Graphics PCs will put Workstation Graphics in the Smithsonian

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Graphics accelerators for Personal Computers are becoming more powerful and cheaper very rapidly. The panelists will argue whether this development spells the end of graphics workstations as we have known them. Calligraphic displays were supplanted by raster frame buffers; workstations with internal graphics replaced minicomputers with attached frame buffers. Has the next transition arrived? What are the implications? Should we fight the tide or hail the conquerors? Are there other options?

Note: The esteemed panelists have been promised immunity from prosecution and/or persecution based on any statements, positions, posing, or posturing that may occur in the course of this debate, to free them from any concerns of propriety, modesty, self-incrimination, and image maintenance. Their employers have been promised plausible deniability.

First affirmative: Michael Cox

PC graphics will drive workstations (WS) into Chapter 11. At the top of the market pyramid are the few users who need astronomical performance at astronomical prices. At the bottom are the PC masses. PCs will ultimately take the whole pyramid because of unyielding forces: business model, technical requirements, and volume.

1. The WS business model makes workstation graphics conservative by necessity. The PC business model requires innovation. PC graphics will get better and faster, FASTER than WS graphics. WS advances are limited by silicon advances (more gates, more possible). WS customers and ISVs are conservative. Legacy applications drive WS graphics. WS product cycles are 2.5 years. SW and HW development are tightly coupled. Innovation is THE source of value-added in PC graphics; advances will come both with silicon and with changes in the fundamental algorithms and HW/SW partitioning. There are no legacy applications, and interfaces on PCs are fluid anyway. PC product cycles are 1 year. SW and HW development are independent.

2. Technical requirements in the PC market are richer, and will drive solutions to be better and faster. PC graphics are today “playback” graphics, requiring guaranteed real-time rates; WS are “authoring,” requiring only interactive rates. As PCs match WS quality, frame rates will be higher. Playback requires much more integrated MEDIA support than authoring. New, richer applications will happen first on PCs. Price insensitivity has driven WS graphics down an evolutionary dead-end (e.g. 2 Gbytes of redundant texture memory, with no solution for the texture download bottleneck); PC price sensitivity will drive superior technical solutions (e.g. UMA instead).

3. More PC volume means more opportunity, more start-ups, more projects, more people, more innovation, greater investment in technology development, better technology. Expect a “brain drain” (who’s at Microsoft?). More PC volume also means lower part cost. Even with the same algorithms, PCs win.

New technologies develop in three phases: games, retrofit, innovation. First, toys. Second, the new technology replaces the old. Third, new applications are invented. PCs obviously will dominate the toys. Over time PCs will replace WSs. Where will new applications be developed? First (and perhaps only) on PCs, because of market opportunity, richer media platform, and because that’s where most people will be working!

WSs will keep the top of the pyramid for a while. Once, “big iron” ruled. As the smaller, more numerous, more nimble workstations evolved, “big iron” disappeared. Sure, there are today still die-hard applications that need “big iron.” Cray, CDC, and Thinking Machines are still in business, but would you want to be one of these companies?

First negative: Michael Deering

3D graphics hardware for PCs have finally found their killer app: home games. Such entertainment cards have become successful by no longer trying to compete with workstation 3D graphics hardware for industrial applications. In multi-billion dollar aerospace and automotive design efforts, time to market is more important than cutting a few percent off the overall design budget. Modern 3D graphics workstations are just that: well integrated computing and rendering engines designed from scratch as a single system, both hardware and software. Such systems now, and for the foreseeable future, deliver system graphical throughput well above anything available on commodity PC platforms. 3D graphics workstations also pay attention to quality: high resolution, “crack” free surface rendering, stable numeric algorithms, high quality anti-aliased lines, and adherence to standards also differentiate most 3D workstations from most 3D PC graphics. Indeed, the most successful PC vendors are busily dumping their half-hearted attempts to achieve such “workstation” quality in an effort to shave a little cost off to be more price competitive in the cutthroat 3D home game market, where such features are not yet needed.

Second affirmative: Jay Torborg

Personal computers have rapidly become a ubiquitous tool for a broad range of applications ranging from games to financial modeling to video servers to computer aided design. Applications that were previously the domain of expensive specialty computer systems are migrating to the PC every day. The significant investment this ubiquity affords has allowed the PC to rapidly close the gap in performance and provide dramatic advantages in price-performance, relative to workstations and other specialized systems.

One significant area near and dear to our hearts in which the PC has yet to catch up is 3D graphics – at least as far as functionality and performance are concerned. There are actually more 3D applications (measured in units) running on PCs now than on the entire installed base of workstations; most of these happen to be games. But the PC is catching up quickly. This significant market is supporting significant investment in this area. In the next few years, tens of millions of HW 3D graphics accelerators will be sold for the PC, many of them far outstripping the 3D performance of a typical workstation today.

The PC has several key advantages over workstations that will allow it to dominate in this area. The CAD market, which has driven the 3D workstation architectures we know today, has very different 3D graphics requirements than the immersive animate environments I expect will dominate PC applications. Since the PC does not have the huge 3D graphics legacy carried by the workstation, we can afford to explore new architectural approaches that leverage current technology to create 3D systems that deliver significant price performance advantages for interactive animate environments. The huge volume potential in the PC market allows aggressive use of advanced semiconductor processes, an alternative that is not economically feasible for low-volume workstations. And the huge base of application developers will insure the availability of compelling content.

These key advantages, which are unique to the PC platform, will allow the PC to rapidly become the 3D graphics platform of choice.

Second negative: Kurt Akeley

3D graphics are increasingly central to interactive computing. Soon all interactive systems will include hardware support for 3D graphics, and will be optimized for interactive 3D rendering. When all PCs and workstations support 3D graphics, it will be true that most graphics applications are PC based, and that PCs command most of the market share for 3D graphics. That this will be true, however, no more implies that PCs will be the 3D graphics platform of choice than the current situation, in which PCs dominate the general-purpose computation market, implies that PCs are the platform of choice for computing. There will always be demand for systems that are faster and more capable than commodity machines, and this market demand will continue to be met by computer vendors. PC graphics will flourish, and workstation graphics will continue to lead the way.