



Deploying and Provisioning High Performance Workstations

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Introduction

For most users, a normal notebook or desktop computer is more than adequate for their needs. However, some users have special needs that can only be met with a workstation. This whitepaper will explain what a workstation is, what factors to look for when purchasing one, and their special needs in terms of deployment, support, and maintenance.

A workstation is a computer geared towards heavy computation and/or visualization tasks. Users such as graphic artists, mathematicians and scientists, engineers, some software developers, and so on are the primary market for workstations. Workstations will be found in software development environments, the financial industry, multimedia-related industries, engineering firms, and anywhere else where there are users in need of serious horsepower. Workstations are separated from standard machines by having:

- More memory
- More CPU horsepower, and typically more CPU cores than a desktop PC (and often, multiple physical CPUs)
- Higher quality components
- More disk space, and/or RAID, higher quality hard disks
- Multiple monitor connections
- High end video cards
- Form factor: workstations can be found in desktop, laptop, and rackmount or blade configurations

In addition, workstations will often run an operating system other than Windows if needed for the user's specialized task. For example, many workstations being used for scientific computing will run a version of the UNIX operating system or Linux, and Macintoshes are traditional favorites for graphic artists.

Purchasing a Workstation

When purchasing a workstation, there are a number of factors to be considered. It cannot be stressed enough that without properly analyzing your users' needs, you will end up with a piece of hardware that will be wasted money. Take a look at the applications that the users will be working with, and examine the loads on their current machines if possible to see where the bottlenecks are. You may want to contact the application manufacturers for recommendations as well.

The most important factors in a workstation purchase are:

ISV Certification

If you are purchasing a workstation specifically for a particular application, you will want to see if that application's vendor certifies workstations for use with that application. A certified workstation will not have any hardware conflicts with the applications you intend to use, which can save dozens of frustrating hours of troubleshooting. It will also ensure that the workstation is configured to perform

well with that particular application. If the application vendor does certify workstations, you should purchase from that list, unless there is a really good reason not to.

Support

An often overlooked aspect of workstation purchases is the matter of support. Support is a major differentiator between a “whitebox” workstation and one purchased from an OEM. Due to the highly specialized nature of workstations, they may have technologies in them that your desktop support staff is not familiar with, so the vendor’s support becomes quite important. In addition, the cost of workstations and the fact that most companies do not need many of them (compared to standard PCs) means that a company is less likely to have spare parts or systems on hand to quickly fix issues. To make matters worse, the cost of having a typical workstation user sitting idle while their computer is down is extremely high.

OEMs rigorously test components for compatibility, buy parts in bulk, and learn things like which batches of a certain part will not work well with certain batches of other parts. This is the kind of experience that an OEM who is building thousands of units can bring to the table that the local computer shop or your own internal IT department probably will not be able to provide. In addition, the help staff at a vendor will possibly have more experience in non-Windows operating systems than your IT department’s desktop support staff. Make sure that your workstation vendor is able to deliver the level of support that you need to keep your users productive.

Another aspect to consider regarding support, is whether or not the system OEM is familiar with your applications. When you have a problem, an OEM with experience in that application will be able to work as a team with the ISV to help figure out the problem quickly and accurately. Just as time is money when it comes to the performance of the hardware, time is money when the system is down too.

Hardware

When it comes to a workstation, time is definitely money! When you consider the typical overhead of keeping an engineer, statistician, or graphic artist on staff, a workstation that can cut the time they wait for computations to occur pays for itself very quickly. You will want to talk to your application vendors to understand the applications’ workloads and get their recommendation on hardware. If your application vendor does not have specific hardware recommendations, here are some guidelines which may help you make your purchasing decision.

Processing Power

If you are considering a workstation, its CPU horsepower is one of the most important considerations in the purchase. Developments over the last few years in CPU technology have made multicore CPUs quite affordable. But beyond that, what should you be looking for? Not all CPUs are equal, even on a clock speed basis. Things like the L2 and L3 cache (the more, the better) are important, as is the wafer technology (the smaller the wafer, the better) and power consumption. You will also want to look for technologies such as HyperThreading and virtualization support. Many workstations will come with server grade CPUs which are specifically designed to handle multithreaded loads and be extra reliable,

but will be a bit more expensive. Finally, the more cores and physical CPUs you have, the faster your applications will be able to run, provided that they are designed to leverage multiple cores or CPUs.

RAM

You will most likely want as much RAM as you can afford in your workstations. The more RAM you have, the less the operating system will need to hit the much slower virtual memory file on the disk. In addition to the amount of RAM, you should look at the speed of the RAM, and its technology. The newer triple channel RAM will be substantially faster than the more common dual channel RAM. You will also want to ensure that the speed of the RAM itself is at least as fast as the CPU's front side bus speed. Recent studies show that RAM errors which can cause data corruption may be more prevalent than previously thought; you may want to sacrifice a bit of RAM speed and pay a bit more for error correcting (ECC) RAM.

Hard Drives

Some workstation users will need a lot of local storage space, others will not. That being said, the speed of the hard drives will always be important to a workstation user. The faster the read speeds, the lower the seek times, the faster the machine will go. For even more speed (at the expense of a much higher price per gigabyte), the new solid state drives (SSDs) offer lightning fast access. One thing to consider is RAID technology. If the local data is absolutely critical, you will want to use RAID 1, 5, 6, or 10 to provide some redundancy. If you need more space in a single volume than what a single drive can provide, RAID 0, 5, 6, and 10 can help there as well. Different RAID levels can also bring significant performance gains (or penalties), so you will need to consider that as well. Finally, high end, standalone RAID controllers can offer significantly higher performance than built-in RAID controllers, by offloading the RAID functionality from the main CPU. If disk speeds are a primary concern for your tasks, consider using a standalone, enterprise class RAID controller in lieu of the motherboard's RAID controller.

Video System

Many workstation tasks require heavy duty video cards. Lately, technologies such as NVIDIA's CUDA, allow the video cards to be used to perform specialized high speed number crunching as well as the traditional display duties. At this stage in the game, it is nearly mandatory that a workstation support multiple monitors, and be able to drive them at very high resolutions, because the people using workstations benefit from having multiple, large displays.

NICs

Every workstation on the market should come with at least one gigabit Ethernet NIC. There may be the possibility that you will need secondary NICs, but if the workstation does not come with them, they can be easily added later.

Operating System

Nearly every desktop PC sold is bought with a copy of Windows. But workstations have specialized needs, and may require a different OS. Many scientific tasks, for example, will require you to use a version of Linux or perhaps UNIX, or even Mac OSX. The choice of operating systems can dictate your choice of vendors, if an operating system proprietary to a hardware vendor is required.

Deployment and Maintenance

Deploying and supporting workstations can be more of a challenge than the standard PCs in your enterprise. Many times, workstations will have a specialized, “one off” configuration so your standard deployment package will not apply. This multiplies your patch testing work and other maintenance tasks, as well as forcing you to keep a separate system image. In addition, some workstations may have an operating system that your support staff is not familiar with, and that your central management systems cannot handle. As a result, many workstations operate fairly “off the grid” as far as IT support and management are concerned.

To make things more difficult, workstation users are almost always “power users.” They will demand levels of access to the system that the normal users will not need, which can introduce all sorts of security risks. They are much more likely to do things like install applications that are not on the approved application list, which can be security liabilities, licensing nightmares, or reliability headaches. And of course, the applications that they rely upon will be outside of the day-to-day experiences of your support staff. On top of the specialized hardware of the workstation itself, some users will require unique peripherals such as tablets, which your IT department may not know how to troubleshoot. Some workstation applications even require specialized networking configurations, firewall exceptions, and other items which will drive your network folks up a wall.

Another thing to keep in mind is parts availability and compatibility. Workstations typically contain a number of highly specialized parts. Unlike a desktop, it may not be harmless to swap out a broken part for another part from a different manufacturer. In fact, with some parts, even two parts with the same model number may have slight differences between batches that can cause reliability and compatibility problems. You will want to either stock plenty of spare parts or work with an OEM who does, to reduce headaches when it comes time to replace broken pieces of hardware or upgrade to newer equipment.

Conclusion

When you have a need that requires a workstation, there is no avoiding purchasing one. When you consider the cost to keep an engineer, graphic artist, or mathematician on staff, it simply makes no sense to have them twiddling their thumbs while they wait for your standard business PCs to process their requests. At the same time, workstation purchases and ongoing ownership present a set of challenges which your IT department may not be accustomed to. And workstation configurations are very task dependent; the workstation that your statistician uses may be extremely different from your graphic artist. The most important step in the process is the first one, which is to properly identify your users’ needs and translate that into a purchase specification. Without doing this, you are throwing your money away.