



What is Computer Hardware?

NOVEMBER 8, 2012

TUTORIALS: SECTION 1

Computer Hardware

Computers are becoming so common today that it is almost impossible to go anywhere without seeing them. They are at work, school and home. Although many people are familiar with using them. Some may not know what is meant by computer hardware or what goes into making a computer. This is meant to be an introduction for those of us who may not be familiar with the computer and all its parts.

Computer Hardware is made up of four main categories or types of devices. The Processor (better known as the CPU), Memory and Storage devices, Input devices and Output devices. Each has its part to play and is necessary for us to be able to use it. What follows is a short discussion of the different types out there and what we use them for.

The Processor (CPU)



The Central Processing Unit or CPU is located on the mother board (pictured) and does all the work within computer. We might call it the brains. It takes and executes instructions stored in Read Only Memory (ROM). The mother board also has the memory modules known as Random Access Memory (RAM) which it uses to store data while it is being processed.

The motherboard has ports enabling input, output, and storage devices to be connected to the CPU. These ports vary in size and design depending on the purpose of the device to be attached. A group of wires (known as a Bus) connect the ports to the CPU, allowing the input we provide to be processed by the CPU and the results sent to an output device or saved to storage.

Input Devices



There are numerous types of input devices available depending on the situation and application but almost all computers will have a keyboard and mouse. These allow us to enter instructions and interact with the software. There are also cameras, scanners, microphones, touchpads, game controllers, graphics tablets and touch screens. Each of these has their uses and some are more preferable to others. For instance, an artist would find a graphics tablet much more useful for drawing than a mouse and keyboard.

Whatever the type of input device is used, the information is received and processed by the CPU before being returned to an output device or being saved onto a storage device.

Output Devices



When talking about output devices we can put them into three groups: those we see, those we can feel and those we can hear.

Output we can see: Displays, monitors, TVs and screens. These output devices enable us to be able to see what we are doing on the computer. Anything from editing a word document or spreadsheet to watching movies and playing games can be seen through a monitor or screen.

Output we can feel: Printers in all shapes and sizes can print out hard copies of whatever we can see on the display. They range from simple impact printers suitable for printing text to color LaserJet printers capable of printing beautiful pictures and artwork. There are even 3D printers capable of printing a 3D image. All of these enable us to hold a copy of our work in our hand.

Output we can hear: Speakers enable us to listen to music or hear the sounds of a video. Coupled with other input devices we can talk with others via teleconferencing as well as interact with multimedia.

Storage Devices



Storage Devices include things like magnetic tape drives, hard disks, and optical discs (such as CDs, DVDs and Blu-Ray). All of these allow us to write data to them and read it back. Thus enabling us to transfer data between computers or make copies of our work to be stored elsewhere. In this regard, they are both input and output devices. These drives may be internal (housed in the computer casing) or external (connected to the computer through a port). External drives can be easily transported between computers and locations.

Another storage device is flash memory. Unlike the previously mentioned storage devices, flash memory has no moving parts and is typically smaller and easier to handle. An example of flash memory is the USB thumb drives we see being used these days.

The Computer

All in all we tend to think of a computer as all of these things together. No computer is complete without a mouse, keyboard or hard drive. What good would it be if we could not see what we are doing with a monitor or other display device? Each part serves a vital function in allowing us to use a computer effectively. Computers have increasingly become a part of our lives in work and play. I hope we all can have a better understanding of what the hardware is that computers are made of. In the end a computer is putting all of these things together.



Software Basics

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TUTORIALS: SECTION 2

Why software?

Computers are a wonderful tool for us to use but computers can only understand binary instructions we don't. So how do we get our ideas across? We need a translator. That is where computer software comes in. Software enables us to communicate our ideas and problems to computers and for computers to communicate solutions back to us. In its most basic form software is a set of instructions for the computer. It is like a recipe for a meal. It tells the cook how to make the dish.

Types of software

There are three kinds of software: Compilers, System software (OS) and Software applications. In this document I want to talk about the first two.

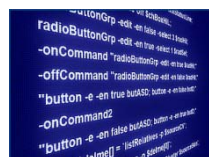
System software



System software, better known as the Operating System, helps bridge the gap between us and the computer. They act as translators so that we can tell the computer in our language what we want it to do and the software translates it into a set of instructions the computer can understand. Some of the most popular software out there is Microsoft Windows, MAC and Linux.

How we talk to computers

The operating system is partially stored in the ROM memory. When the computer boots up it reads the OS instructions and then loads the rest of the operating system during the boot process. The operating system is written in machine language.



We as humans speak in what is known as natural language. Programmers use a language in between the two to be able to create the software. These programming languages such as C++, Java and Visual Basic are known as high-level languages and enable the programmers to write the programs using terminology and notations closer to our own natural language.

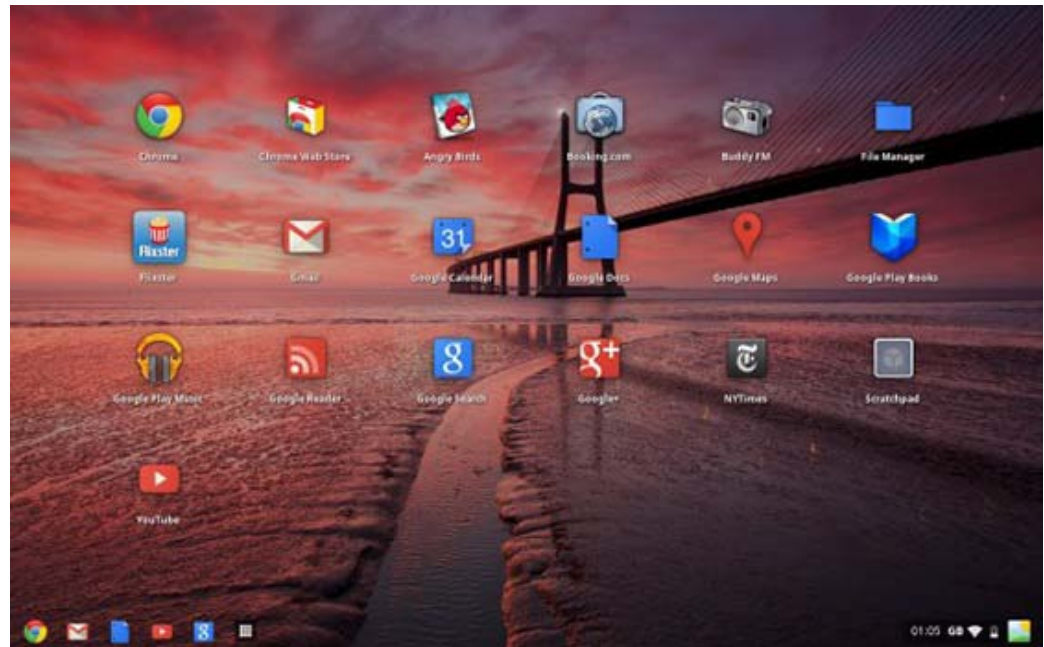
Compilers



Once the programmers finish, the programs are then compiled, using compiler software, into something readable by the computer. Once compiled, these programs can run again and again without needing to be recompiled unless there is a change made to the instructions. It has been said that a computer is fast, but it is only as smart as the programmer.

Our user interface

As users the operating system presents the user interface on a display. We can manipulate files and folders, save, copy and delete files. We may also run other applications such as word processing or games. The Operating system manages the computer hardware and tells it what to do. The OS also runs a lot of behind the scenes work that we as users will never see. The operating system is what allows us to use a computer. It translates our keyboard strokes and mouse clicks into instructions the computer can understand. Thus enabling the computer to perform the appropriate calculations to produce the output we desire.

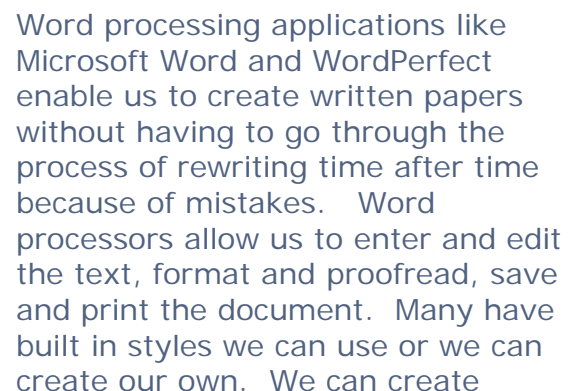


Example of a user interface for a Google Chromebook

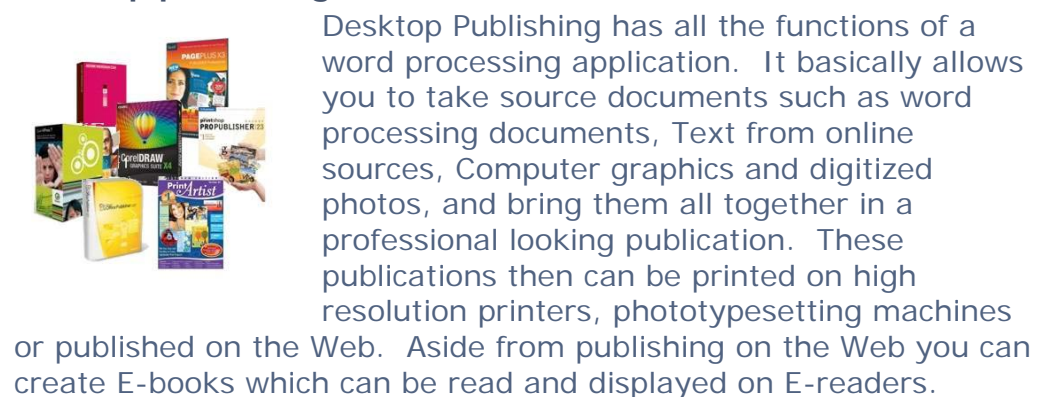


Software has been written and exists for all manner of applications. From a simple word processor to desktop publishing and computer modeling applications, applications enable us to do things with our computers. Some help us be productive, others help us learn. Some provide entertainment in the form of music, movies, TV, and games.

Word Processors



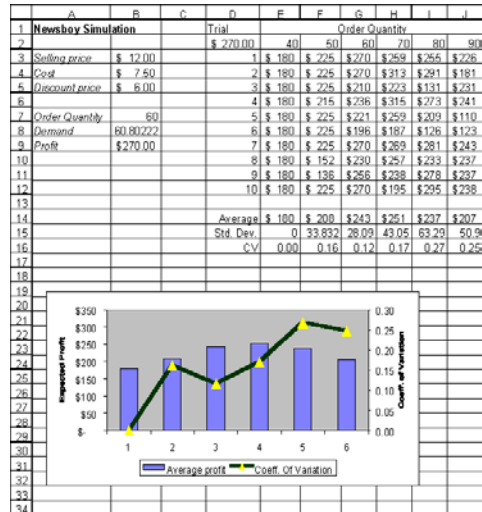
Desktop publishing



Spreadsheets

Spreadsheet applications like Microsoft Excel are able to store information in worksheets. Each worksheet is made up of rows and columns. Where each row and column meet are cells. We are able to store information in each cell and we can create labels so that the information makes sense.

Spreadsheets allow us to do the following:



- Make lists easily.
- Automatic replication of data and formulas.
- Automatic recalculation when values change.
- Predefined functions.
- Use of Macros.
- Formatting options.
- Templates and wizards.
- Data validation for calculations.
- Ability to link data between worksheets
- Limited database functions.

Spreadsheets are good for helping us answer the what if questions. We are also able to create charts and graphs from the data in the worksheets to better visualize trends in the data.

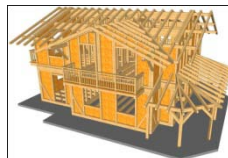
Statistics



Statistical software can include basic money managers such as Quicken, math-processing software and statistical analysis software go beyond the basic features of spreadsheets and are tailored to the task at hand with advanced features.

Scientific-visualization software allows scientists to visualize things we could not otherwise see like creating a picture of a patient's brain to better see the problems.

Modeling with computers



Computer modeling and simulation applications allow us to build 3D models and simulate real life situations for research and learning or just for entertainment. Whether it is an engineer simulating the stresses of a new bridge design or a flight simulator, applications enable us to test and

try new things with low risk to the real systems. But simulations don't stop there, many video games are simulations of real life situations or computer models of real places and events.



Networking

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TUTORIALS: SECTION 4

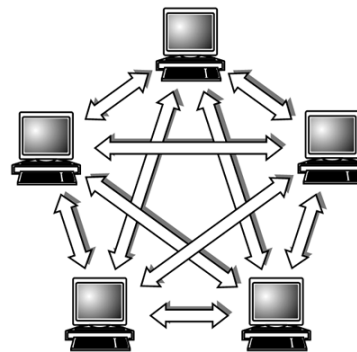
What is it?

A computer network is a system of computers that are connected together. The size of the network can vary depending on the use and need of those building it. Two computers connected together in a garage or many computers across the globe are both considered computer networks. Networks can be classified by the size (such as a LAN) and by the technology used to connect them (such as Ethernet).

Network models

Typically networks come in two models: Client/Server and P2P.

The client/server model, below left, has one computer acting as a server and the other computers connect to it as clients.



In the peer-to-peer (P2P) model, above right, computers act as both server and client enabling connection and sharing of information between them.

Networks by size.

A Personal Area Network (PAN) typically uses Bluetooth technology to create a close range connection for devices such as wireless keyboard and mouse or a wireless headset. These are typically used with laptops and mobile devices such as cell phones. These networks usually only cover an area up to 30ft away.

A Local Area Network (LAN) typically includes a floor or an entire building of connected computers. LANs typically are connected using Ethernet, Wireless (802.11a/b/g/n) technology or a combination of both. Your office network is a good example of a LAN.

A Campus Area Network (CAN) is similar but typically covers multiple buildings in the same area. A University campus, for example, that includes multiple buildings could be considered a CAN.

A Metropolitan Area Network (MAN) is much bigger than a CAN and typically covers an entire city.

A Wide Area Network (WAN) is a network a LANs that extends over long distances. Each LAN that is attached is considered a separate node in the WAN. The Internet is considered to be a WAN.

Network technologies.

1. Ethernet is a standard (using twisted pair cable) for wired connection of devices with a bandwidth of about 10Mbps (megabits per second). Faster standards today are Fast Ethernet @ 100Mbps and Gigabit Ethernet @ 1Gbps (gigabit per second).
2. Bluetooth uses radio technology to transmit a signal up to 30ft away. It is intended to replace wires for peripherals such as mouse and keyboard as well as the wires for connecting PDAs and cell phones to computers .
3. Wi-Fi technology uses radio waves which have a longer range than Bluetooth does. There are several type of Wi-Fi technology:



Wi-Fi uses radio waves to connect computers to a wireless access point. An access point is a central point which computers and other Wi-Fi enabled devices can connect to.

There are several variations on Wi-Fi. Each uses different bands (2.4GHz, 5GHz) and speeds (802.11(b) @ 10Mbps, 802.11(g) @ 54Mbps and 802.11(n) @ 160Mbps). 802.11(n) has become the standard today.



Database Basics

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TUTORIALS: SECTION 5

What is a Database?

A database is a collection of data that is related or connected. For example, an address book could be contained in a database.

Simply speaking a database is a collection of tables. Each table contains a number of records. Each record is made up of fields containing specific information. If we consider the example of an address book the fields of the records may be as follows:

ID	Last Name	First Name	M I	Address	City	State	Zipcode	Phone
1	Smith	John	D	1234 No Street	Mytown	VA	12345	123-456-7890
2	Doe	Jane	E	2555 Any Street	Meville	SD	56789	987-654-3210
3	Tent	Jimmy	S	444 Circle Ct	Skyburg	CA	25896	147-852-3690

All these fields make up one record and several records make up the Table as shown above.

Some databases may contain several tables each of which may contain a different set of information. Let us look at a student grade record for instance:

ID	Class ID	Class Name	Credit Hours	Grade	Grade Points
1	ENG 111	English Composition	3.0	A	4.0
1	BUS 101	Introduction To Business	3.0	B	3.0
1	CIS 115	Introduction to Information Technology	3.0	A	4.0

In this case we are looking at John Smiths grades for three different classes. The two tables Student Grades and Student Address can be linked by the ID column. This is what we call a relational database where tables of related data have similar fields (in this case the ID Field). Obviously there is no limit to the amount of data that could be gathered and stored this way.

What are they good for?



So what is all this data good for? What can we do with it? In the above example the database allows us to keep track of our students and their grades. We could also have tables that keep financial aid information for the students as well as tables to keep track of students in a particular class. Sky's the limit!

Deal Analyser (for Stephen)

Property Valuation Details Survey Value: £110,000.00 Purchase Price: £90,000.00 Your BMV is %: 18.18% £20,000.00 Monthly Market Rental: £550.00	The Purchase Purchase Price: £90,000.00 Total Purchase Costs: £1,800.00 Mortgage Raised: £93,500.00 Cash Required: -£1,700.00
Legal Costs Stamp Duty %: 0.00% £0.00 Our Legal Fees: £750.00 Vendors Legal Fees: £750.00 Total: £1,500.00	Refurb Refurb Cost: £1.00
Mortgage Details Mortgage Type: Tracker LTV Ratio: 85.00% Interest Rate: 5.24% Rental Cover Required: 125.00% Arrangement Fee: 2.00% Max Borrow Coverage: £100,763.36 Max Mortgage on (LTV): £93,500.00 UpFrontFees: £300.00 Fees Added to Loan: £2,015.27 Fees Due At End: £1.00 Bridge Costs: £1.00	Holding Costs Mortgage Cost: £417.08 Interest on Borrowed Capital: 0.00% £0.00 Misc Costs: £12.00 Period (Months): 1 Total: £429.08
Total Cash Required: -£1,269.92	Profit: £15,739.72

Close & Save to Stephen Close & Not Save

While Databases look a lot like spreadsheets when viewed in table form, they give us a lot of capabilities to manage our data quickly.

- 1) Databases are searchable. In most databases we can search on any field in any table of the database to find the information we are looking for.
- 2) Databases allow us to create forms (as seen above) in which we can view the data in a different way than the table view. Forms also provide a convenient way to enter data in and add new records. These forms can usually be printed out.
- 3) Data bases allow us to see the data together which can enable us to make better decisions regarding it. For example, by seeing all of the grades for a specific student together, you can make better decisions regarding the help the student may need.
- 4) While allowing us to search for specific information, databases also allow us to create reports from the data. These reports can be displayed and printed on demand.



Graphics

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TUTORIALS: SECTION 6

What is Graphics?

There are two types of graphics: bitmapped graphics and object-oriented graphics. Bitmapped graphics display the picture by pixel (little dots of black white or color arranged in rows). Object-oriented graphics are not a collection of pixels but a collection of lines and shapes. Because a picture is stored as lines and shapes that can be recreated using mathematics the storage requirement for an object-oriented picture is lower than the equivalent picture in bitmapped form.

The following are several types of image editing applications and how they work:

Painting software



Painting software enables us to paint pixels on the screen with a pointing device such as a mouse, trackball or stylus. They provide a number of editing tools to manipulate the images as well as create new ones. You can also save these images once you are finished.

Image processing software



Image processing software enables us to manipulate digital photos (stored as a bitmapped image) and other high resolution images in the same way that painting software does. They too provide a similar selection of editing tools much like painting programs do. In addition, image processing software typically includes specialized tools such as red-eye reduction and the ability to remove unwanted blemishes and reflections from the image. At its heart Image processing software is a tool for editing high resolution bitmapped images much like painting software.

Drawing Software



Drawing software is different from the previously mentioned painting and image processing in that instead of storing the image as a bitmap, the image is stored as a collection of lines and shapes. Because lines and shapes can be calculated using a mathematical formula we are able to reduce the size of the image file. This also enables really high resolution when printing because you are not dealing with dots. While bitmapped graphics are better for screen displays (such as found in video games), simulating natural paint

and editing photos, object oriented graphics are better suited for creating printed graphs, charts and illustrations because of the clean lines and smooth shapes they are capable of.

Animation Software



Animation software gives us the ability to create motion out of still pictures, just as in the old days when artists would draw a series of pictures and place them together to create the illusion of movement.

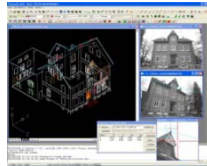
Animation tools have improved over the years and some more advanced tools allow us to create 3D animations. Many movies and TV shows use 3D animation to create special effects to help tell the story.

3D Modeling Software



3D Modeling software allows us to create 3D images on the computer. They also enable us to rotate and view the model in 3D.

Computer Aided Design Software

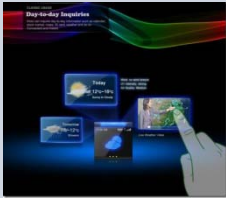


Computer Aided Design software also known as CAD is used extensively in the engineering fields to design anything from computer parts to huge skyscrapers in 3D. CAD software is continually advancing and today we have the ability to add physical characteristics to the objects. We can even stress test them in CAD before ever actually building the design in real life. Computer Aided Manufacturing (CAM) is also used to take the design and translate it into prototypes or products in a factory. When CAD and CAM are combined it is called computer-integrated manufacturing or CIM.

Presentation Graphics Software



Presentation graphics programs such as Microsoft PowerPoint help us create presentations in the form of visual aids and slides. These programs allow us to integrate all sorts of media and graphics into the presentation. Because of this these programs are sometimes referred to as multimedia presentation programs.



Multimedia

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TUTORIALS: SECTION 7

What is multimedia?

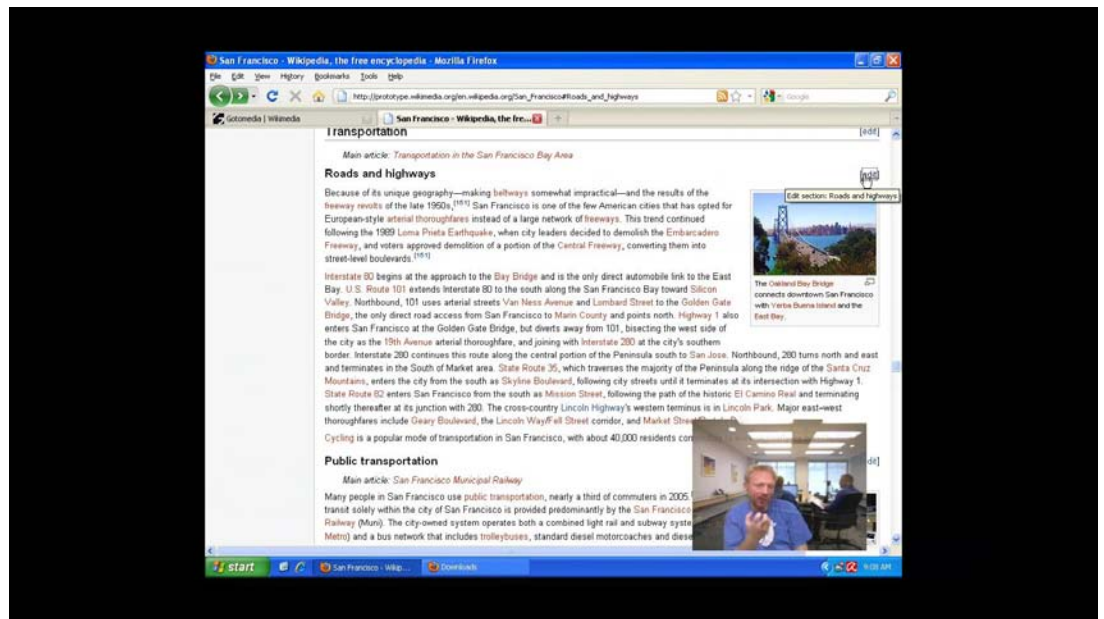
Multimedia is defined as using some combination of text, graphics, animation, video, music, voice and sound effects to communicate. It might be a TV show or movie or a Website. Computers are used every day to create all sorts of multimedia projects. There are a number of applications, such as Nero, available that enable you to create multimedia files.



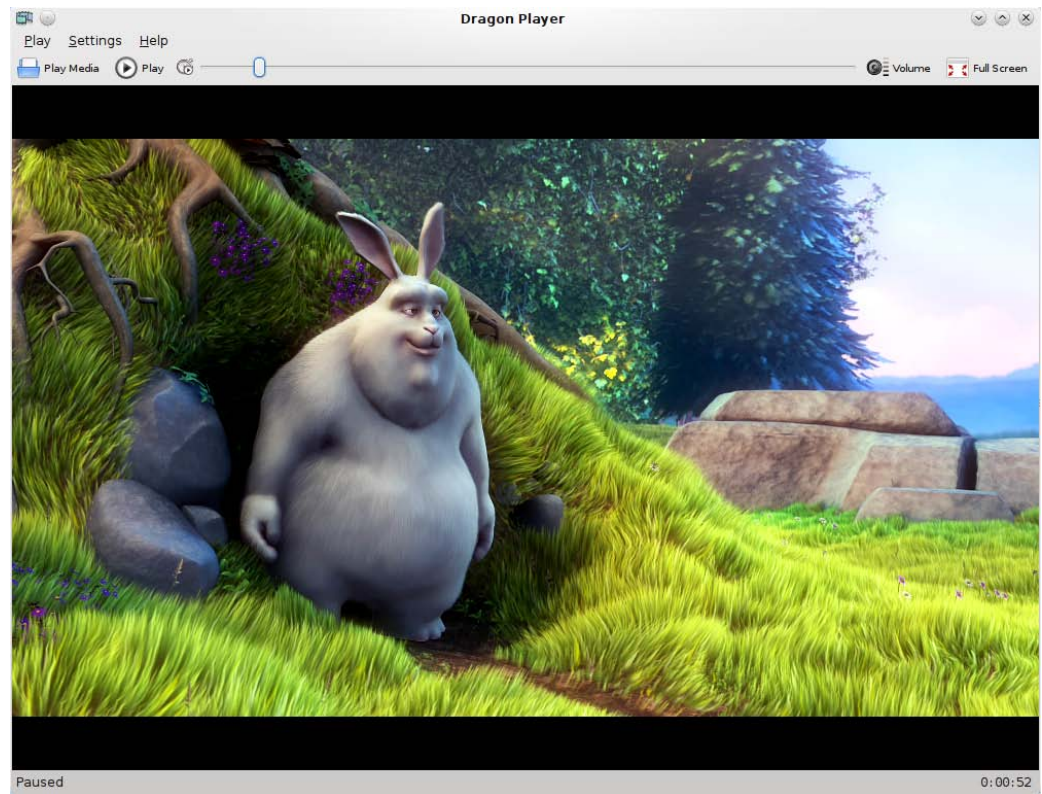
Creating multimedia projects

Multimedia-authoring software enables us to create and edit multimedia presentations. You basically take an assortment of source documents and create a document containing them to communicate a message. The source documents or files could include:

- A selection of text describing or containing what you want to communicate to the user.
- Graphics supporting the theme and message you are trying to get across.



- Animation sequences to explain a particular principle or subject.
- Perhaps a video about the subject (such as a “how to” video).
- Music, voice or other sound effects.





Privacy

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TUTORIALS: SECTION 8

Are we safe?

Privacy in computers is the expectation that our information is safe. We make assumptions that the information we provide is kept under lock and key. But as the computer and the Internet have grown, our privacy is less and less secure.

Because computers allow us the ability to collect and store data such as in databases, and because the internet has enabled communication with others, we find that our privacy online is in jeopardy. Database queries allow quick and easy access to data that is stored there. Anything we do may be recorded in a database for later retrieval and analysis. For example: what we buy may be stored and analyzed to better see what types of things we are most likely to buy next time. In a way this information can be used to find out what we like and who we are.

What happens to the data?

Some companies buy or sell information to others. Others may just take the information if they know where to look. The consolidation of data available online can easily paint an accurate picture of who we are. Big threats in this area are social networking sites which have all sorts of information about the people who use them. In this case what you say to friends and family could be analyzed and helps to identify who you are. Online websites also store information about you and your activity there. A key thing to remember is that once the information is online it never goes away.

Increasing our privacy.

So what can be done to ensure our privacy? The following are a few suggestions on how we can protect our privacy online:

Keep IDs to yourself.

Never give away your social security number to anyone unless they have a legitimate reason to have it. The same goes for your driver's license or other identification numbers. The fewer times you give it out the better chance you have of maintaining you privacy.

Private Information should stay private.

Don't give away information about yourself. Many people don't think about the information they provide on questionnaires and other forms. The key is to remember that whatever you put down is now stored their database. Don't put it down if you don't want it out there.

Stay away from mailing lists.

Don't sign up for direct mail, phone, and email solicitations. By removing yourself from these mailing/calling lists you keep your data out of reach. Be careful about these options when filling out forms, many times the option to enroll is on by default.

Know who has your email address.

Don't give out your email address to everyone. Use it only with those you can trust. In the case of online websites and stores, use an alternate email address instead to help protect your identity from those most likely to share it.

Just say "NO" to sharing.

When possible tell them not to share your personal information.

Who needs to know?

Think before you post. Don't post things you don't want the world to see.

Check your preferences!

Look at privacy preferences. Many online retailers, social networking and web sites have privacy preference settings that you can choose from. Be sure you understand the preferences and set them up to only allow those you want to be able to see your information.

Are you secure?

Use technology to help secure your information. There are numerous software applications available that can help you secure your information.

Hey, that's not right.

Correct any false information you find. From your credit report to your school records, make sure the information they need to have is accurate.

Can you find me?

Minimize your profile. To hide your financial transactions use cash instead of credit, don't want your number out there, use an unlisted number. Use a post office box instead of your home address. These will make it harder for people to find you.

Don't be shy about privacy.

Don't be afraid to speak out against companies who you feel are compromising your privacy. If you feel your privacy is being compromised, say something. You can also support organizations that fight for privacy rights.

It's about minimizing risk.

While there may be no sure way to keep your information from getting out these steps can help minimize the risk and keep your information in the hands of those who should have it instead of those who shouldn't.



IT in Business

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TUTORIALS: SECTION 9

Information systems

Information Systems are here to help people in the organization gather and use information, communicate with other people and make effective decisions.

Businesses use computers daily to manage almost all aspects of their operations. These are a few of the uses for computers in the business world.



Acquisition of data

We use computers to capture data about important events. For example, a retail store might use a computer to scan in the items it sells or to track the inventory coming into the store.

Processing of data

Computers are used to do many calculations that we need. For example an Accountant may use computers to calculate how much taxes our business owes each year or what our total sales were for the day.

Storage and Retrieval of data

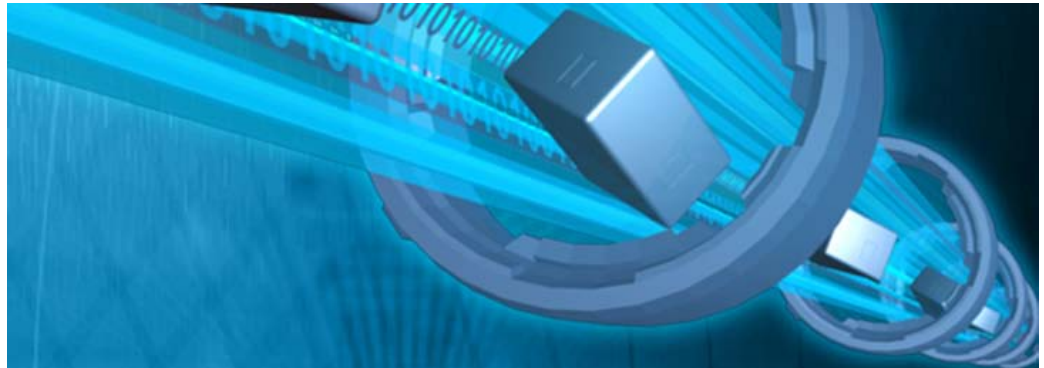
Businesses use databases to store information about customers, inventory or any other information related to their business for later use.

Presentation of data

We use computers to create reports or display information for us. An example of this would be displaying the total amount owed at the checkout counter when you check out.

Transmission of data

Businesses need to talk to each other, share data, submit orders, payments, send reports or any number of other things. Computers enable businesses to be connected to the world.



In the business world we see several types of specific information systems:

Transaction processing system

Typically process and track money transactions, inventory, ticket and Hotel reservations and financial transactions.

Resource Planning systems



Help businesses manage their resources better based on information received from their transaction processing systems in place. Resource planning at a business level collects data received from all aspects of the business and helps us make better

decisions about using our resources to increase effectiveness.

Supply chain management

Some businesses will connect their systems with suppliers, manufacturers and delivery companies to better manage the entire supply chain.

Computers enable us to not only do things faster but more efficiently in our businesses.