



The Integrator



(A Quarterly newsletter produced by National Systems Integrator)
VOLUME 15

Technic@l Corner



In this addition of the “Technical Corner” We ask, “How does a computer work?”

NSI would like to thank Dave Cushman for most of this information.

First we must establish what a computer is...

A computer is simply a machine (Hardware) that is capable of receiving and processing data in accordance with a series of instructions it receives, these instructions may be generated externally from the user via the keyboard, mouse or may be generated internally from 'applications' stored as programmed instructions (software). When the data has been processed, the results of the processing are usually sent to an output device, which can be a screen (Monitor), printer, plotter or another computer.

Most computers can be classified into one of Five types...

Mainframe Computers

These are huge computers often housed in a dedicated room or complete building. They are capable of executing a wide variety of applications at great speed as well as supporting a very wide range of equipment (peripheral Devices) and large number of users via many individual terminals. Often costing several millions of dollars each, this type of computer is only used by the larger companies, universities and government departments.

Mini Computers

A minicomputer is a smaller version of the mainframe computer. These are the next largest in terms of physical size and cost. They are floor standing machines which commonly take up the same floor space as a filing cabinet. This type costs several tens of thousands of dollars each and have largely been replaced by microcomputers that have very high specifications.

Micro Computers (PCs)

A microcomputer is small and less expensive, sizes vary, but generally they will fit on to an office desk and are thus known as 'desk top computers'. This type of computer is the most

numerous and they are employed by large, medium and small companies as well as individuals in their homes. This type is what most people mean when they use the word 'computer'. They are constructed of standardized modules or cards and can be easily worked on, altered or upgraded. Also fitting into this category are 'laptop' computers, 'notebook' and 'sub-notebook' computers, which are typified by briefcase styling and 'all in one' construction. Laptop and notebook types are not quite so easily worked on for alteration or upgrading, indeed they can be difficult to even disassemble to get at the internal parts.

Some types of microcomputer have been 'ruggedized' for service in an industrial or military environment.

Palm Top Computer (PDAs)

Palm Top Computers (also known as 'Personal Digital Assistants') are so small that they will fit on the palm of your hand or slide into a jacket pocket. Generally these are slower, with less storage and have a lower specification than desktop computers, but they can be coupled to other computers to download or upload data. They are extremely portable and some incorporate mobile phone technology and digital imaging giving a high degree of functionality for their relatively small size.

Embedded Computers are microprocessors that are built into various industrial and consumer products. They are usually dedicated to specific tasks and most of the data that they use will come from sensors or transducers rather than a keyboard or mouse.

Throughout the rest of these tutorial pages we will use the word 'computer' to mean a microcomputer.

Computers have several depths of complexity. The first of these is the physical units that a machine is made up from. It is possible to work with a computer for many years without understanding what goes on inside these boxes, but if you do gain an understanding of the internals and the way they work, you will make better use of the resources at your command.

In the previous paragraph, I used the word 'command' and this is truly the correct word to use... You are in control of the machine and not the other way around.

Standalone Computer versus Networked Computers

A standalone computer system is a computer (CPU and peripherals) that the operator has sole use of and which are not connected to any other computer systems, although they may be connected to the internet (which is a massive network) the computer itself is 'in charge'. There are NO shared facilities or features with this type of computer system. The operating system, applications software and user data files are all stored on the computer's hard disk or on floppy disks which are inserted into the computer's drive(s).

Advantages of Standalone Computers

If the PC fails... That PC is the only one affected, since the PCs are completely separate, if it breaks down it will not affect any other PCs.

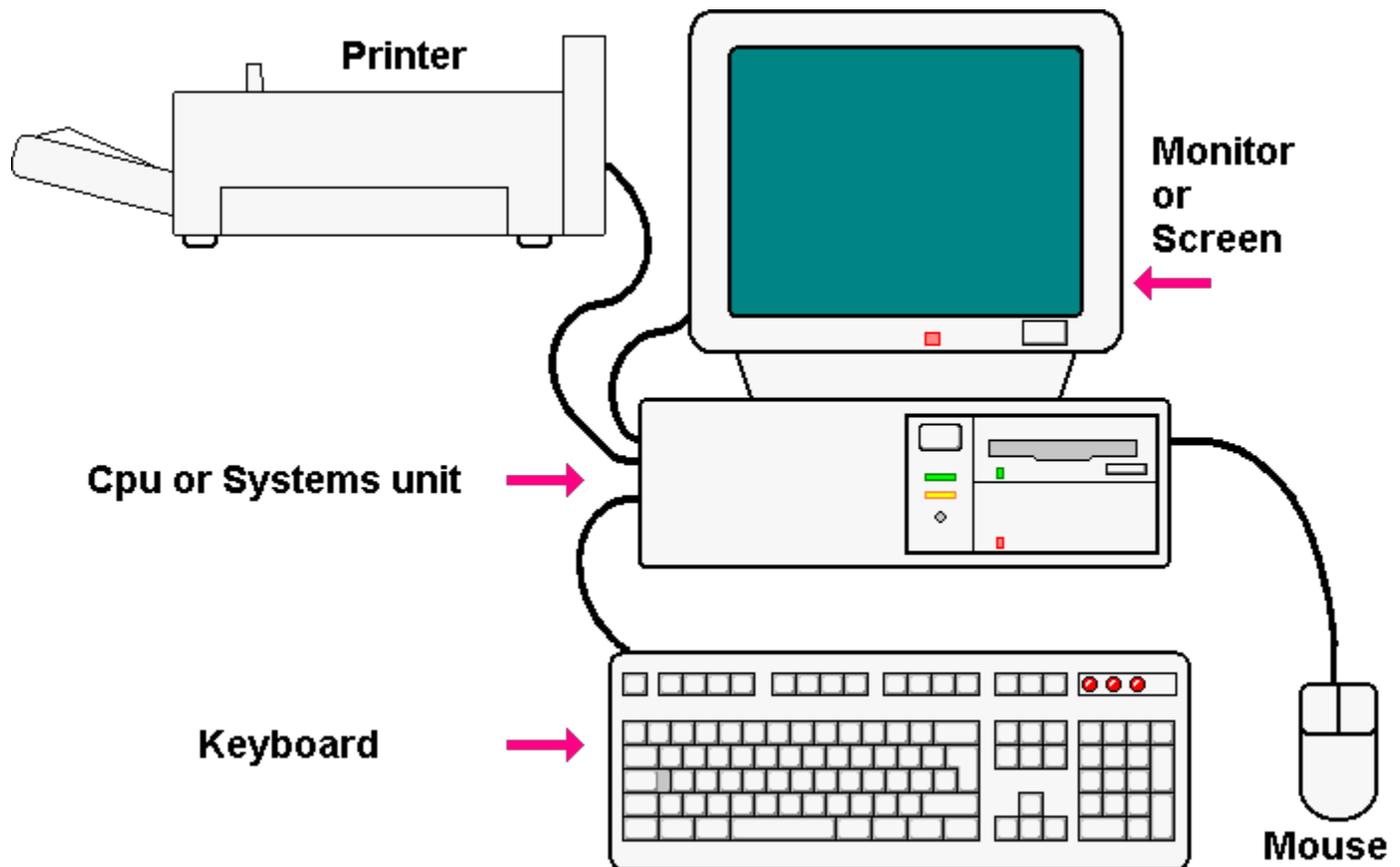
Portability... A standalone PC can easily and quickly be un-plugged from the power and telephone/data sockets and moved to a new location.

Can be dedicated to single or a limited number of tasks... The relatively low cost of a PC system make it economical to be used for one or a small number of jobs.

Dedicated CPU... The Central Processor in the PC is working for only one user. This utilizes all the processor's speed.

One PC costs less than setting up a network for a single user. The breakeven point is typically around four users.

The main hardware components of a typical standalone computer system consists of:-



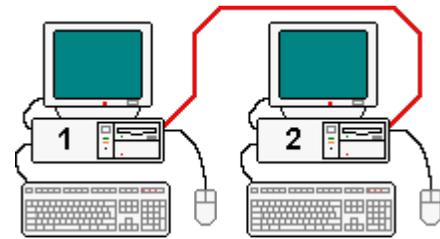
The diagram above shows the CPU or Systems unit as a horizontal form that the monitor will stand on top of, there is an alternative style of CPU case that is vertically arranged and is known as a 'tower unit'. Whatever style you have, it will contain similar components within its case and perform the same functions. All the individual chunks have cables that are all plugged into the Systems unit or Tower, in addition there will be a power cable that leads to the Systems unit from the domestic electricity supply point. The Monitor will also have a mains supply cable and this may connect direct to the mains supply or it may connect to an outlet socket on the back of the Tower unit or CPU box.

Networked Computer Systems

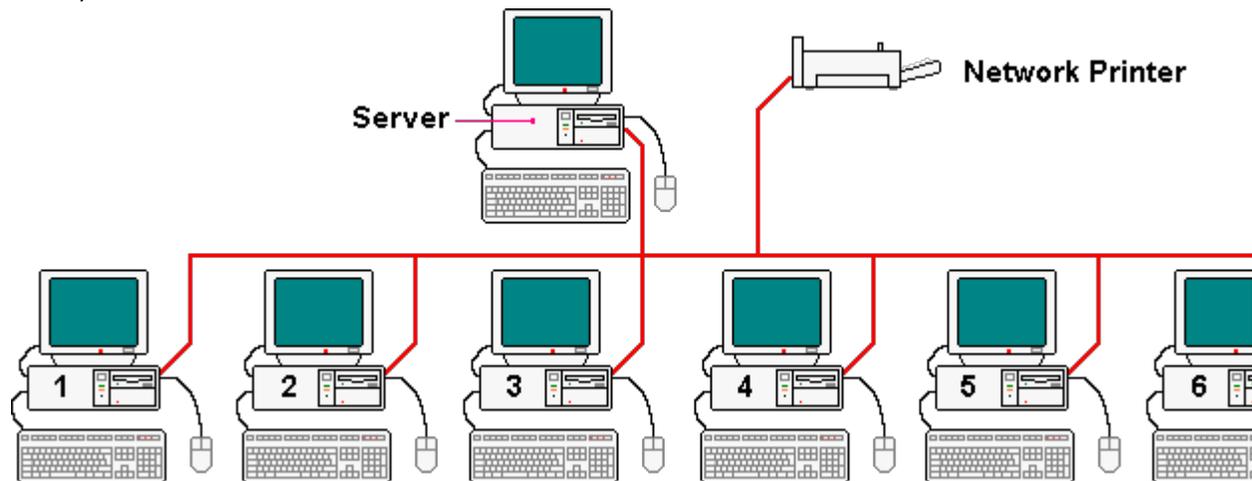
A network of computers is formed by linking two or more computers together via a communications system to a central computer called the 'network file server' often just called 'the server'. The reason for networking computers is to share computing power and peripherals, and to exchange application software or user data files and information, both within and outside the organization.

Networks may be either local, wide or 'peer to peer'.

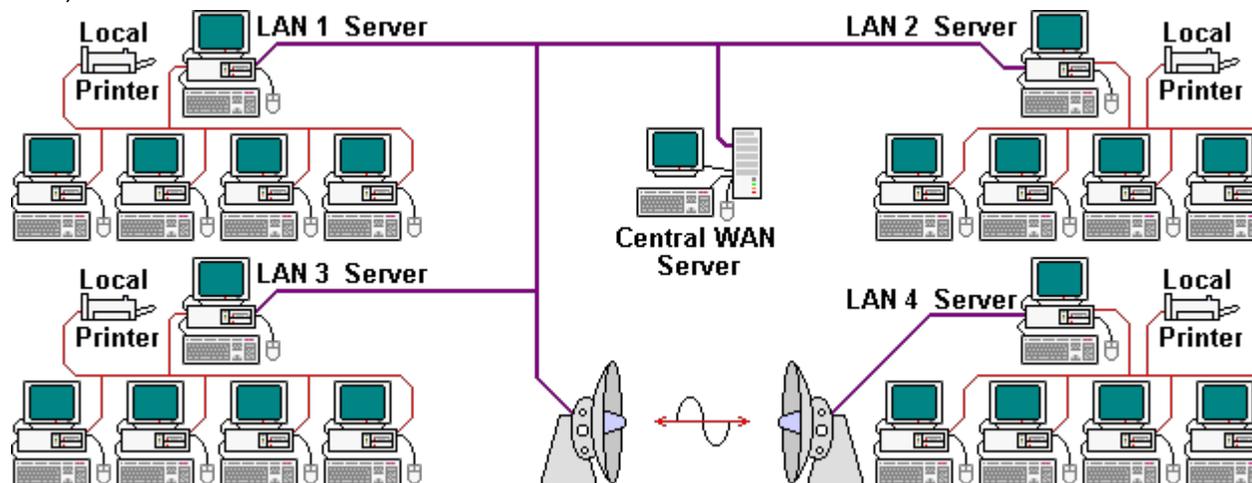
The simplest of these is the peer to peer, which as its title suggests has workstations that are of equal status. Generally this setup only has two workstations, each with their own operating systems, but able to share each other's data and peripherals. If more than two linked workstations are required then it is usual to go to a local area network setup, but it is possible to link many individual computers to work in combination on massive problems by this method.



Local area networks (LANs) are networks where the workstations are connected to a network file server, and are situated on the same site. A site being defined as one or more rooms within the same building or a group of buildings next to each other. LAN workstations are usually connected by a cable (hard wired) to the file server.



Wide area networks (WANs) are networks where the workstations can be situated on the same site or anywhere in the world, or even in space, and may be hard wired to the file server or connected via land lines, radio links or even satellites.



On a network it is usual to store the applications software, network communications software and user data files on the file server's hard disk(s). Each workstation then communicates with the file server through the networking software to load the application software that it needs and relevant data files. Hard copy output is produced from the network printer(s) which are shared between all the workstations since each workstation prints via the file server the output of any machine is placed in a

print queue.

Communications between the server and the individual workstations needs to be specific to each workstation. If for any reason it is not, the network becomes inoperable. In order to maintain the integrity of the network, a human administrator is required. Known as the 'network manager', whose duty is to administer the day to day operation of the network, to solve any and all network problems and queries, to maintain the network configuration and set-up new hardware, new software, user passwords etc..

Advantages of Networked Computers

Hardware Costs are usually lower when the number of workstations exceeds four.

Sharing Facilities such as the software applications and data on the server's hard drive(s) and allowing many machines to use a small number of printers, saves cost and desk space.

Transmission of data files and messages between users connected by a network is easy and rapid.

High levels of security can be achieved since only authorized users have access to the data on the network. However, once a 'hacker' has gained access, the data becomes easily available to them and since networks can be designed to be accessed from a remote location via a modem, security may be lower than a standalone system which has no remote access. (future link to Quarantine machine)

Software upgrades are easier on a network than on the same number of standalone machines, since only one copy is installed and configured on the file servers' hard disk instead of an individual copy on each standalone machine.

Note... The advantages of networks tend to be disadvantages of standalone systems and vice versa.

Network Limits... There can be almost any number of users that are allowed access to a network. However, they may not all be able to use the network at the same time. There is a finite limit to the number of workstations that can be connected to any one server.

Passwords and User Names... All network users are supplied with some form of security. This restricts access to the network to those who are entitled to use it. Security is controlled by means of group or individual user names, and/or by passwords.

Logging On and Logging Off... When a user wishes to access the network they must 'Log On'. This involves typing in his/her user name or code followed by his/her password if they have one. Once typed in, the network software checks the details against a list of authorized users. If the typed data matches then, and only then, the user is allowed to proceed. If either the user identity or password is incorrect the user is prompted to log on again. When the user wishes to leave the network, say at the end of a work period, then he/she must 'Log Off' the network. This involves quitting the software application(s) in use, returning to the network menu screen and then selecting or typing exit, logoff, quit, logout or whatever the 'logging off' command is.

Note... Standalone systems can be set-up with passwords for authorized users, but this is not very sensible as they are inherently less secure than networks, owing to most standalone systems having at least one floppy disk drive which, with a suitable boot disk, the machine can be booted and run independently of any security system.

Input Devices

These are peripheral devices connected to the CPU or systems unit in order to command or inform the computer of the user's desired course of action.

Input devices include...

Keyboard... Used to select or enter commands, enter text, QWERTY keyboards are not particularly user friendly but they are likely to be replaced by voice/speech recognition at some as yet unspecified time in the future.

Mouse... Used to move the cursor, select commands and features from the on-screen menus, also used for many actions in drawing diagrams.

Digitizing Tablets and the associated puck are used to move the cursor, select commands and features, enter co-ordinates, mainly used for computer aided drawing (CAD) or map making.

Joysticks can be used to move the cursor, select commands and features, but they are not often used for general work as they are slower than a mouse. However they are commonly used in computer games.

Output Devices

Output devices are peripheral devices which are used to present, to a human operator, the result of the programming instructions on the data provided.

Output devices include...

Printers... Are used to produce the hardcopy of text or drawings.

Plotters... Can be used to produce the hard copy of large drawings, architectural plans.

Screens, VDUs (Visual Display Unit) and Monitors... Used to display in graphic or textual form, the results of the CPU's processing of data in accordance with the instructions given.

Ports... Are connections by which the CPU can pass data to the outside world as raw data for use by other computers or electronic devices.

Internal Devices

These are not normally visible without removing the outer covers of the systems unit or tower.

CPU (Central Processing Unit) 'Micro Processor' or just 'Processor'

The CPU is the brain of the computer. The CPU organizes all the functions of the computer system and consists of three sections.

The control unit ... Co-ordinates all the computers functions by interpreting and carrying out the instruction sent to it by an input device or program.

ALU (Arithmetic Logic Unit)... this is the computational engine that makes the calculations,

decisions and logical comparisons.

Cache Memory... This is an array of memory cells which can be easily and quickly accessed by the ALU to store data until it is needed for another part of a calculation.

The processor is totally solid state with no moving parts. They are usually fabricated on one thin plate of doped silicon with circuitry architecture that is incredibly small, resulting in short transmission paths and high data rates.

Memory storage can be either 'chip' based or 'backing store' based. Chip based memory mainly consists of 'RAM memory' and 'ROM memory'.

RAM (Random Access Memory)

This type of memory is available only when the computer is switched on and is therefore a non-permanent or 'volatile' memory store. Copies of device drivers for screens, scanners, printers etc. are all placed here by the main processor during the startup sequence, as well as application software and currently active data files.

Note: - When a computer is switched off or re-booted, all the data stored in the RAM is lost.

ROM (Read Only Memory)

This type of memory is a permanent or non-volatile memory store and is used to store data or applications which the computer needs in order to function. These may be... Character sets, internal programs such as the BIOS, certain device drivers that control the disks, cooling fans etc.

Note: - When the computer is switched off or re-booted, the data stored in read only memory is not lost. It is permanently burnt into the memory chips and cannot be erased or deleted.

There are other types of ROM that are electrically alterable or re-programmable, but the principle is the same... The information is retained when the power is switched off. They can only be re-programmed by a deliberate act and sometimes this requires removal from the circuit board concerned.

Backing Store Memory

Backing store memory is usually some type of magnetic storage media i.e. magnetic cassette tape or magnetic disks (both hard and floppy), but other media forms can be used including punched paper tape, punched cards, plastic media and CD-ROMs (including DVDs).

Magnetic media has advantages over other media storage means including...

1. Ease of use and reuse.
2. Speed of access of data. Transfer speeds of several million bytes per second are commonplace.
3. Capacity of storage, sizes from approximately 360,000 characters for older styles of floppy disk up to many thousands of millions of characters on a hard disk.
4. Small physical size of the media for the amount of data held.

Operating System

The operating system is a suite of utility routines which form the link between the operator, the computer (C.P.U.) and the application software by providing the facilities of...

1. File, Disk and System Management (via the BIOS) comprising a range of commands and utilities that allow the computer to carry out its file and disk management.
2. Software Application Support enabling the software application to carry out (via the BIOS)... Data file operation, character input and mouse position sensing.

Software Applications

Software applications are the programs that are required to satisfy a particular operational need. They include Word Processing, Database, Spreadsheet, Internet Browsers, Graphics and image manipulators, Games, CAD, CAM etc. These programs are usually stored on the computer's hard disk, but may be stored on a floppy disk or other removable media. Software can be of many types to achieve the same object, some are simple, some are complicated, some are available freely others command high fees. Matching the precise requirement to the software is much a part of the selection process as evaluating value for money. It is possible to run quite a sophisticated system without spending a penny on software, I personally have never expected payment for any software that I have written, nor do I expect to have to pay for anything anyone else has written.

Output Devices

Hard copy output devices fall into one of two categories... Plotters and Printers.

Plotters are used mainly for producing line drawings that have been generated by CAD methods. They can be ink jet or pen type and flatbed or drum.

Printers are of various types...

- Ink Jet... These work by spraying ink onto the paper through a number of very fine nozzles. A set amount of ink is sprayed through selected nozzles depending on the character being printed. The print head which contains the nozzles moves along the paper spraying ink as it goes. Both text and graphics can be printed in black or in color.
- Dot matrix... Although they are considered old fashioned, they are ideal for some label printing applications. They work rather like typewriter but use, an array (matrix) of pins to print dots on paper via an inked ribbon. They are inexpensive to run, but are noisy and slow in operation. They exist in both color and black only versions, but are mainly only used for black these days.
- Laser Printers... These are the latest technology printers and are capable of printing at high speeds. They are the most expensive table top printers when comparing like for like, but they do produce good quality. Laser printers can print both text and graphics in black or full color. They work rather like a photocopier, using a laser beam to selectively discharge an electrostatically charged surface, this charge is transferred to the paper which picks up powdered ink particles (toner). The toner is bonded onto

the paper by passing through heated rollers.

Safety Shield



For our safety shield topic this quarter, we wanted to re-visit the art of defensive driving.

It's not something we happy-go-lucky road trippers and "travel to work-ers" like to dwell upon, but about 50,000 people die each year in collisions on the roadways of the United States. By most estimates, over twenty-two million are injured. The costs associated with such collisions are staggering -- often quoted at more than \$80 billion. This carnage is unnecessary since nearly all collisions are preventable.

"I never saw him!" is the most common excuse heard after a collision. Was the other vehicle invisible? Virtually all collisions involve inattention on the part of one or both drivers. Inattention can involve many things, some of which are daydreaming, distractions, sleepiness, fatigue, "highway hypnosis," talking, etc. A moving vehicle develops thousands of foot-pounds of energy. YOU as a driver have the responsibility not to use that energy to injure or kill others, or damage their property. Paying attention makes it possible for you to see, recognize and avoid the hazards lurking on the road; these are the three basic elements of defensive driving. The primary attribute necessary for a safe driver is alertness, and paying attention is the most important driving task because it helps create the time you need to recognize hazards and avoid a collision. One statistic often quoted is that most collisions happen within a short distance from home. Why is this true? Since we mostly drive in our own neighborhoods, the odds are we'll have most of our mishaps there. Close to home we get more comfortable and perhaps let our guard down (and the other guy does the same thing); you've heard that "familiarity breeds contempt?" Better yet, familiarity breeds inattention. We don't often consider that serious or fatal injuries can occur in low speed collisions. I have a challenge for you. While it is important for you to be alert and aware, it isn't an easy task. The next time you drive, try concentrating solely on the driving task. Think of nothing else. Then see how far you get before your mind wanders. Many drivers won't even get out of the parking lot! Seasoned drivers don't HAVE to think about driving much. It's something we do automatically, and our minds are free to wander. And our minds WANT to wander. Have you ever driven somewhere and been so lost in thought that you couldn't remember anything about the trip itself? Is this a problem? Is this a curable problem? Paying attention can become a habit, but you have to work at it. Make with about 16,000 foot-pounds of force, should your vehicle hit some immovable object - like a tree. A defensive driver chooses a speed matching traffic as closely as possible without

exceeding speed limits. If traffic is moving at higher speed than you should go, keep to the right and out of the way. This is often a legal requirement as well, if you are traveling at a speed less than the flow of traffic. Also, don't neglect to maintain the correct following distance. Consider that speeding often doesn't save much time. How many times have you reached a red light, only to find a "jackrabbit" waiting there that passed you a half mile back like you were standing still? Ever wonder why? Around most urban areas, signals limit overall speeds to what the system can handle (in terms of numbers of vehicles). In Phoenix, for example, that's approximately 40 to 45 mph. Drive faster than that and you'll simply spend more time waiting at red lights, wasting fuel, wearing down, and accumulating just a little more stress in your life for no good reason or gain. Even on the highway, you don't often gain much. Frequently, once you pass someone, you find them on your back as you slow down to enter the next town. So you gained what, exactly? On an Interstate, where you truly can save some time by speeding (provided you don't get pulled over), the difference between 65 mph and 80 mph over 50 miles is only 8.7 minutes. *Big deal.* conscious, persistent choices NOT to eat while driving, or whatever you do that takes your attention off where your moving vehicle is pointed. Connect your mind to your eyes and work at consciously analyzing what you see while you drive. We call this "situational awareness." Driving is the most dangerous thing most of us ever do. It deserves your full attention. Mastery of this one habit can almost make you bullet-proof. Not quite, but almost. Driving at a higher than reasonable speed increases your risk in two ways: it cuts your reaction time and results in more "stored" energy (that must be dissipated in any collision). You should consider if the risks are worth the gain. This is the science of math and physics—you cannot bend these rules. Each incremental increase in speed reduces your ability to react in time to hazards, because you may be covering distance in less time than it takes to react. Normal reaction time is between .75 second and 1.5 seconds, on average. Average reaction time distance at 50 mph would be approximately 83 feet. At 70 mph, it is over 115 feet (over 7 modern car lengths). These numbers do not include braking distance, just reaction time. The average difference in reaction-time distance from 50 mph to 70 mph is about 32 feet. If you were relying solely on braking, any hazard you encounter within the reaction distance is already a problem; you can't react quickly enough to miss it. This is particularly important at night, when darkness restricts your visibility. Do you know at what distance your headlights will illuminate a hazard? How is your night vision these days? When headlights finally light up a road hazard, it is often too late to avoid it. Many experts would tell you that even 50 mph is too fast for conditions at night, on any dark roadway. If you could choose the speed at which to hit a brick wall, assuming that it was a sure thing you were going to hit one, would you choose to hit the wall at 10 mph or at 100 mph? Not hard to decide, is it? Higher speeds also bring additional accumulated, or stored, energy. More stored energy means increased crash forces if you hit something. Here's a real-world example; a loaded semi traveling at 60 mph develops about 6.5 MILLION foot-pounds of force. Or, your body, unrestrained in the vehicle, could hit with about 16,000 foot-pounds of force, should your vehicle hit some immovable object - like a tree. A defensive driver chooses a speed matching traffic as closely as possible without exceeding speed limits. If traffic is moving at higher speed than you should go, keep to the right and out of the way. This is often a legal requirement as well, if you are traveling at a speed less than the flow of traffic. Also, don't neglect to maintain the correct following distance. Consider that speeding often doesn't save much time. How many times have you reached a red light, only to find a "jackrabbit" waiting there that passed you a half mile back like you were standing still? Ever wonder why? Around most urban areas, signals limit overall speeds to what the system can handle (in terms of numbers of vehicles). In Phoenix, for example, that's approximately 40 to 45 mph. Drive faster than that and you'll simply spend more time waiting at red lights, wasting fuel, wearing down, and accumulating just a little more stress in your life for no good reason or gain. Even on the highway, you don't often gain much. Frequently, once you pass someone, you find them on your back as you slow down to enter the next town. So you gained what, exactly? On

an Interstate, where you truly can save some time by speeding (provided you don't get pulled over), the difference between 65 mph and 80 mph over 50 miles is only 8.7 minutes. *Big deal.*

Me, myself and I

Making your customers feel important is a tremendous step in building customer loyalty. How do you know what customers want in order to feel important? While each individual is different, there are six definitive ways you can make your customers feel important every time they interact with your business. 1. Know Your Customer's Name

Know thy customer! If you or your service team regularly meets customers face-to-face, then practice learning and memorizing names. Every time the customer returns to your place of business, or in our case, we return to their business (hospital) they are greeted by name, making them feel like they are royalty. 2. Treat Each Customer as Your Best Customer

Customers want to know they are valued by your business. No customer should be an interruption. They are the lifeline of your business and should always be treated as such. Train your service staff to give complete attention to a customer. Let the customer know that their needs are the most important item of business at this very moment. 3. Smile Genuinely

Why is it so hard for some service professionals to smile? A dour-faced service professional will accomplish much less than one who is friendly. Be sure that you and your service staff practice giving a smile to every customer. 4. Resolve Issues Immediately

If you have a customer with an issue, resolve it immediately. Nothing makes a customer feel valued and important than when you drop everything to solve their problem. Avoid saying, "I'll see what I can do." Sometimes it is necessary to get back to a customer at a later

Company Snapshot

The results of our 4th quarter NSI fun poll (on our website home page- "nsi-usa.net") are as follows:

The Internet

Should the internet be regulated?

100% of the responders said that the Internet should NOT be regulated!

This is not surprising to us at all!!!

It appears that those in charge of our government will do anything, including going against the publics' view, to keep the money flowing into Washington D.C.!

NSI would like to thank our customers and employees for being a part of National Systems Integrator!

date, but if there is an immediate solution available, do it now.5. Be Proactive

Making customers feel important also means that you anticipate their needs. Do you know that Mrs. Smith likes to have a coffee waiting at her table? That Mr. Jones requires extra legroom? Think ahead of your customers. Know what your returning customers need are and be ready to meet them. Though you may not know all the needs of new customers, try your best to read them and anticipate what they may need. Do not be afraid to ask what else you can do to make them happier. 6. Say "Thank You"

Your mother probably taught you this fundamental rule, and it is certainly good advice. Always say "thank you" and use the customer's name whenever possible. By acknowledging that you appreciate their patronage, your customers will know they are valued.

Valued customers are your loyal customers. Make the effort to make them feel important. With each positive impact you make on a customer, you will be rewarded - not only with their business, but by referrals and a reputation that precedes you.