

Computer hardware for dentistry: What, where, and when to buy



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Selecting computer hardware for a dental office can be daunting. Dr. Larry Emmott makes the challenge easier by taking a look at:

What to buy (page 38)

The basic requirements for:

- Servers
- Workstations (business and clinical)
- Printers (laser, ink-jet, label, and dye-sublimation)
- Plus: modems, CD-ROM drives, sound cards, and backup systems.

Where to buy (page 42)

The pros and cons of buying from:

- Retail stores
- Mail-order outlets
- Internet sites
- Value-added resellers (VAR)
- Combined VAR/Internet outlets

When to buy (page 44)

Some buying theories (as Moore's law) and advice, such as:

- Buy quality components three to six months after they are introduced
- Replace one-third to one-fourth of your computers every year.

—The Editors

By Dr. Larry Emmott

Buying computer hardware for a dental office is not as simple as wandering down to the “Computers R Us” store and dragging home a computer off of the shelf. In fact, doing that is probably a big mistake. The computer hardware you need for a dental office will vary greatly depending on where it will be used and the functions for which you will use it. You will also need to set the hardware up, establish a network, integrate various applications, troubleshoot problems and, over time, upgrade; most importantly, you will need great service.

Buying hardware can be very expensive, and it is easy to make a costly mistake. This article provides guidelines to help you make good choices about the following: 1) What to buy, 2) Where to buy, and 3) When to buy. The article also includes a list of computer hardware terms (see the “Glossary” on pages 74 and 75).

1 WHAT TO BUY

This section takes a look at the basic requirements for computer hardware, including computer types, such as a server and workstations; components such as modems, a CD-ROM drive, sound cards, and backup systems; and printers.

Computer types

Most dental offices will need three different types of computers: a server, and business and clinical workstations.

Each computer type requires different specifications, depending upon the job it must perform. The key three computer specs are processor/speed, RAM (random access memory), and hard drive storage.

- **A server** is the main computer in a network; it stores all data and distributes it to the other workstations.

This machine should have a powerful processor, lots of memory, big dual hard drives for storage, and a complete backup system. The server may not need any sound or multimedia capabilities.

The server can be configured in one of two ways: with a SCSI (small computer system interface) or with an IDE (integrated drive electronics) interface.

SCSI (pronounced “skuzzy”) has some advantages, but it costs a lot more than an IDE interface. There are now good, fast IDE options, including mirrored hard drives. Mirrored means that as information is recorded on one drive, it is duplicated (mirrored) on the other. If there is a hard drive crash, the second drive takes over. Such IDE options make SCSI look less attractive. A SCSI server will work great, but for most offices it just isn't needed. It would be like using a semi-truck to haul a six-pack.

For most dental offices, an IDE server will cost from \$3,000 to \$3,500; a SCSI server will cost twice as much. (See “Costs” chart above for a look at some price ranges for computers and printers.)

- **Business workstations** or front-desk stations will be the least powerful machines in the practice. They have modest processing requirements, need virtually no hard drive storage, and do not need sound or multimedia. A business workstation will cost \$1,000 or less.
- **Clinical workstation** requirements are changing. The develop-

ment of an amazing array of digital devices to attach to and integrate with treatment room computers has completely changed the concept of dental computer use.

Computers in treatment rooms have gone from simple data-entry business machines to multimedia patient-education and communication stations. For example, in addition to running practice management software, a treatment room computer could be used to store and display digital radiographs, run patient education programs, and perform a variety of digital image management functions.

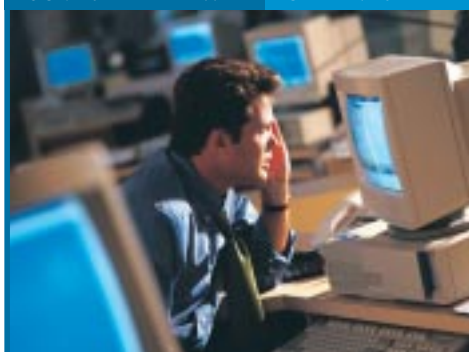
Your treatment room computers might also have multiple monitors and speakers. In addition, the computers might have multiple inputs for technology devices such as computerized probes, voice charting, light pens, video input, a CD-ROM, a modem, DVD, and even a blood pressure cuff. In fact, there are not enough slots, ports, or IRQs (interrupt requests) on most computers to support all the systems now available for the treatment room.

For this reason, the treatment room computer needs to be the most powerful machine in the office next to the server, especially if you wish to do image management.

These machines need full multimedia capability, including sound, CD or DVD, powerful processors, and lots of memory. They do not need hard drive storage, as all the data will be stored on the server. A clinical workstation will cost from \$1,800 to \$2,200.

- **A consultation workstation** may be needed by some offices. This fourth type of computer station would be used in a consultation room for case presentations. This machine would be similar to a clinical workstation with full multimedia capacity, but it would not be used to capture images, radiographs, and other data. Plan on getting a big consultation monitor for the “Wow” factor when presenting cases.

COMPUTER HARDWARE FOR DENTISTRY



ITEM	PRICE RANGE
COMPUTERS	
IDE* server	\$3,000–\$3,500
Business (front office) workstation	\$1,000 or less
Clinical workstation	\$1,800–\$2,200
PRINTERS	
Laser printer	\$ 700–\$1,300
Ink-jet color printer	\$ 200–\$600
Label printer	\$ 180
Dye-sublimation printer	≥\$800

COSTS

Most dental offices will need computers and printers. Here's a look at some price ranges for such items slated for the dental office:

* IDE stands for integrated drive electronics. An IDE interface is the most common disk interface for hard drives.
Source: Dr. Larry Emmott

Components/add-ons

There are many choices in peripherals and add-on components for a basic computer system. Not every computer needs a full set of components. Here's a look at four basic ones: modems, CD-ROM drives, sound cards, and backup systems.

- **A modem** is a very useful device or program; you will use it to send electronic insurance claims. Modem speed is measured in kilobits per second (Kbps); its rate of speed also is called the baud rate. The higher the baud rate, the faster the modem. The minimum baud rate you should consider is 56K. In choosing a modem, faster is definitely better.

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You do not need a modem on every workstation, but you should definitely get at least two. You need one modem on the server to send claims and another modem in the doctor's office so you can access on the Internet.

The alternative to a modem is some form of high-speed Internet service, such as DSL (digital subscriber line) or cable. These services are optional, but they will become more important over time. In the next few years, we will be using the Internet to communicate in very creative ways, and it will then be important to have the entire office online.

• **A CD-ROM** (compact disc—read-only memory) can store large amounts of data (but the data can only be read or played). Every computer you buy should have a CD device.

A CD-ROM drive is needed to install software from a CD. All CD-ROMs conform to a standard size and format, so you can load any type of CD-ROM into any CD-ROM player or drive. The drive also will allow you to use patient education programs, drug education programs, and other databases, which are available on CD.

An alternative to a CD is a DVD (digital video disc). DVDs hold as much as six times

the data as a CD does. If you have a DVD drive, it will also read CDs. However, DVD is primarily an entertainment media; it would only have value in a treatment room to show movies or education programs.

• **Sound cards** and speakers will be needed on treatment room workstations and in a consultation room.

• **A backup system** is essential for a commercial computer system. It allows you to copy all crucial office data onto another medium (a disc or tape, for example), and then store it off site, if desired. A backup system protects the office from possible computer failures or other disasters, such as a fire.

There are several acceptable methods to copy or backup computer data. The most common method is using a tape drive, which can be internal or external. External means the drive is not inside the computer box, and it can be disconnected; also, it is portable. Usually, backup systems are part of the server, but they could be installed on a workstation as well.

Backup systems should be set up to automatically backup on a regular schedule every day. Backup is not an option; it is required.

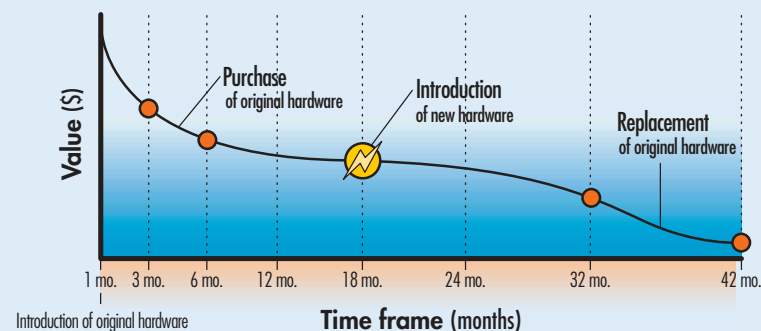
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PURCHASE/REPLACEMENT STRATEGY

Computer hardware prices tend to fall (decrease in value) along an S curve, as depicted below, suggesting the following buying and replacement strategy:

- Purchase hardware on the first shoulder of the curve (three to six months after the hardware is introduced).
- Replace hardware on the second shoulder of the curve (32–42 months later).

COMPUTER HARDWARE: THE VALUE (\$) CURVE



A TYPICAL SCENARIO

- | | |
|-----------------------|---|
| 1st month: | New (original) hardware introduced. Cost: \$3,000 |
| 3 months later: | Cost of original hardware drops to \$2,000 |
| 6 months later: | Cost of original hardware drops to \$1,000 |
| Between 3–6 months: | Time to buy the original hardware |
| 18 months later: | New hardware is introduced that doubles the capacity of the original hardware |
| Between 32–42 months: | Time to replace the original hardware |

Source: Dr. Larry Emmott

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Printers

You will need at least one printer and, maybe, as many as four. When choosing a printer, unlike with the computer itself, brand names are important. Check with your software vendor to find out which printers work best with your software.

In general, there are two basic kinds of printers to choose from: a laser printer or an ink-jet printer. In addition, you might find it useful to add a label printer and a dye-sublimation printer. Here's some background on each of these four types of printers as used in the dental office.

- **Laser printers** are faster, produce higher

quality prints, and offer greater versatility. They are also more expensive. However, for most dental offices a laser printer is a good choice. Generally, the faster the printer, the more it costs. Larger offices with multiple dentists will want to consider the faster heavy-duty types of laser printers. The cost will range from \$700 to \$1,300.

- **An ink-jet printer** can be added for greater versatility. A color ink-jet printer will allow you to print color charts, intraoral color photos, color patient education materials, and many other fun things. However, ink-jet printers are slow and not adequate as the primary office printer. A color ink-jet printer will cost between \$200 and \$600.

- **A label printer** prints individual peel-and-stick labels off of a roll; these labels can be used for addresses or charts. A label printer will cost about \$180.

- **A dye-sublimation printer** prints pictures that look as if they came from a professional photo lab. Until recently, dye-sublimation printers cost many thousands of dollars and were used only by high-end photo labs. Last year, Olympus America introduced the P-400 dye-sublimation printer for use in dental offices. The P-400 costs less than \$800 and makes quality prints. This May, Sony Electronics Inc. introduced a dye-sublimation printer for the dental office that costs about \$1,695.

2 WHERE TO BUY

Currently, there are three common options for purchasing computer hardware: retail stores, mail order/Internet, and VAR (value-added reseller). Each has some advantages and some potential problems as well. Most dentists probably would be best served with a VAR, or better yet, with a combined VAR/Internet option, an emerging trend.

The only exception is when you are buying printers. You can buy printers most anywhere, with service and support provided directly from the manufacturer. For that reason, shop for price when buying printers.

Here's a look at your basic buying options for most other computer hardware purchases.

Retail

A quick glance at the daily newspaper will show you that computers are for sale everywhere. You can buy a computer at a special giant "Computers R Us" type of store, an appliance outlet, or even at a department store. All of this competition means that prices are low and coming down even more. For a single computer intended for home use, buying from a retail outlet is a good choice. However, for most business uses, there are some problems.

When you buy retail, you take what is on the shelf; there is little capacity to customize. To meet dental office network needs, you will need to modify store-bought computers at additional expense. The design of these computers makes such modification or upgrading difficult and, as such, expensive. In addition, store-bought computers usually come with unnecessary add-ons and software packages. The most significant problem, though, is that retailers hardly ever provide on-site service, delivery, set up, troubleshooting, and repair.

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Mail order/Internet

Without a doubt, you'll find the best selection and prices when buying any kind of computer product from mail order or Internet outlets. Generally, mail order allows you a wider range of choices, and you may be able to customize your computer choice at prices below most retail stores.

The problems with mail order are much the same as retail stores, with the added concern of long-distance service and support. Usually, a dental office will need an expert to install and set up a computer system, especially a networked system. Mail-order buying complicates this. It is a good idea, though, to know what is available

and what it costs from mail order so that you can judge the value received when you contact a VAR.

Value-added reseller

If you look up "computers" in the Yellow Pages, almost all of the companies will be value-added resellers. A VAR will custom-build a computer to your specifications. Usually, the seller will also install the computers, software, and any networking. Many VARs develop a specialty area, such as dental or medical offices. VARs also contract with dental software companies to sell and service dental software programs along with the computer hardware.

The advantage of a VAR is the value-

added part. VARs will deliver computers, set them up, install software, set up network protocols, install the peripherals, set up printers, network printers, troubleshoot the system, and integrate components. This is a lot of added value, and it is worth it to pay more for it.

However, the most important added value is onsite service and support. If you have a critical failure, you need a local VAR person who will come to your office that day to fix or replace the failed component. For that reason, choose your VAR with care. Get references and check them out. In particular, ask current clients how a VAR responded in an emergency. Don't make the common mistake of buying from a neighbor's nephew who makes

computers part-time in his garage. This is your business, and you need a reliable professional.

Combined VAR/Internet

The only problem with VARs has been the price. How do you pay for the added value? In the past, most VARs included their service fees as part of the computer price. This was convenient, but it made it difficult to compare prices. The new trend is to combine a VAR's services with the Internet's up-to-the minute access and pricing.

A combined VAR/Internet has a lot of merit. A VAR will price computers at market value, based on Internet prices. The VAR will then provide service as a separate fee. Some will charge so much per computer; others charge by the hour or by the job.

3 WHEN TO BUY

Computer hardware is changing at a remarkable rate. For more than 20 years, computers have followed Moore's law, which states that computer capacity will double every 18 months. (Gordon Moore, was a co-founder of Intel.) That means if you buy the best possible machine today, in less than two years there will be a new machine available that will be twice as fast and twice as powerful. Plus, software developers will add features that use the increased capacity of computers that are faster and have more memory than the one you bought.

Replacement then will be needed, not because the computer is worn out, but because it may not have the capacity (even after upgrades) to perform adequately with current software, such as the latest version of your management program. We must also face the fact that the price of today's computer technology will decrease in the future.

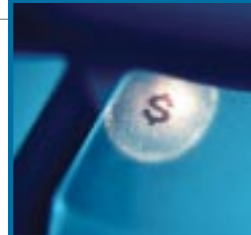
When it comes to buying computer hardware, the trick question is: How fancy do you go today knowing that the hardware you buy may be cheaper in the future? If you get a better machine today, will it be a longer time before you have to replace or upgrade?

To answer these, let's take a look at the Value or S Curve I've devised to help you make a sensible hardware choice. The curve (see "Purchase/replacement strategy" on page 40), is based on Moore's law, Paul's axiom, and my optimistic computer purchasing outlook.

Paul is Paul Feuerstein, a high-tech dentist from the Boston area. He has noted that hardware companies tend to price computers at three approximate price points: \$3,000, \$2,000, and \$1,000. He then observed that these price points cycle every three months. In other words, what was selling for \$3,000, sells for \$2,000 three months later, and then sells for \$1,000 three months after that.

So when should you buy? Here's the strategy. Hardware prices tend to fall along the S curve. You will get the most

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GLOSSARY

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for your money if you buy on the first shoulder of the curve (about three to six months after a product introduction) and replace hardware on the second shoulder (some 32 to 42 months later).

Buying on the shoulder does not mean that you buy “cheap” stuff, as hardware

is essential to your practice and must be of high quality. Buying on the shoulder means that you buy quality components, but not necessarily the latest, fastest, and most powerful computer on the market.

As for replacement, a good policy is to plan to replace one-third to one-fourth of your computers every year. For a typical

office with six computers, this means replacing one or two computers every year. This plan spreads out the cost over time, and the office always has an up-to-date system. It also means that you will have a better computer to run software upgrades and to allow for additional components.

And a remarkable number of new prod-

Here's a look at 24 key computer hardware terms, as compiled by Dr. Emmott. (For an online reference, go to www.pcwebopedia.com.)

BIOS: Basic input/output system; installed on a computer's motherboard. BIOS controls the most basic operations and is responsible for starting your computer.

BUS/SYSTEM BUS: Just a bunch of wires that transmit data from one component to another.

CACHE: Pronounced “cash,” but you won't find it in your wallet. Cache memory is the fastest type of RAM. Used in CPUs, hard drives, and some other components.

CHIPS/CHIPSETS: Little pieces of silicon that hold computer information and instructions. Motherboard chipsets control the computer's basic ins and outs. Video card chipsets control the output of images to your monitor.

CPU: Central processing unit; an important chip. The actual CPU is about 1.5” square, yet is a computer's most critical part. Having a fast CPU is the most important factor in a computer's overall speed. CPU sometimes refers to the basic computer box.

HARD DRIVE: Stores all of the computer's information. A fast hard drive is essential to supply the CPU with data as fast as it needs it. Hard drive sizes are typically measured in gigabytes (GB). The larger the number, the more applications and data such as charts, photos, and x-rays that can be stored. A hard drive can be IDE or SCSI, the two most common interface standards for passing data between a hard disc and a computer.

IDE: Integrated drive electronics; the most common disk interface for hard drives. Easy to use, but the most limited interface. Integrated into the motherboard; will support up to four devices. (SCSI, the other interface option, is faster, allows for many more devices, but is more complicated to configure.)

IRQ: Interrupt request. When you add a new device to a PC, you sometimes need to set its IRQ number by setting a DIP switch, a tiny switch built into a circuit board. This specifies which interrupt line the device may use. IRQ conflicts used to be a common problem when adding peripherals, but USB and Plug-and-Play has made this less of a problem.

ISA: Industry standard architecture; an old technology for connecting computer peripherals, such as modems or x-ray sensors. ISA is much slower than PCI, a highspeed connection; if you have a choice, PCI devices are generally better.

MHz/GHz: Megahertz (MHz): the primary measure of a CPU's speed; one MHz represents 1 million clock cycles per second. The newest CPUs have ratings of 1,000 MHz, which is a gigahertz (GHz) or 1 billion clock cycles per second.

MOTHERBOARD: The motherboard is like the human body's nervous system: Circuits on it transfer data between all other components.

PCI: Peripheral component interconnect; a highspeed connection for devices, including SCSI cards, video cards, sound cards, modems, and other peripherals such as radiography sensors. A primary way of adding devices to your computer. PCI is faster than ISA, so it is preferred for devices such as sound cards and SCSI cards.

PERIPHERAL: Any device or component not part of the basic computer that connects to the

motherboard. Peripherals include modems, sound, and monitors.

RAM: Random access memory; typically measured in megabytes (MB). The active data you are working with. RAM is much faster than reading from a hard drive, so having a lot of RAM makes everything run faster. Having too little RAM is a common cause of computer crashes.

RDRAM: A new form of memory that is replacing SDRAM, the fastest current memory technology. RDRAM is up to four times faster than SDRAM, but it also costs much more.

REFRESH RATE: The speed at which a monitor's picture is redrawn or flashed on the screen. Higher refresh rates create a steady picture (which is easier on your eyes). A minimum of 75 Hertz (Hz) is recommended. (TV refresh rates are 30 Hz, which is why they sometimes appear to flicker.)

RESOLUTION: Monitor resolution is measured in pixels (the number of dots on the entire screen): so many pixels wide by so many high. The most common resolutions are 800 x 600; 1,024 x 768; 1,280 x 1,024, and 1,600 x 1,200. Higher resolutions provide sharper, better quality pictures, but they also make type and images smaller. The size of the monitor is important when considering the resolution; some suggestions for monitor size/optimal resolution follow:

- 14" or 15" monitor: 800 x 600 resolution
- 17" monitor: 1,024 x 768 resolution
- 19" monitor: 1,280 x 1,024 resolution
- 21" or larger monitors: recommended only for use with 1,600 x 1,200 or greater resolution
- The resolution of a TV screen is 640 x 480.

SCANNER: Allows users to digitize images, such as photos or x-rays, as well as text. Once digitized, an image can be stored, manipulated, and transmitted with a computer.

SCSI: Pronounced "skuzzy"; small computer system interface. There are two types of interfaces for hard drives: SCSI and IDE. IDE is much more common and less expensive than SCSI. SCSI, while more expensive, is also more flexible and a bit faster. A single SCSI card can support up to 15 devices. An IDE system has a maximum of four. To make a SCSI computer, you need a SCSI card, a SCSI hard drive, etc. SCSI is more complicated to configure and should not be taken on by amateurs. All of this means it costs a lot more than IDE. Most dental offices do not need a SCSI system.

SERVER: Main computer in a network; stores all the data and distributes it to clients or workstations.

USB: Universal serial bus; a newer technology that allows users to connect a large number of external devices to a computer. This overcomes the limits of ISA, which is obsolete, and PCI, which has limited capacity. USB is intended primarily for low bandwidth (slow) components, such as mice or keyboards. It is also used to connect cameras and x-ray sensors in the dental office. Most new computers have two USB ports. However, it is possible to add more USB devices with a hub.

UPS: Uninterruptible power supply; provides continuous, reliable power to your computer. The UPS plugs into your outlets, and you then plug your computer, monitor, and other components into it. It has a battery to ensure that the computer will stay on even if a power outage occurs. UPSs generally are used only for critical machines and servers. UPSs, such as APC-office, are very cost effective (about \$80) and should be considered for all systems.

VIDEO CARD: Component used to transfer data to your monitor so that it can be displayed.

WORKSTATION: Computer connected to a network; sometimes called a client. Used to collect data, which is stored in the server. The data can then be retrieved and manipulated at any other workstation.

ucts and ideas will work with your dental office computers, including intraoral camera images, digital radiography, interactive patient education, cosmetic image enhancement, record storage, Internet connections, paperless charts, real-time insurance claims, and much more. It all starts with the right hardware for now and

for the future—for the future is coming and it will be amazing! **DPR**

Dr. Larry Emmott, a recognized authority on dental technology in America, is a practicing general dentist in Phoenix, Ariz. He also is an award-winning professional speaker, a featured instructor at the Las Vegas Institute,

and a member of the American Academy of Dental Practice Administration. He has written hundreds of articles on dentistry, computer use, and management. Since 1995, he also has written a monthly electronic newsletter, Emmott on Technology, showing dentists how to use technology effectively. Visit his Web site at www.drLarryEmmott.com.