

## **Computing Technology Vendors Guide**

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# Computing Technology Vendors Guide

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## Introduction

The primary mission of the Imaging Technology Group (ITG) is to provide state-of-the-art imaging facilities for researchers at the Beckman Institute for Advanced Science and Technology and the University of Illinois. To achieve that goal, the ITG must provide cutting-edge computer systems which are capable of delivering high performance, capacity, flexibility and reliability. Our years of experience in building these systems have led to informed preferences for various vendors and integrators of Personal Computer (PC) technology products. This report is intended to be a starting guide for anyone who wishes to build their own cutting-edge PC.

## Background

The fundamental parts of any computer system are the motherboard, central processing unit (CPU), random access memory (RAM, memory), non-volatile memory (hard drive), power supply and the case. Many other devices can connect to a computer system and provide an interface to it, such as video devices, input devices (keyboard and mouse), network devices, removable storage devices (floppy, CD-ROM). Even though most computer parts are designed to work together in a PC, it is important to make certain that they are compatible with each other. This is especially true with the motherboard, processor and RAM. A great place to find out about compatibility issues is from the manufacturers' website. They will often give lists of other manufacturers' PC parts which are compatible with their own.

## Workstations and Servers

**Workstations** are computers which may be used by a single person at the home or office, or by multiple users in a lab setting. First, the workstation must be easily accessible to the user(s). Devices such as CD/DVD-ROM's and USB/firewire ports are often used in order to provide the maximum media flexibility. Workstations also need flexibility so that one could remove/add additional devices in the future if need be. Finding a quiet workstation is also important - sitting next to a loud workstation will quickly become annoying. The ITG needs their workstations to provide cutting-edge performance: dual processors, at least 2GB of memory and plenty of disk storage. Finding and building such a workstation is what this document is all about.

**Servers** are computers which need to serve some function(s) repeatedly, often sending results to some other computer (client). File serving, http, sendmail, print jobs, authenticating users, or even serving out processing time are just some of the tasks that servers may provide. A server must be very reliable and must perform those tasks very quickly.

## Should I buy a pre-built Dell PC?

Buying a pre-built workstation PC from resellers such as Dell or IBM may provide some benefit to you. For example, once you receive your PC there is very little assembly and often an operating system is pre-installed for you. You may not have the time or desire to research and build your PC from the ground up. If a Dell PC were to fail, they will either send a technical representative out to fix it, or they will send the replacement parts to you, assuming the PC is still under warranty. However, those systems are built for the masses and you may find the PC to be lacking essential performance, capacity, flexibility, or reliability characteristics. There are literally hundreds of manufacturers who make individual PC parts. Buying the parts separately and assembling the parts yourself assures you that you pay not one cent more than you need in order to get the most cutting edge system, which is optimized and streamlined to perform in your environment.

There are some occasions when reliability and capacity outweigh any need for flexibility. Recently, when the ITG was looking to purchase a server, top on our needs was storage capacity and reliability. We found the Dell PowerEdge 4600 more than fulfilled our needs, and did so at a very competitive price. The Dell PowerEdge servers often come with up to 10 built in hard drive bays, redundant power supplies, redundant power inputs and many other reliability benefits. Most items on the PowerEdge are also hot-swappable which means you can add/remove the device while the system is running. (Even the PCI slots are hot-swappable) Servers such as the PowerEdge series are often a wise buy because you not only have the true-tested hardware, but you also have the support structure of the entire Dell Corporation behind you, and their service reputation is very decent.

## Components of a Workstation PC

**Motherboards** often come with a host of devices built into them. Network, SCSI, RAID, video, sound and other components can commonly be found on many motherboards, and buying boards with built-in devices is normally less expensive than buying the devices separately. The downside to buying a motherboard with built in devices is that normally have less choice in what kind and brand name adapters are on the motherboard. Motherboards come in different sizes (form factors) the most common one being ATX. (See <http://www.pcguides.com/ref/mbsys/mobo/form.htm> for a quick guide to motherboard form factors)

**Central Processing Units (CPU's):** Both Intel and AMD provide 32-bit and 64-bit CPU's, currently at speeds of up to 3.2GHz and 2.2GHz, respectively. Don't be fooled by Intel's faster GHz rating, as AMD's processors often perform as good as or better than Intel's processors. See <http://www.tomshardware.com/cpu/20030923/index.html> for more information on benchmarks of Intel vs. AMD. For single processor machines, Intel Pentium 4 processors have Hyper-threading technology, which offers an inexpensive way to simulate a dual processor system. See <http://www.intel.com/business/bss/products/hyperthreading/overview.htm> for more information about Hyper-threading technology. Both Intel and AMD have Dual CPU options: Xeon for Intel, Athlon and Opteron for AMD. As of this writing, only AMD has a Dual or Quad 64-bit processor. Those are the Opteron 2xx and 8xx processors.

Processors function correctly only when placed in specific "chipsets". You must match the chipset in the motherboard to the processor which you want to use. For example, the Intel E7505 chipset is designed to work with the Intel Xeon Processors with a 533MHz Front Side Bus (FSB). The Intel875P chipset is designed to work with the Intel Pentium 4 processor with an 800MHz FSB. Normally, a computer reseller, such as Monarch Computer, will list what processors go with what motherboards, so you need not worry about what chipset is involved.

**Random Access Memory (RAM)** comes in many types: registered DDR, Unbuffered DDR, error correcting (ECC), speeds and sizes. Common speeds are PC2100 (266MHz), PC2700 (300MHz), PC3200 (400MHz). Sizes are anywhere from 128MB to 2GB and it is wise to get the largest size that you can afford, that way there will be plenty of memory slots left on your motherboard for future upgrades. It is very important to make certain the RAM is compatible with the motherboard. See the motherboard manual or manufacturer's website for listings of compatible RAM. Crucial Technologies website (<http://www.crucial.com>) also has a helpful "Memory Advisor" which will show you exactly what kind of memory you need for your motherboard.

**Storage** (hard drives) come in the following most common types: SCSI, Serial ATA (SATA) and IDE/ATA. SATA drives are relatively new for the commercial market and offer a cost effective way to store data (<http://www.serialata.org/>). If you buy SATA drives, make certain your motherboard has SATA connections or else you will need to purchase a separate SATA controller card. IDE/ATA and SATA drives currently have capacities up to 400GB. SCSI has capacity up to 146GB. SCSI has traditionally outperformed IDE/ATA and SATA. However, using RAID (Redundant Array of Independent Disks; <http://www.acnc.com/raid.html>) is a good way to increase performance and redundancy of any collection of drives, whether it is IDE/ATA, SATA or SCSI. For more information about RAID see [http://www.acnc.com/04\\_01\\_00.html](http://www.acnc.com/04_01_00.html). Creating RAID volumes on Windows systems is fairly easy, and is done in Disk Management tool. The ITG normally fits its workstations with a single 80GB Western Digital for the system partition, and two 120GB Western Digitals in a RAID stripe for a 240GB workspace partition. We use the high performance Western Digital Special Edition EIDE drive with 8MB cache (Western Digital part number WD1200JB). We have used more than a hundred of these drives, and we've never had a failure once the drive was in production. The drives also come with a 3 year warranty. The 120GB drive also represented the least expensive GB/\$ ratio at the time of purchase, although prices are always coming down. Of particular interest for server storage needs are the Direct Attached Storage (DAS) systems that are on the market today. They can provide cost effective storage (compared to SCSI) and easily connect to the computer system via SCSI or fiber channel.

**Power supplies** have different connectors depending on what type of processor chipset is being powered. Cases come in many sizes meant to hold ATX and Extended ATX motherboards, as well as several other devices that you may want to add to the system. Be sure that the power supply you have will drive your motherboard/CPU combination. You must also make certain to supply enough wattage for all of the devices which you plan to put in your PC. Normally, 300-400 Watts is more than enough.

Video devices are usually important to workstations. Many users run applications that require fast 3D rendering as well as good 2D performance. Nvidia and ATI Technologies seem to be the forerunners in today's PC market. But there are others, such as 3DLabs which make very nice cards as well. At the time of writing, ITG uses the Nvidia Quadro 980 XGL 128MB card in a lot of its lab PC's.

**External Peripheral Devices**, such as firewire hard drives and external CD-RW's provide flexibility to interface to your PC. Make sure your motherboard has the connection type (USB, firewire) either built in, or you must buy a firewire/USB adapter in order to connect the device to your PC.

**Troubleshooting your new PC** is made much easier with the use of <http://groups.google.com>. If you have a problem with your PC and you don't know what to do, enter in the error message or a description into the browser and you'll probably see messages from 10 other people who have had the exact same problem and found a solution on Google. ITG uses it all the time for troubleshooting computer problems.

**Keeping up with the new hardware and software** may be difficult. However there are several resources which can help in that endeavor. Tom's Hardware Guide (<http://www.tomshardware.com>) is a great website devoted to reviewing newly released hardware for PC's. A few ITG members also subscribe to "Maximum PC" magazine, as it is a very nice source as well. Although it is slightly aimed at the PC gaming enthusiast, Maximum PC does offer good insights into the PC market.

The ITG recommends the following manufacturers/resellers:

**Computer Integrator/Parts reseller:**

<http://www.monarchcomputer.com> - Many of our workstations were purchased here. They offer complete PC systems or parts with no limitations, and the prices are very competitive. You can design your system online from parts, or buy a pre-built system. They have live tech support as well, and don't seem to mind taking calls with whatever questions you may have.

<http://www.c-computer.com> - Champaign Computer Corp. (CCC) is a local PC reseller. They stock many items we use. Prices are not as good, but if you need it now, you can have it in 15 minutes from CCC.

<http://www.cdw.com> - We buy from CDWG, the government/education branch of CDW. They sell many items in addition to PC parts. Prices are very competitive.

<http://www.newegg.com> - Possibly the cheapest prices on computer parts. They do have limits on items, such as only 2 per customer of certain items. Returns/replacements can be a hassle with newegg.

<http://www.dell.com> - We buy our servers from Dell. Dell has top notch customer service, and if

**Motherboard Manufacturers:**

<http://usa.asus.com> - Asus sells very reliable hardware. We use their motherboards and video adapters in some of our workstations.

<http://www.intel.com/products/server/motherbd> - Some people say using an Intel motherboard with an Intel processor will provide you with better reliability and performance. We have not found that to be true across the board. We use Intel motherboards, network adapters and processors.

<http://www.tyan.com> - They sell good high end motherboards. We recently purchased a Tyan motherboard which was the best option that supported the 64-bit AMD 246 processor. No problem with the machine so far.

<http://www.supermicro.com> - We purchased a few of the X5DAE motherboards from them. They have done very well.

<http://www.abit.com> - We haven't bought a lot of Abit motherboards recently.

your computer fails, they will replace it or fix the failing part. Guaranteed. Their systems can also be configured with a great deal of redundancy built into them: power supplies, fans, hard drives even PCI cards can be hot-swappable and redundant.

<http://www.apple.com> - This tech report does not mention Macintosh hardware, even though we have several Mac systems. The Mac store (apple.com, click on the "store" tab) is a good place to get hardware for your Macintosh.

#### Processors:

<http://www.amd.com>

<http://www.intel.com/products/server/processors>

We use Intel and AMD processors. They are both equally good, but if we had to say: Intel usually wins in performance, AMD usually wins in price. That is by no means true across the board.

#### Hard Drives:

<http://www.westerndigital.com> - We use Western Digital Special Edition drives for all our workstations. We have had great experience with them. Few failures. Top notch performance. Very little heat and noise. Price is incredible. Great all around drive.

<http://www.seagate.com> - Don't use Seagate too much anymore, but had no bad experience with it.

<http://www.maxtor.com> - We use the Maxtor Atlas 10K SCSI drives in one of our file servers. It is a great drive.

<http://www.hgst.com> - Hitachi bought IBM's hard drive business. Some of the IDE drives are way too loud.

#### RAM:

<http://www.crucial.com> - Great place to buy memory. They offer the "Memory Advisor" which is a great way to assure you get the correct memory.

#### RAID Direct Attached Storage (DAS):

<http://www.medea.com> - We have two medea units on our Macintosh systems. The units are very reliable and perform as expected. Slightly pricy though.

<http://www.excelmeridian.com> - We are in the process of evaluating one of the SCSI-SATA RAID 4TB units. Excel uses a slightly better processor than some of its competitor (RaidKing). If the performance and reliability tests out, this will be a great way to increase our fileserving space. \$10,000.00 for 4TB in a single array is unbeatable. Attaches to your system via any SCSI-3 adapter.