle IVv6. But, conversion from IPv4 to IPv6 is far from complete.

3. Game Development and Production system

Game engine

Game engine is the favorite of game developer. The

game engine provides not just simple software components but also provides complete developing suit of designing, integrating and all the necessary tools and technique to author a game title. Due to development and advancement of game engine technology, the time for game development and porting to other game platform can be reduced.

The game engine is set of tools and library necessary to complete the game title. The tools set includes map tool for generating game environments, character tool for compositing the game character, items, and effects. They also provides packing tools necessary to master the game contents to media.

3D Model and animation editor

The 3D models used in game have different properties compared to TV or movie, animations. The movie takes a lot polygon to make the model realistic. It takes a lot of time to render these hi-polygon count models. The game is for real time rendering. So the polygon count of a game models is much less compared movie models, usually about 2K polygons. This count is not absolute. According to the game design and genre, the polygon count can move to be as large as 10K and as little as 100.

The animation data is also limited. The game can't handle all possible animation of character, so there are usually 10 to 100 animations attached to a model. These animations could be shared among similar structured models.

Usually, 3D modeling and animations are edited using commercial tools like 3DS Max, May, or XSI. These tools have their own merits and falls. The decision to use which tool heavily depends on model designer and game programmer.

Automatic modeling and animation data capturing have been researched deeply by many researchers. But, automatically captured data does not usually fit the specification of game system. The automatic capturing process does provide more natural looking models and animation and reduce great amount of time and human resources, the final touches of human hand are always needed.

4. Hardware

System Hardware (CPU, Bus, Memory)

Game does not needs specially adopted CPU for efficient processing. The game is in itself state art of computer program and pinnacle of system integration. The game uses every resource that the computer could provide. To get as much as possible out of game, you will need fast CPU, wide and flooding system bus, and a lot of memory to deal with flooding game data.

In PC and Windows environments, every system components are available as off the shelves components. The CPU benders develop their system bus optimized to their CPU to increase performance. These designs are made available to PC industries and each system builder could modify to gain as much processing power as possible within system stability and compatibility limits.

As the CPU got faster, the system bus and interface to peripheral devices became the limiting factors to computer performance. Usually system buses are designed by CPU benders. As the CPU's generation change, new system bus is introduced. Changing the peripheral bus makes old device obsolete. Usually a PC motherboard holds two or more bus systems to reduce upgrading easier.

A new generation of peripheral bus is now in PC industry. PCI-X which succeeds PCI exceeds current AGP (Accelerated Graphics Port) performance.

But in game consoles, the performance of CPU and system bus is fixed. The production and sales are in hand of console maker. As long as new console is not published to market, the system structure stays as same as the day the console was born. This is same for mobile game console and PDA.

Mobile phone does not have this kind of limits. The choice of system components are usually based on previous models, expertise of developer, marketing position, price and availability. Some of mobile phones have two different CPU working tandem as one to telecommunication and the other as application processor. Some have single CPU to accomplish both. With short product cycle, new models show up every 3 to 6 month cycle. The structure of mobile phone is much more diverse compared to any other game platforms.

GPU (Graphics Processing Unit), shader

The GPU handles 3D Graphics, the most important part of 3D gaming system. The GPU accelerates graphics performances. The graphics pipe lines are consists of series of stages, vector and matrix operations stage followed by rasterization of specific pixels calculated from previous stage. These stages performed fixed operation when the GPU was introduced. New generation of GPU did not fix operation of these stages. The programmability was introduced to the GPU, who have very small memory for instruction and register for each stage. The shade is program which run within each stage of GPU. When the shader was first introduced, every instruction was coded with instruction mnemonics which made programming the shade a lot difficult. With introduction of HLSL (High Level Shader Language) C like programming language for the shader, though there are still a lot of limits, programming got easier.

The shader was in first place developed for handling 3D

graphics. So shader's programming can handle a lot of vectors and matrices in SIMD fashion. As the programmability of the shader improving, the ability to process a lot of vectors and matrices attracted some other application to the shader, such as signal progressing, physics simulation, neural network computing, etc. These new techniques could relieve a lot of work from CPU.

The server computer could use a lot of these new generation of graphics accelerators in parallel to compute physics simulation or other tasks in server system which are almost impossible with just plane parallel CPUs. The shader is not just for desk top or server system. Some of graphics accelerator for mobile system employs very crude form of the shader.

Display

The display system did not have much change since scan line display was first developed. The B/W became color, screen got bigger, brighter and cleaner, flat paneled LCD was launched. But in principle, not much was changed. The usual 2 dimensional plane displaying projected image are still in use.

Every one wanted to make 3 dimensional display system, but with little success. A lot of display system showing two slightly different images to each eye was developed, such as reticular lens, timing shutter, and polarization filter, etc. Some became quite successful, some failed. But majority of current display system do not use 3D display.

Nowadays, HDTV became a vogue in game console industry. Compared to old SDTV, the HDTV have a screen area to cover, which old game consoles can't fully appreciate. PS2 and Xbox claims to be HDTV compatible, but they performance can't wholly fulfill the image quality of HDTV. New generation of game console will need the GPU with a lot of memory, fast bus and powerful shader to gratify full impact of HDTV.

I do not think there will be a lot of 3D displaying device. Some game maniacs will use 3D display, but not much. With addition of polarization filter, current LCD displays can be easily converted to 3D display device. But without broadcasting system change, 3D display does have great merits.

HCI hardware

The keyboard has been used from very early history of computers. And mouse after Apple Macintosh, became so popular, no computer comes without a mouse. In windows based game platform, which is PC, these two input devices are used at every game. FPS(First Person Shooting) and SSG(Strategic Simulation Game) are hard to imagine without these two devices. But, in game console, every game uses game pad, which usually are equipped with one or two joysticks, direction buttons, and several fire buttons. Some other HCI devices for games are joy stick, driving wheel, gun controller, stepping pad. The digital cameras and headsets are used for voice chatting, video chatting, image processing and gesture recognition. Some of games use natural language recognition in restricted sense. Custom controllers which lack general usability are not used widely.

There are experimental HCI system which utilize electromyogram or brain wave to accomplish direct interface, but still these systems are not reliable enough to be used in general market.

Battery Life, Energy Efficiency

In mobile environment, battery is one of most important factor to consider. You just can't play games endless without recharging, or changing battery. Though the capacity is increasing slowly, Li-ion which is current battery technology for most of mobile phones is now reaching for theoretic limits.

The Fuel-Cell technology has much higher energy capacity compared to traditional battery. Nowadays, direct methanol fuel cell is developed to replace battery as mobile power source. Current fuel cell technology needs mechanical parts, and is not small enough to be in real mobile environments, but the fuel cell technology has great potential for mobile energy source.

5. Game Software

Game Components Software

One of the most crucial parts for future game is game components software.

Physics Engine

Natural language recognition, parsing

Distributed computing

World presentation, world recognition, World interface

A.I. and interface

Standardization of various interfaces

Genre by network usage

Upgrade and extension, MOD

Multi-platform games

Cross-platform games

Game Network, Server System

Fault tolerant

Redundancy

This document briefly describes the camera-ready format for the ICAT. ICAT is the first international conference on virtual reality open to all who are interested in this field. For the last years, ICAT has had many speakers from all over the world presenting their latest researches. ICAT2004 is the place to exchange current theories, experimental results and technological development in Artificial Reality and Tele-Existence.

2. Style

Table. 1 describes the camera-ready paper format for the ICAT. The standard paper size is ISO A4 paper. However, you may use Letter size paper with margin parameters in Table. 2. The camera-ready paper will be printed in original size. If you do not have “Times New Roman” font, you may use similar fonts. Logo marks should appear on the top-right corner of the first page.

Section heading should be numbered, as it is in this example.

3. Figures and Photographs

Figures and photographs must be size and pasted on your camera-ready paper. We **cannot** enlarge or shrink your photograph so that it may fit on to your paper.

All photographs will be printed in black and white, even if you submit color photographs in your camera-ready.

4. Conclusion

In conclusion, please briefly summarize the paper. Following the conclusion section is reference section. Reference should be in order of the appearance and numbered. However, this is just a recommendation. You may choose a different style for the reference. We look forward to seeing you in Seoul.

References

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Table 1. Camera Ready Format for A4

Paper Size	A4
Top margin	25 mm
Bottom margin	25 mm
Left margin	20 mm
Right margin	20 mm
Title Font	Times New Roman, 20 pt
Author Font	Times New Roman, 14 pt
Affiliation Font	Times New Roman, 12 pt
Section Header Font	Times New Roman, 11 pt
Text Font	Times New Roman, 10 pt
Column Style	Double column
Page Length	8 pages

Table 2. Camera Ready Format for Letter

Paper size	Letter
Top margin	10 mm
Left margin	20 mm
Right margin	26 mm
Bottom margin	25 mm