COMPUTER GRAPHICS IN INFORMATION, KNOWLEDGE AND CONSCIENCE SOCIETIES

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Abstract. In present communication are discussed memory recuirements for Human - Machine Graphical Interface: BI - dimensional computer graphics, 3D - computer graphics, and Adaptable computer graphics. It is analyzed modern evolution of Computer graphics: Next Generation Graphics & Thunderbolt I/O Technology, NVIDIA Quadro® 400 graphics processing unit, Video Editing Requirements of Creative Professionals. In conclusion are presented computer classes and their enabling components

Keywords: computer graphics, application education, memory requirements

1. Introduction

Modern society evolves under the sign of rapid changes. Permanent innovation through the creative capacity of the individuals – in all domains of knowledge – is equivalent to a huge amount of information and an implicit step towards progress.

Change has become a reality at all levels: everyday-life of the individuals, the life of the organizations and social systems. In our modern society, change equals to "a new way of life".

Since the 70s, Alvin Toffler was pointing, in his work "Shock wave", the unprecedented acceleration of the transformation of the whole society. This transformation has been mainly generated by the informatics revolution. The annalists identified this new type of revolution in economy and society, next to the industrial revolution.

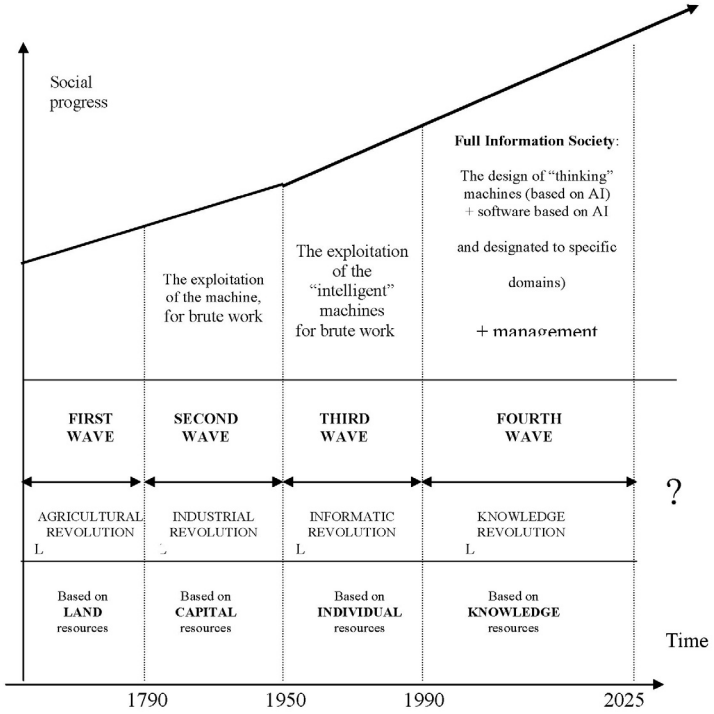

Figure 1. Social progress

In “The fourth wave”, Alvin Toffler’s work published in 1993, he predicted the approach of a new wave of progress. This wave follows the post-industrial economies and is indebt to a revolution of knowledge, especially of the knowledge sprang from intuition, imagination and creative capacity of the human being. This stage, together with the previous ones, is represented in Figure 1.

2. Memory requirements

Multiple languages are a barrier to communication, and much of the world's population is illiterate. Video and music, including gestures are, however, universal languages easily understood by all. Thus, the coupling of images, music, and video with computer translation of speech may become a new, universal form of communication.

All this information will be networked, indexed, and accessible by almost anyone, anywhere, at any time - 24 hours a day, 365 days a year. With more complex data-types, the performance and memory requirement increase, as shown in Figure 2. Going from text to pictures and video, demands performance increases in processing, network speed and file memory capacity. Figure 2. lists the memory requirements necessary for an individual to record everything he or she has read, heard, and seen during their lifetime. These values vary by a factor of 40,000: from a few gigabytes to one petabyte (PB) - a million gigabytes.

Data type	Data rate (bytes per	Storage needed per hour and day	Storage needed in a lifetime
Read text, few pictures	50	200 KB; 2 -10 MB	60 - 300 GB
Speech text (≈120 wpm)	12	43 K; 0.5 MB	15 GB
Speech (compressed)	1,000	3.6 MB; 40 MB	1.2 TB
Video (compressed)	500,000	2 GB; 20 GB	1 PB

Table 2. Data rates and storage requirements per hour, day and lifetime for a person to record all the read text, all the heard speech and all the seen video

In what follows, we shall examine the three cyberspace building blocks: platforms, hardware and software cyberization interfaces, and networks. We will still live in towns, but in 2047 we will be residents of many "virtual villages and cities" in the cyberspace sprawl defined by geography, demographics and intellectual interests.

3. Human - Machine Interface (HMI).

The People-Machine-People interactions, at different stages of the Development of the Informational Society, are based on the raising possibilities of Software, Hardware, People, Brainware (Procedures, Algorithms, Modules, Models), Knowledgeware (Data, Information, Knowledge) and Communications in Computer Based Information Systems (CBIS), main phases of which are Input, Storage, Processing and Output.

The following three different types of such interactions are well known:

(a) IT professional - Software - Hardware - Specialist User (Figure 3.);

(b) Specialist User - Software - Hardware - People (Figure 4.);

(c) People - Software - Hardware - People (Figure 5.).

Each phase of the Human-Machine interactions is supported by the correspondent groups of Software - Hardware units.

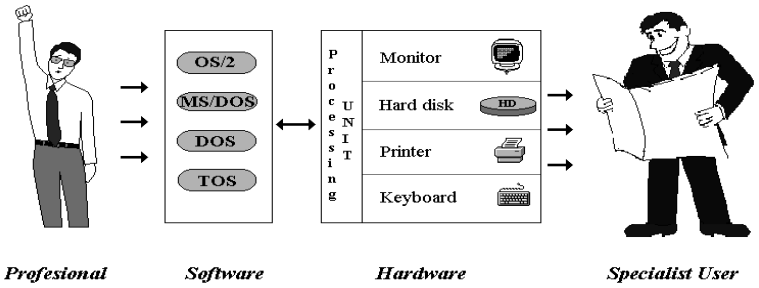

Figure 3. First type of human-machine interaction

3.1. BI - dimensional computer graphics.

BI - dimencional conputer graphics represents mostly the Operating Systems which support first type of human-machine interaction. This situation is characterized by the next interactions: IT professional - Software - Hardware - Specialist User (Figure 3). Computer graphics inteaction is based on vectorial graphics, omogen coordinates, and Bezier curves. These types of graphical representation are mostly supported and introduced in every day activity as parts of TOS, DOS, MS/DOS, and, partly, of OS/2.

Our experiments comprise such Operating Graphical Systems as GRAPHICS, GEOGRAPHIS and other [1], which were used with the second generation of computers. Were developed fisical and mathematical aspects of graphical human-machine interactions, graphical languages GRAPHICS and GEOGRAPHIS and were created corresponding graphival systems GRAPHICS and GEOGRAPHIS using recursive programming method [2]. Such graphical systems in combination with universal languages and systems were used to prepare the Software for first generation graphplotters and graphical monitors-displays EGAT-EO, DGU-2 and DGU-4 .

3.2. 3D - computer graphics.

Nowadays humans interact more with computer-based technology than with hammers and drills. Unlike tools, the visible shape and controls of a computer do not communicate its purpose.

The task of an HMI is to make the function of a technology self-evident. Much like a well-designed hammer fits the user's hand and makes a physical task easy; a well-designed HMI must fit the user's mental map of the task he or she wishes to carry out.

In nearly every technological solution, the effectiveness of the HMI can predict the acceptance of the entire solution by the intended users. Often, as far as consumers are concerned, the HMI is the product - the user's experience with the interface is far more important than the architecture of the internal workings.

HMI effectiveness is measured by a number of components, such as learnability and productivity. These components are sometimes brought together under the title of "usability," also known as quality of use.

The ISO 9241 standard defines three components of quality of use applicable to the design of HMIs:

- Effectiveness - Does the product do what the users require? Does it do the right thing?
- Efficiency - Can the users learn the HMI quickly? Can they carry out their tasks with minimum expended effort, including a minimum of errors? Does it improve the productivity/effort ratio? Does it do things right?
- Satisfaction - Do users express satisfaction with the product? Does the new product reduce stress? Do the end users now have a more satisfying job?

This HMI is characterized by the interaction: Specialist User - Software - Hardware - People (Figure 4).

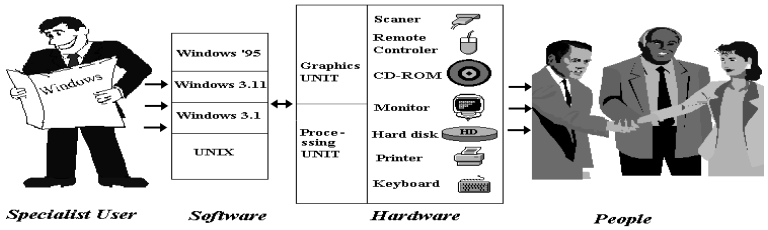

Figure 4. Second type of human-machine interaction

Computer graphics inteaction was based on rastral graphics, 3D-graphics, and 3D-rastral graphics. These types of graphical representation are mostly supported and introduced in every day activity as parts of all types of WINDOWS, UNIX, and its variations for Personal Computers, Minicomputers, Active Ternimals and, partly, for Supercomputers.

Our experiments comprise such Operating Graphical Systems as GRED, GRED-3D, YADRO, COMSIBASIC and other [3], which were used with the third generation of computers. Were developed fisical and mathematical aspects of graphical human-machine interactions, graphical languages GRED and YADRO and were created corresponding graphival systems GRED, GRED-3D, COMSIBASIC, YADRO using extensible programming method [4]. Such graphical systems in combination with universal languages and systems were used to prepare the Software Personal Computers, Minicomputers, Active Ternimals and, partly, for Supercomputers.

3. 3. Adaptable computer graphics.

This HMI is characterized by the interaction People - Software - Hardware - People (Figure 5.) using Processing Units, Graphics Units and Multimedia, Video and Audio Units.

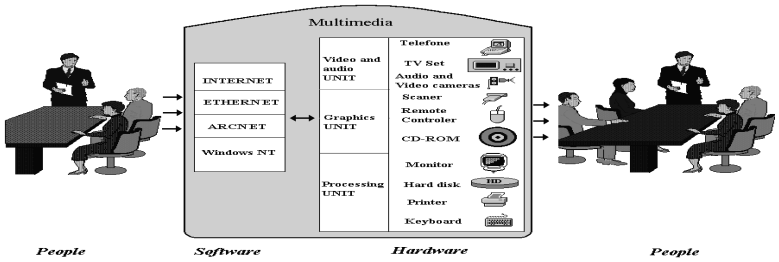

Figure 5. Third type of human-machine interaction

Graphical HMI are supported by Windows NT and its next variations, ArcNet, EtherNet, and INTERNET which support Software for all types of Personal Computers, Minicomputers, Active Ternimals, Mainframe computers , and Supercomputers.

Our experiments comprise YADRO, GRED-3D and SAGRED-3D Graphical Software [5], which were used with the forth generation of computers. Were developed procedural, algorithmical, fisical and mathematical aspects of graphical human-machine interactions, using adaptable programming method [6,7]. Such graphical systems in combination with universal languages and systems were used to prepare Software for Personal Computers, Minicomputers, Active Ternimals and, partly, for Supercomputers.

Computer graphics inteaction was based on developed rastral graphics, 3D-graphics, 3D-rastral graphics with texting, ilumination, omogen coordinates, Bezier surfaces, transformations and normal vectors procedures, models, modules and algorithms.

4. Modern evolution of Computer graphics.

4.1. Next Generation Graphics & Thunderbolt I/O Technology

Apple Announces (May 3, 2011) New iMac With Next Generation Quad-Core Processors, Graphics & Thunderbolt I/O Technology [E-1]: http://money.msn.com/business-news/article.aspx?Feed=BW&Date=20110503&ID=13507465&Symbol=US:AAPL

Apple® today updated its signature all-in-one iMac® with (1) next generation quad-core processors, (2) powerful new graphics, (3) groundbreaking high-speed Thunderbolt I/O

technology and a (4) new FaceTime® HD camera (Figure 6).

Starting at $1,199, the new iMac is up to 70 percent faster and new graphics deliver up to three times the performance of the previous generation.*(Testing conducted by Apple in April 2011 using preproduction iMac configurations. For more information visit:: www.apple.com/imac/features.html.)

Figure 6. Business Wire

"Our customers love the iMac's aluminum enclosure, gorgeous display and all-in-one design," said Philip Schiller, Apple's senior vice president of Worldwide Product Marketing. "With next generation quad-core processors, powerful new graphics, Thunderbolt technology and a FaceTime HD camera, we've made the world's best desktop even better."

The new iMac features quad-core Intel Core i5 processors with an option for customers to choose Core i7 processors up to 3.4 GHz. These next generation processors feature an integrated memory controller for an amazingly responsive experience and a powerful new media engine for high-performance video encoding and decoding. With new AMD Radeon HD graphics processors, the new iMac has the most powerful graphics ever in an all-in-one desktop.

iMac is the first desktop computer on the market to include groundbreaking Thunderbolt I/O technology. The 21.5-inch iMac has a single Thunderbolt port while the 27-inch model features two ports for even greater expansion. Developed by Intel with collaboration from Apple,

Thunderbolt enables expandability never before possible on an all-in-one computer. Featuring two bi-directional channels with transfer speeds up to an amazing 10Gbps each, Thunderbolt delivers PCI Express directly to external high performance peripherals such as RAID arrays, and can support FireWire® and USB consumer devices, and Gigabit Ethernet networks via adapters. Thunderbolt also supports DisplayPort for high resolution displays and works with existing adapters for HDMI, DVI and VGA displays. Freely available for implementation on systems, cables and devices, Thunderbolt technology is expected to be widely adopted as a new standard for high performance I/O.

iMac includes a built-in FaceTime HD camera and Apple's innovative FaceTime software for crisp, widescreen video calling the whole family can enjoy. The new camera supports high definition video calls between all FaceTime HD-enabled Macs and standard resolution calls with iPad® 2, iPhone® 4, the current generation iPod touch® and other Intel-based Macs. The iMac continues to feature its signature aluminum and glass design, gorgeous IPS LED-backlit high resolution display, SD card slot and comes with Apple's innovative Magic Mouse or Magic Trackpad.

Every Mac comes with Mac OS® X Snow Leopard®, the world's most advanced operating system, and iLife®, Apple's innovative suite of applications for creating and sharing great photos, movies and music. Snow Leopard builds on more than a decade of innovation and includes the Mac App Store℠ for finding great new apps for your Mac. iLife '11 features iPhoto® with stunning full screen views for browsing, editing and sharing photos; iMovie® with powerful easy-to-use tools to transform home videos into fun theatrical trailers; and GarageBand® with new ways to improve your playing and create great sounding songs.

4.2. NVIDIA Quadro® 400 graphics processing unit.

New NVIDIA Quadro 400 (April 5, 2011) Empowers Designers and Engineers With Up to 10 Times Better Performance [E-2]: http://money.msn.com/business-news/article.aspx?Feed=MW&Date=20110405&ID=13269752&Symbol=US:NVDA

NVIDIA announced today the NVIDIA Quadro® 400 graphics processing unit (GPU), which is a new professional graphics solution that puts the power of the GPU in the hands of designers and engineers. Built for use with professional applications, such as Autodesk AutoCAD, the NVIDIA Quadro 400 GPU provides up to (1) 5X faster performance over high-end consumer gaming cards; it also

gives up to (2) 10X improvement when running industry leading CAD/CAM applications. Priced at just $169, the Quadro 400 GPU also (3) offers excellent power efficiency, consuming less than 35 watts, and its low-profile footprint means it offers the flexibility to fit into any workstation, including small form-factor systems. With 512 MB of DDR3 memory, the Quadro 400 processor enables professionals to (4) interact with a wide range of design models. It also (5) provides high visual fidelity, featuring a 30-bit (10-bits per color) color engine with a dynamic range of over one billion color variations. Quadro 400 (5) drivers are optimized and certified on leading professional applications.

"Designers and engineers, whether designing the largest assemblies or smallest components, rely on Quadro," said Jeff Brown, general manager, Professional Solutions Group, NVIDIA. "The Quadro 400 is the right tool to help ensure that job gets done the right way, especially when it comes to running professional apps like Autodesk AutoCAD."

Additional features of the new Quadro 400 GPU include: (6) Unified Driver Architecture - Guarantees forward and backward compatibility with professional application software drivers, and simplifies upgrading to a new solution; (7) Hardware 3D Window Clipping- Accelerated clip regions enable faster data transfer between a window and the frame buffer to improve overall graphics performance; (8)High-Quality Display Connectivity - Drives ultra-high-resolution panels, producing phenomenal image quality, supporting two active connectors, including dual-link DVI with up to 3840 x 2400 resolution @ 24Hz on each panel, and DisplayPort (DP) with up to 2560 x 1600 resolution; (9) NVIDIA® Mosaic™ Technology- Enhances workspace across up to eight displays (using one card per two displays), enabling seamless taskbar spanning, as well as transparent scaling of any application. Works over multiple displays or a single high-resolution display, and with NVIDIA nView® desktop management software.

The NVIDIA Quadro 400 processor also supports NVIDIA 3D Vision™ and 3D Vision Pro active shutter glasses 3D technology that delivers crystal-clear, stereoscopic 3D visualization for the most immersive 3D experience, ranging from desktop workstations to collaborative work spaces.

4.2.1. Designed, Built and Engineered by NVIDIA to the Highest Standards of Quality

As with all Quadro professional graphics cards, the Quadro 400 is designed, built and warranted by NVIDIA to provide industry-leading performance and reliability when running professional applications. Companies consistently certify Quadro professional graphics solutions for their users whose livelihoods depend on them.

4.2.2. Availability and Pricing

The Quadro 400 ($169 MSRP, USD) is available immediately for the HP Z800, Z600, and Z400 Workstations, and for all Fujitsu CELSIUS workstations. It will be available later this month and next on select Lenovo ThinkStation D20, C20, S20 and E30 models. It's also available from NVIDIA Quadro channel partners including PNY Technologies in North America and Europe, ELSA in Japan, and Leadtek in Asia Pacific.

For more information about NVIDIA Quadro Professional Graphics Solutions, please visit www.nvidia.com/quadro.

4.3. Video Editing Requirements of Creative Professionals.

LSI MegaRAID Controllers (April 12, 2011) Help Rain Computers Meet Demanding Audio and Video Editing Requirements of Creative Professionals [E-3]: http://money.msn.com/business-news/article.aspx?Feed=PR&Date=20110412&ID=13298439&Symbol=US:LSI

LSI 6Gb/s RAID controllers deliver balanced system performance, premium features and proven reliability for Rain's digital audio and video workstations. LSI Corporation LSI today announced that Rain Computers has chosen LSI® MegaRAID® 6Gb/s SATA+SAS RAID controller cards for (1) integration with its new Venturi Video + Graphics Workstations. The high-end I/O performance and reliability of LSI MegaRAID controllers allow Rain Computers to (2) deliver systems for some of the world's most demanding audio and video editing environments, including customers such as Cirque du Soleil, The Walt Disney Company, the new Conan O'Brien Show and the U.S. Olympic Committee.

"Digital audio and video editing professionals demand workstations that don't allow their compute-intensive environments to interfere with the creative process," said Bill Paschick, founder and chief architect, Rain Computers. " Our Venturi platform is designed to balance power, stability and compatibility, and this can only be achieved by integrating technologies that meet

these same standards. Based on our rigorous testing and qualification processes, LSI MegaRAID controllers proved to be the only RAID products on the market that excelled in each of these critical areas."

Rain's Venturi workstations are: (3) turnkey, high-performance video and audio production computer systems designed for use with applications such as Adobe Creative Suite, Avid Media Composer and AutoCAD; (4) Venturi runs a finely tuned, 64-bit version of Windows 7 Professional and custom BIOS that boosts performance and prevents glitches and dropouts; (5) Venturi workstations are optimized for high-speed video throughput and 2D and 3D rendering.

Rain Computers selected the LSI MegaRAID SAS 9260-4i four-port, PCI Express® 2.0 controller for integration with Venturi systems based on its high transactional I/O performance capabilities, rich feature set, rock-solid reliability and competitive price. The MegaRAID SAS 9260-4i controller, featuring the LSISAS2108 6Gb/s SAS RAID-on-Chip (ROC), helps enable Rain customers to take full advantage of the mulitcore processing power of the Venturi platform. Using the LSI MegaRAID SAS 9260-4i controller, multiple streams of high sample-rate audio with bit depths of 24 or 32 are tracked into the Rain Venturi system. The streams are then filtered and mixed on a PC platform using all the required plug-ins. The Venturi system helps enable a perfect balance of power, stability and compatibility for today's complex and demanding digital audio and video editing applications.

"Access to digital content is essential to meeting audio and video editing deadlines and to avoiding costly project delays," said Brent Blanchard, director of worldwide channel sales and marketing, LSI. "The I/O performance, proven reliability and assured interoperability provided by LSI MegaRAID controllers, together with Rain's high-performance workstations, are helping creative professionals bring their visions to life on time and on budget." Additional information about the LSI MegaRAID controller and Rain Computers' audio and video editing solution is available at http://www.lsi.com/DistributionSystem/User/AssetMgr.aspx?asset=56767

Conclusion

The volume of Knowledge Based and Conscience societies' new MicroSystem industry will be huge-producing at least two orders of magnitude more units than the PC industry. For every PC, there will be thousands of other kinds of systems built around single-chip computer architecture with its interconnection bus on dug, complete with processor, memory hierarchy, I/O (including speech) firmware, and platform software (Figure 7). With more powerful processors, firmware will replace hardware.

Generation	Platform (logic, memories, O/S)	User interface and control	Network infrastructure
The beginning (direct and batch use) (1951)	the computer, vacuum tube, transistor, core, drum and magnetic tape	card, paper tape direct control evolving to batch O/S	none originally-computer was stand-alone
…		…	
Distributed PCs and workstations (1981)	microprocessor PCs and workstations, floppy, small disk	WIMP (windows, icons, mouse, pulldown menus)	WAN, LAN
…		…	
One info dial tone: Phone, videophone, TV, and data (2010)	Video-capable devices of all types	video as a primary data type	Single high-speed network access; home net
Anticipatory by "observing" user behaviour (2020)	room monitoring, gesture	vision, gesture control	Home net
Body net: vision, hearing, monitoring, control, comm., location (2025)	artificial retina, cochlea, glasses for display	implanted sensors and effectors for virtually every part of a body	Body network, gateway to local IR or radio nets everywhere
Robots for home, office and factory(2025)	general purpose robot; appliances become robots	radar, sonar, vision, mobility, arms, hands	IR and radio LAN for home and local areas

Figure 7. New computer classes and their enabling components

The MicroSystem industry will consist of: (1) customers building MicroSystems for embedded applications like automobiles, room- and person-monitoring, PC radio, PDAs, telephones. Internet TV boxes, videophones, smart refrigerators; (2) about a dozen firms that manufacture

MicroSystems; (3) custom design companies that supply "core" IP and take responsibility for the systems; (4) existing computer system companies that have large software investments tied to particular architectures and software; (5) IP companies that supply designs and are paid royalties: ECAD companies that synthesize logic and provide design services (e.g. Cadence, Synopsis); (6) circuit wizards who design fast or low-power memories (e.g., VLSI Libraries), analogue for audio (also a DSP application), radio and TV tuners, radios, GPS, and micro-electromechanical systems (MEMS); (7) varieties of processors from traditional RISC to DSP and multimedia; (8) computer-related applications that require much software and algorithm understanding such as communications protocols and MPEG; (9) proprietary interface companies like RAMbus developing proprietary circuits and signalling standards (old style IP).

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[10] http://money.msn.com/business-news/ article.aspx?Feed=PR&Date=20110412&ID=13298439&Symbol=US:LSI