Much of HP’s graphics differentiation and value-add draws from our long history of graphics product development. The expertise HP possesses in this area affords us many significant advantages over the competition. Many of these advantages are not obvious at first glance but do represent HP value over competitive products. It is the purpose of this paper to present the differentiators HP has in the area of graphics.

graphics strategy

Before discussing the actual product differentiators, it is beneficial to first understand HP’s strategy with regards to the graphics component.

HP’s workstation graphics strategy is to deliver leadership performance and functionality across ALL HP workstation platforms (PA-RISC, IA-32 and Intel® Itanium™ processor) while supporting ALL 3 major operating systems (UNIX®, Windows® and Linux®). This strategy is implemented within the framework known as the Leadership Graphics Program.

Our graphics strategy is based on the same fundamentals that have formed the basis of our workstation and graphics developments over the last 20 years. The foundation that we have based our graphics product offering has been comprised of 4 basic principles:

- leveraging HP’s core competence in graphics technology
- providing feature and performance leadership
- providing the customer with a single point of support
- creating and maintaining strategic partnerships

The Leadership Graphics Program continues to stress and provide these foundational elements to the customer.

“HP has always been a leader in graphics, and their Leadership Graphics Program enables users to approach a single source for the best graphics solutions available. Given HP’s wealth of graphics expertise, it is in the unique position of being able to leverage this expertise into industry available graphics solutions.”

Jon Peddie
President
Jon Peddie Research
leading market-research firm specializing in graphics and multimedia
hp graphics experience

HP has a long history of developing workstation graphics products. The experience gained from these investments gives HP a significant advantage over our competitors. Much of what we are able to achieve with respect to graphics product differentiation goes back to HP’s long history of developing our own workstation graphics products.

HP’s graphics development started in 1980, and over the subsequent 20 years there were 7 distinct architectures of graphics products created. There have been over 40 different graphics products that HP has developed based on these 7 architectures. It is important to understand that HP’s graphics experience is much broader in scope than just designing graphics hardware. It encompasses a complete understanding of not only the graphics subsystem but also how the graphics interact with the rest of the system and the application. This understanding is critical in order to meet the demanding requirements of workstation customers. Leadership performance requires consideration of the entire system when designing any single aspect. Without this consideration, bottlenecks will exist which will limit the end-user’s performance when running real applications. The expertise HP has in system level design was critical when we developed our own systems and graphics but is also used directly in influencing graphics vendors’ designs and working with the graphics vendors to achieve leadership products.

HP has always stressed leading the industry by creating significant Intellectual Property (IP) and our graphics development has been no different. As a proof-point of this, HP has over 500 graphics-specific patents. To put this in perspective, this is twice the amount held by the leading graphics vendors today. HP’s dominant position in graphics IP is a clear indication that HP has graphics expertise that is second to none in the industry.

HP is the leading force in 3D Linux. HP’s graphics development has provided products that cover the 3 major operating systems (UNIX, Windows and Linux). This development required an in depth understanding of each of the operating systems and how each of them interact with the graphics component. In addition to having expertise in developing graphics technology, HP has expertise in developing this technology to work best on 3 different operating systems. HP’s expertise on developing UNIX products has translated directly to our leadership in providing Linux solutions. Graphics cards supporting Linux on personal workstations have greatly benefited from HP’s collaboration with the graphics vendors producing those cards.

As previously mentioned, one of the foundational elements of our graphics strategy is the creation of strategic partnerships. The word ‘partnership’ is thrown about rather freely by many of our competitors today. When HP uses the word ‘partnership’ we have a much more expansive meaning to it. For example, HP does not just send a machine to an ISV and state that we have a partnership. HP actually has engineers located on-site at the major ISVs’ places of business. HP invests very heavily in the creation and maintenance of these partnerships. New partnerships have been created with the leading graphics vendors.
Overall HP has a total of over 1000 years of combined experience in developing graphics (hardware and software). This is second to none in the graphics industry today and something we will continue to foster moving forward. The value of this graphics expertise reveals itself in HP’s ability to produce workstation products which provide customers with superior performance, functionality and quality.

“HP has a wealth of graphics knowledge that it is willing to share with the graphics vendors.”
D.H. Brown Associates, Inc
August 2000

leadership products

Delivering the best graphics products available to our customers is the key point in HP’s workstation graphics strategy. The selection of leadership graphics requires an in-depth understanding of the graphics architecture and feature-set as well as the knowledge of how to evaluate each product to determine how well it functions within the intended system running technical applications.

performance

Often the most visible product differentiator is performance. This is primarily due to the ease in which it can be measured and compared to alternative products. Achieving leadership application performance requires that the appropriate feature-set be supported on the graphics card. To ensure application performance leadership, HP has invested in the creation of new strategic relationships with the leading graphics vendors. The collaboration resulting from these relationships is performed on an engineer-to-engineer basis.

HP’s graphics expertise provides HP with the credibility to enable these discussions with the graphics vendors. This collaboration consists of weekly phone conferences with the vendors to discuss application performance tuning opportunities.

To identify and take advantage of performance opportunities, HP has engineers dedicated to focusing on application performance. One result of this collaboration is shown by HP’s standard application performance benchmarks. Below are some specific examples of HP’s performance leadership enabled by the graphics component.

- HP submitted results on an ATI® Fire GL™ 4 card with HP value-add that resulted in HP’s Fire GL4 configuration achieving performance leadership on the ProCDRS benchmark. The ProCDRS benchmark is probably the most visible graphics benchmark today and thus receives a great deal of attention.

- HP submitted Fire GL configurations that included HP value-add for the Pro/Engineer application. This resulted in HP’s Fire GL configurations exceeding the performance of all competitive platforms configured with the same graphics hardware.
• On the April and June, 2001 submittals, HP had the lead in 4 out of 5 APC benchmarks leading the way with both ATI Fire GL and NVIDIA® Quadro products. HP had the overall best scores on both Fire GL and Quadro submissions. This is a clear proof-point of HP taking the same components as our competitors and removing barriers to make industry standard graphics components run fastest on HP platforms.

• In August and September, 2001 submittals, HP systems continue to hold the lead in 4 out of 5 APC benchmarks and leverage the capabilities of the Leadership Graphics Program.

• In February 2002, HP submitted the first system to break the 100 barrier on ProCDRS.

leadership product selection

The key component of HP’s workstation graphics strategy is providing leadership performance and functionality across our workstation platforms. There are numerous graphics products available for consideration as members of our Leadership Graphics Program. The process of testing and evaluating several graphics products from different vendors requires an in-depth understanding of not only the graphics technology but also the applications that will be used and how all the workstation components interact under real customer workloads. The detailed evaluation of these graphics products and the selection of the best architecture for our workstations heavily leverage HP’s graphics expertise. It is this selection of leadership products that enables HP to achieve the performance leadership results previously mentioned.

HP led the industry to the Fire GL4 product. Other workstation suppliers did not have the graphics knowledge or expertise to look beyond the claims of the past leader. As stated, HP submitted the Fire GL 4 product, with HP value-add, to the SPECviewperf® ProCDRS benchmark. At the time of this submittal, HP was the ONLY vendor to have selected the ATI Fire GL4 graphics card. No other tier-1 OEM had selected the Fire GL4. But HP, with our 20+ years of graphics expertise, realized that the ATI Fire GL4 was a superior product. HP proved one aspect of the Fire GL4’s superiority by achieving leadership on the ProCDRS benchmark. When the ProCDRS benchmark went public, other vendors stood up and took notice. Shortly after this submission, others announced support for the ATI Fire GL4.

HP’s selection of the Fire GL4 product is an example not only of HP’s ability to add value but also HP’s ability to recognize the superior products available. This capability ensures our customers will always be at the leading edge due to HP’s commitment and ability of providing the best graphics products to meet their requirements.
Often an overlooked aspect of our graphics experience is the quality achieved by leveraging this graphics expertise. All the advantages of developing our own graphics for 20+ years - the knowledge of the OpenGL Application Programming Interface (API), technical applications and graphics hardware - have also applied directly to quality of the graphics component. HP has developed an extensive array of graphics hardware/software tests. This has allowed HP to discover and diagnose several bugs, on industry standard graphics cards, well in advance of our competitors. The overall quality of HP workstation products is outlined below using the specific areas of driver qualification, ISV certification and technical support as examples.

**driver qualification**

HP has consolidated many of our graphics tests into a certification test suite. This test suite has been distributed to graphics vendors for incorporation into their test plan. This has had a very noticeable effect of providing HP better quality sooner on industry standard graphics products.

There have been several instances where HP was the first to discover quality issues in the drivers—across all graphics vendors. An example of this was a data corruption issue with one of the graphics cards that went undiscovered until the problem was exposed by the HP certification test suite. The graphics vendor verified that the problem HP discovered was also present on two of our competitor’s systems that had been shipping to customers. Many of our competitors are continuing to post these poor quality drivers on their web sites and ship them with their systems. This example has been repeated, at least once, on each of our current graphics products. HP’s extensive knowledge in developing workstation-class products ensures that our customers will receive the highest quality available at any point in time.

HP also worked with the graphics vendors to enable Linux support on their products. Prior to HP’s involvement, many of the graphics products lacked the stability to run Linux applications longer than just a few minutes before crashing. This was clearly not in line with what our workstation customers require. As a result of HP’s collaboration with the vendors to diagnose and fix problems, HP now has the broadest and highest quality Linux graphics offering in the industry.

“"The success of HP workstations and the Fire GL4 was a direct result of the collaboration of both Hewlett-Packard and ATI. Leveraging the vast experience and abilities of both teams, we were able to achieve a new level of performance leadership that surpassed our competitors. HP’s knowledge of graphics technology enables them to provide leading edge technology to their customers as part of the Leadership Graphics Program.”

Ed Huang
Director of Workstations
ATI
ISV certification

Qualification of our products on the leading technical applications is critical to our workstation customers. Workstation customers have very demanding requirements in the areas of stability, functionality and performance. Meeting these requirements demands an in-depth understanding of the application and the expectations that the application has on the graphics products in terms of functionality. This level of understanding is something that exists within HP resulting from our extensive experience in workstation and graphics development.

Leveraging HP’s UNIX investments, HP has engineers on-site at the major ISV’s. This provides HP with unique capabilities to:

- understand the application and feed information on how to make the applications run better/faster, back to our Graphics Lab where tuning can be designed to improve graphics performance, and

- provide the ISVs information and insight on the architecture of graphics products along with guidance on how the application should be tuned and enhanced to achieve the highest performance possible.

technical support

Leveraging HP’s graphics core competence also provides value in the area of technical support. HP’s graphics expertise allows us to continue to present a single point of support to our customers. HP’s technical support organization does NOT just pass issues to the graphics vendors. Problems are escalated to the HP graphics experts who understand the graphics technology and applications and can recreate the problems or issues seen by customers. This follows the exact same process as previously taken for HP’s proprietary fx graphics products. This ability to diagnose problems on industry standard graphics cards affords HP the ability to get problems fixed in the fastest possible time - as fast as if we had developed the graphics card ourselves.

Often the hardest part of fixing a problem is recreating the problem observed by the customer. With HP’s graphics expertise, we have the capability in our lab to recreate any problems and, once recreated, we can pass the simplified tests along to the graphics vendor for repair. Many workstation vendors do not have this expertise and they must pass the entire problem to the graphics vendor. The graphics vendor must then figure out how to recreate the error and fix it. Passing the issues directly to the graphics vendors, who may lack an understanding of the applications or customers, results in an expanded time-to-fix.

“NVIDIA has worked with HP in areas such as driver certification and application testing, resulting in workstation graphics products that exceed the demanding requirements of workstation environments. HP has a wealth of graphics experience and the overall performance and quality of our products has benefited as a result of our collaboration with them.”

Jeff Brown
Director of Workstation Graphics
NVIDIA
Remember that HP was able to discover problems which were previously unknown to the graphics vendors. The issues were unknown to the graphics vendors who may not test their products in the manner that the customer uses them. When a customer experiences a problem only someone with an understanding of the user’s environment can diagnose and solve. Workstation vendors who do not possess this understanding results in having a very long time-to-fix for issues that their customers encounter.

"ATI has been extremely pleased to collaborate with Hewlett-Packard on our Fire GL workstation graphics products. HP has provided ATI with their graphics certification test suite that is used to qualify our graphics products resulting in improved quality. Much faster problem resolution is also achieved through HP technical support’s ability to leverage HP’s graphics expertise and knowledge of the applications."

Richard Mulcahy
Product Marketing Manager
Workstations for ATI

summary

HP’s knowledge and experience in the area of graphics technology provides HP workstations with significant value in the areas of performance, quality and technical support. HP’s graphics strategy of delivering leadership performance and functionality across all HP workstation platforms is primarily based on leveraging HP’s core competence in graphics technology.

Leveraging this core competence also provides HP workstation customers with a single point of support that they can count on to solve issues in the fastest possible time. HP does not stop working on the graphics product when it is released to production. Work continues to improve the quality, functionality and performance. This is in contrast to workstation suppliers who do not continue product improvements once the product is announced.

The latest graphics software drivers are posted on HP’s web site. Customers can rest assured that the best, latest and highest quality drivers are available from HP. Utilizing the capabilities provided by the Leadership Graphics Program and the strategic partnerships with ISVs and graphics vendors, provides HP workstation products with value that can not be equaled by our competitors.