

How the Internet works

Short History

The Internet started in 1969 as something called ARPANET (Advanced Research Projects Agency Network) and was developed by the Advanced Research Projects Agency as part of a research project between US Defense Department, in conjunction with a number of universities and military contractors. But lets not forget that in 1969, it was nothing like what we think of today. For a start, it was all text-based and there were no pictures, graphics or mouse clicks!

By 1984, the Internet consisted of about 1,000 computers connected together. By 1987, there were 10,000 and by 1989 it was 100,000. Today, there are millions of computers that make up the Internet, so many that they can't actually be counted.

However, the Internet we all think of today is what was originally (and sometimes still is) referred to as the World Wide Web (WWW) (and sometimes unkindly as the World Wide Wait!) The Internet didn't become the WWW overnight. The technology for the WWW itself, was first implemented in 1992. However, it wasn't until a new concept, now known as a Web Browser, was implemented as recently as 1993, that the possibility that "ordinary" people could use the Internet as a resource became viable.

E-mail¹, developed slowly during the same period as the Internet was developed. When the concept of e-mail first started, there were few people with the technology (computer programs and network connections) and the know-how, to send and receive e-mail, and standards were non-existent. Primitive emails could be sent in the early 1970s. In the early 1980s, e-mail standards had been initiated, and computer software designed to use those standards. Still, it wasn't until around 1993, when widespread connection to the Internet became possible, that e-mail really took off. After all, it wasn't useful if you were able to send a message, but the person you wanted to send it to wasn't connected to the Internet!

So, in summary, the Internet we think of these days, incorporating graphical, point and click web pages, advanced **Search Engine**² technology and integrated e-mail, has only really been operating since 1993!

To put this in perspective, the founder of **Netsite Australia**, Mr Douglas Smith, has been designing and creating web pages since 1997, and has been a member of the Australian Computer Society since 1984.

What is the Internet?

The Internet is basically a network of permanently connected computers. These computers **host**³ the **web sites**⁴ that we search and use as a resource. They also

¹ Short for Electronic Mail

² A **Search Engine** is simply computer software (computer programs) that allows you to find the information you want. There are billions of web pages out there (many of dubious quality!) but what's the good of having all this information if you can't find it when you need it.

³ Web pages are stored on the permanently connected computers that make up the Internet. We refer to this as hosting the web pages. The computer that does the Hosting uses computer software known as a Web Server, to serve up the web pages it hosts, to whoever requests them.

⁴ A **Web Site** is a term used to refer collectively, to a group of related web pages based on a common thread (eg the pages about company X, the pages forming a public dictionary, or the web pages related to 'holidays in Japan', etc.). Normally, a web site relates exactly to one domain name, but only because this makes sense, it is not a technical requirement.

host all our mailboxes and implement what we think of as e-mail. It is important that a distinction is made between computers that are permanently connected and those that are not. In order for the Internet (WWW) and e-mail to work, the computers that host the web sites, and those that host our mailboxes must be constantly connected together so they can communicate 24x7 (24 hours by 7 days). Computers such as the one you used to download this document are likely not part of the Internet itself, they can just connect when they need to, and switching them off doesn't stop anyone else from accessing all parts of the Internet. The computer you used to download this document probably does not run web server software and does not host any web sites itself, nor any mailboxes.

Internet Service Providers

In order to allow computers to gain access to the Internet without being part of it (ie without having to participate in hosting web sites or provide a **mail service**⁵), there are companies that have computers that allow people to connect and disconnect from the Internet. These companies provide the "public face" of the Internet. They are generally known as Internet Service Providers (abbreviated to ISPs). If the Internet was the electricity grid, then you can think of an ISP as your power-point that gives you access to the electricity grid. These companies generally provide support for non-technical people to connect to the Internet. They hide all the technical details, they generally provide multiple methods of connection (eg dialup, cable modem, wireless) and also provide both e-mail services and web site Hosting services to the public.

How does Netsite Australia fit in?

Netsite Australia is not an ISP. **Netsite Australia** does not allow people to connect to the Internet. **Netsite Australia** provides all the necessary skills to build/construct a web site, plus they can provide a facility for hosting your web site. **Netsite Australia** in fact, does not operate any computers that act as Web servers or Mail services. **Netsite Australia** purchases these facilities from other ISPs and then manages them itself, so that you don't have to concern yourself with these things.

Internet Computer

In order to differentiate your computer and others like it, that connect to the Internet but are not actually part of it, we will use the term **Internet Computer** in this document. In Figure 1 below, the Internet Computers are those that are inside the Internet "cloud".

The Internet has that name because it is an interconnected network of computers. What that means is that every computer can access every other computer, *one way or another*. The Internet itself provides this connectivity transparently. That is, once you are connected into the Internet, you can access the same web sites and the same mail facilities, no matter how or where you connect. How the information transparently passes between the Internet Computers is the magic and beauty of the Internet. Remember, that any Internet Computer is accessible from anywhere else in the Internet. So, if your mail is being held on a particular Internet Computer (eg your ISP), you can access that mail from anywhere in the world, provided you can use a computer connected to the Internet. That is the service provided by Internet Cafes.

⁵ A **Mail Service**, like a web server, is computer software, but unlike web servers that serve up web pages, mail servers are responsible for the transfer of mail and for the management of mailboxes.

You will notice in Figure 1, that the people who use the Internet are generally outside the Internet "cloud". They connect to the Internet by different methods. For example, by dial-up modem, or wireless, or broadband, or cable modem. Notice that different ISPs provide different connection methods. However, regardless of how you connect into the internet, you get the same access to the Internets facilities, that is, the same access to web pages and the same access to mailboxes, because all the Internet Computers are connected together, one way or another.

Notice that Figure 1 also shows some unhappy "customers". They are unhappy because the Internet is not working for them at the moment. It is important to realise that even though they can't get access to any web sites nor their mailboxes, this does not mean that the Internet itself is broken. Consider that any one of the following reasons could be preventing them from accessing the Internet:

- Their personal computer is not working correctly - perhaps it has a computer virus, or
- Their modem is not working correctly - perhaps it has a fault,
- A trench digger between their location and the telephone exchange has cut the telephone line,
- Their ISP's computer may have a fault, and is not working.

In all the cases above, (except if web pages or mailboxes are stored on the ISP's computer and that computer is down) all the millions of web pages and mailboxes are still working and still available, albeit to everyone else!

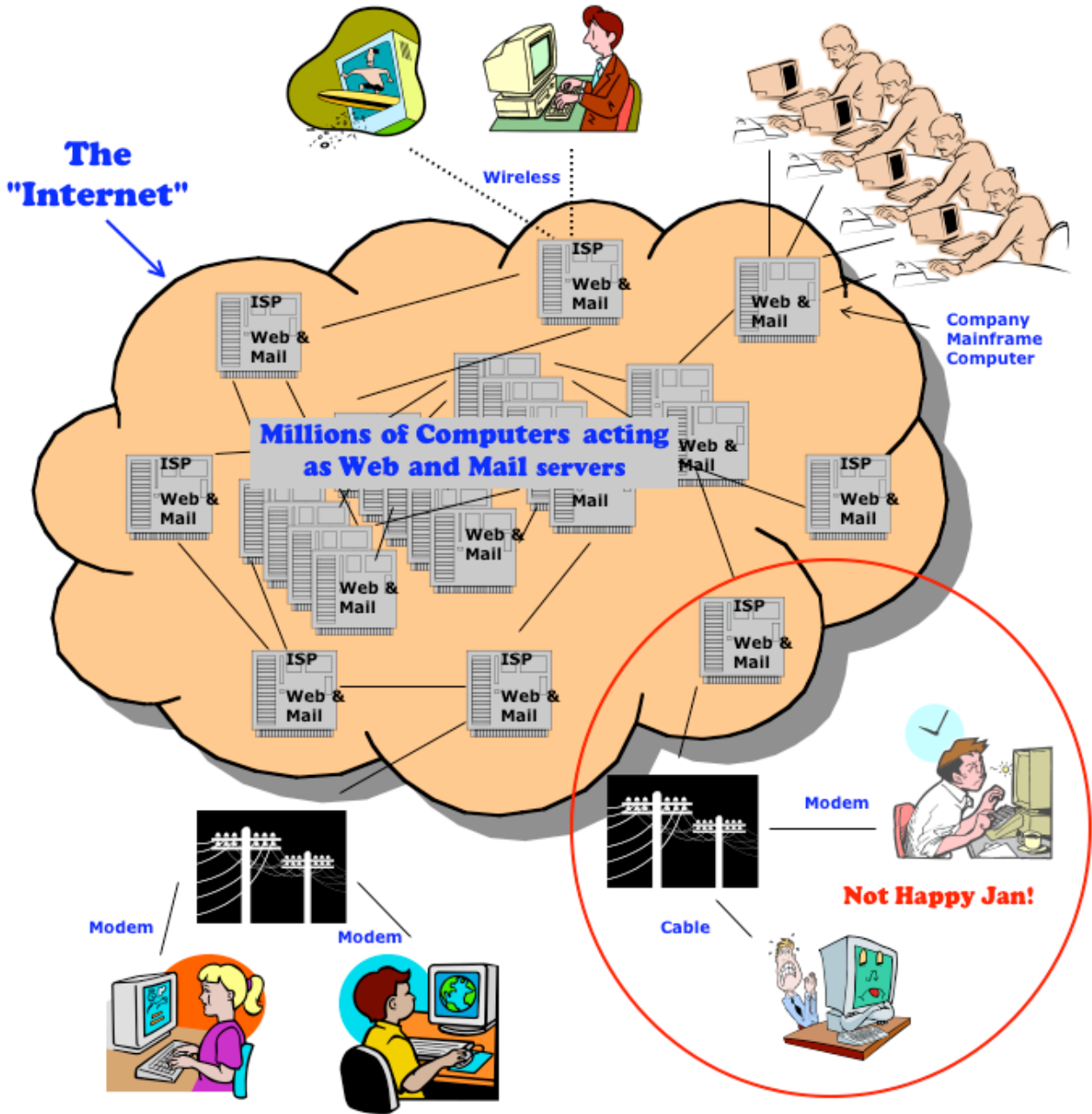


Figure 1 - The Internet

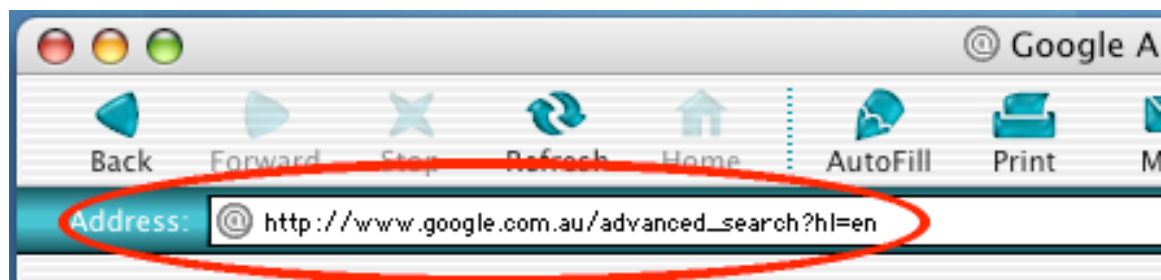
Web Page Addresses

Just like houses, units and businesses in the Postal system, every delivery point must have a distinct address. On the Internet, every computer must have a distinct address, including all the Internet Computers (those that host web servers or mailboxes), but also the computer you use to connect to the Internet. In the latter case, your ISP may allocate you a distinct address temporarily while you are using the Internet. On the Internet, this address is called an IP (Internet Protocol) address, and takes the form of four numbers between 0 and 255, each separated from the next by a dot. So, for example, 216.239.39.104 is the unique address of a computer. However, because humans don't work well with remembering numbers, a system of what is called **Domain Names**⁶ has been devised, such that every computer can be assigned a name, and that name will be transparently converted into the computer's IP address, by another piece of software called a **Domain Name Server**⁷. For example, the domain name `google.com.au` may be translated into the IP address 216.239.39.104.

Having determined which computer is being addressed by translating the **domain name**, the address for a web page must also include the name of the actual web page. This is added after the domain name. An example of a complete web page address might therefore be `google.com.au/advanced_search`.

Universal Resource Locators

Another Internet term is the Universal Resource Locator, or just a URL. A URL is what appears in the "address field" of your web browser.



You would have noticed that the URL contains more than just the domain name and the web page name. If you just want to find a web page and you don't already have a bookmark or favourite for it, you can type something like `google.com.au` into the address field and the rest will be filled in for you. Most of the time, as an ordinary user of the Internet (as opposed to a web page author, for example) you would be unconcerned about the additional information.

One part that can be important, especially if you need to use web pages that need some security, such as for banking or financial transactions, is the first part of the URL. This is called the **protocol**⁸. In the example above, the most common protocol is shown - `http://` When the web site you are talking to supports it, the web site can

⁶ A **Domain Name** is like an alias for an IP address, just like some old houses have names, such as "Ladybird Cottage" and Australia Post is able to translate this into a street address. On the Internet, a **Domain Name Server** does this translation.

⁷ A **Domain Name Server** runs on many computers on the Internet and it translates and domain name passed to it, into the IP address, so the actual computer can be identified.

⁸ The **protocol** simply tells what type of conversation is going on between your computer and the computer you are talking to (the one identified by the **domain name**).

set up a secure conversation between itself and your web browser. This is the protocol called `https://` (the 's' just means 'secure'). Most web browsers try to display an additional icon (which usually appears as a closed lock) somewhere around the edge of the browser window, to indicate that the conversation you are now having between your computer and the computer on which the web site resides, is secure. Some examples of secure icons from popular web browsers are:



However, the only thing these icons are telling you, is that the protocol in the address field in `https://`

Many web sites will allow you to leave off the 'www.' in front of the domain name, but some web sites will absolutely insist that it's there.

Electronic Mail on the Internet

Caveat

A detailed description of how the Internet mail system works, is not possible in this introductory document. There are lots and lots of acronyms involved, but we will try to avoid them altogether and just use some relatively simple concepts, most of which can be related to the equivalent ideas in the real world.

First of all, what we are going to describe here is the Internet mail that *most* of us use. This is the e-mail where you have to click a button to receive your messages. The set-up of e-mail in larger businesses, for example, is different, because the mail comes to you, rather than you having to go and get it (from your mailbox). We are only going to deal with e-mail over the Internet, as most of us would use it from home, for example.

The Mailbox

A mailbox is where your mail is held until you collect it or do something with it. The Internet e-mail system is designed to automate the transfer of e-mail, such that every message sent by someone is delivered (if possible) to the recipient's mailbox, and there it stays until the recipient does something with it. A mailbox is always hosted on an Internet computer, that is, a computer inside the cloud in Figure 1 - The Internet. Your mailbox is not on your personal computer (If for no other reason, that your computer may not always be connected to the Internet, so it can't really participate as an integral part of the e-mail system).

Quite often, your mailbox is hosted on your ISP's computer, but this is just done as a matter of convenience for you and because its a service your ISP can say is part of its offering you (and for which you pay for). However, such mailboxes usually have a domain name related to (and owned by) the ISP (eg `doug@bigpond.com.au`). If you have your own domain name (and anyone can) then you can have the mailbox(es) for that domain hosted on any Internet Computer that provides a mail service facility (and you pay them for doing this). Often, if you have a web site associated with your domain name, the Internet Computer that hosts your web site will also host your mailboxes (at little or no cost).

Internet Mailbox versus Australia Post

You can think of your mailbox as similar to a Post Office box (POB). The mail is delivered directly to your post office box, but it goes no further until you do something

with it. Also, while we draw the comparison, when you send **s-mail**⁹ you do not put your mail into your post office box (there is a separate mechanism for getting the mail you want to *send*, into the mail system). This is the same with e-mail as will come out later on.

Now, if your mail is delivered automatically as far as your mailbox, there are basically two ways you can deal with it. Just like for POBs, you can sort it out, read it, toss it, whatever, while you stand in front of your POB, or you can just bring it all home and deal with it at home. Note that what facilities you have to help you deal with the mail while standing in front of your POB, are probably limited compared with what you can do if you bring the mail home. (Have a cup of coffee, put your feet up, use a letter opener, create different piles for 'bills', 'personal', 'junk', etc.)

Making the Choice

If you choose to 'bring the mail home' then in the e-mail world it means you are going to use an e-mail program on your computer to collect your e-mail from your mailbox and store it on your own computer. Once its on your own personal computer, you will continue to deal with the e-mail using that e-mail program on your own computer.

Alternatively, if you choose to 'deal with the e-mail as it sits in the mailbox', then you can use what is called **Webmail**¹⁰. Webmail simply means using your web browser as a means of delving inside your mailbox, without actually moving the mail out of the mailbox and onto your computer.

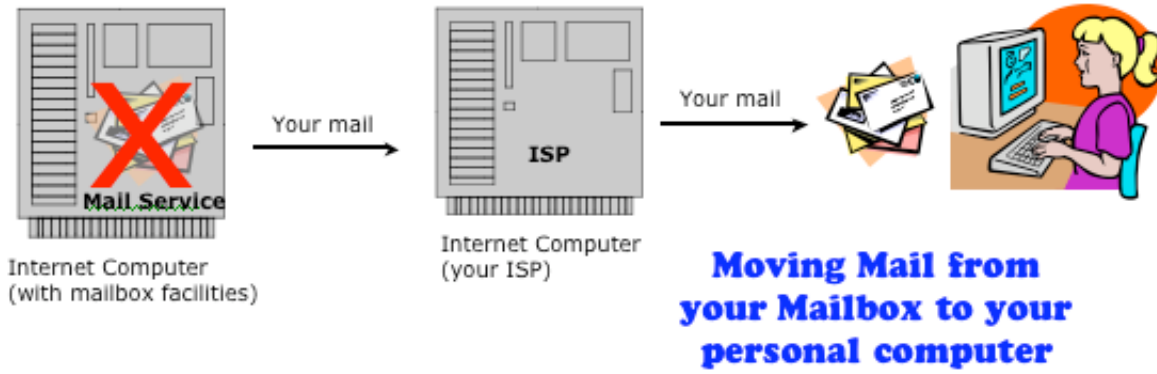
Option 1 - Using an E-mail program

For most people on the Internet, we have e-mail software installed on our computer. There are lots of e-mail programs available, but the most common ones are Microsoft Outlook (and it derivatives), Entourage, Apple Mail, Eudora, Quickmail, CC Mail, etc. What all these programs do, is collect your incoming e-mail from the mailbox and transfer it down to your own computer. The mail is then deleted from the **mailbox**¹¹, so in fact it has effectively been *moved* from the mailbox to you computer.

⁹ short for snail mail, which means the traditional physical 'letter' type mail that Australia Post delivers. A common expression highlighting the difference in the delivery time for mail that has to be physically transported to a mailbox/letterbox.

¹⁰ **Webmail** means using your web browser to deal with your mail from inside your mailbox. This will involve either a) using webmail software installed beside your mailbox (eg Horde, SquirrelMail) which can be used to deal with the mail for *your* domain, or b) a **webmail** service, such as provided by Hotmail, Gmail, Yahoo! Mail, which can be used to deal with the mail for *their* domain.

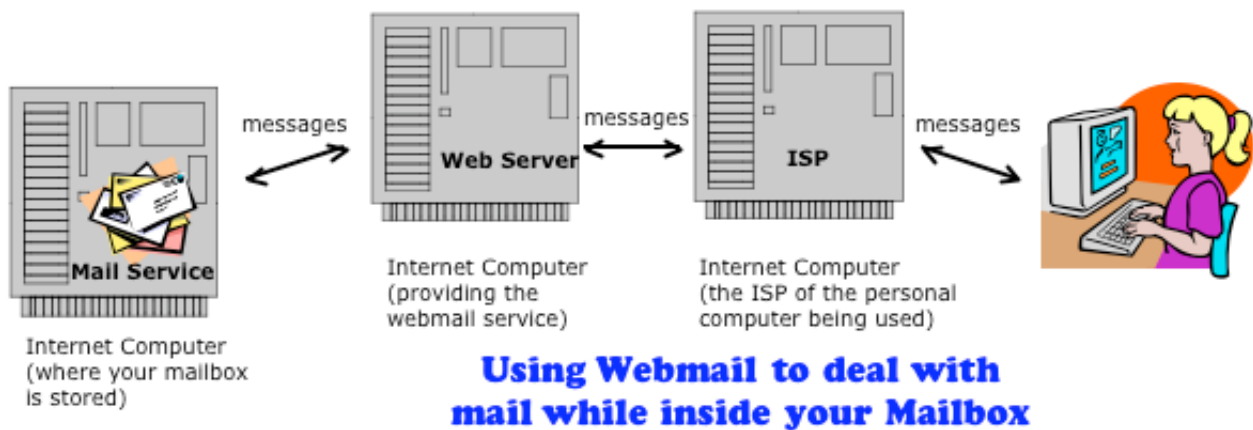
¹¹ Most **e-mail** programs allow you to copy the **e-mail** down to your computer but keep it in the **mailbox** as well. You really have to know what you're doing if you choose this option, otherwise you will keep retrieving the same messages over and over!



If you don't travel anywhere, moving your e-mail from your mailbox onto your personal computer is probably the best thing. You can then disconnect from the Internet (if you wanted to) and still deal with your mail **offline**¹². It also means you can use all the rich features of your e-mail program to deal with your mail, like detaching attachments for example.

Option 2 - Using Webmail

Webmail is great when you are travelling, or you need to deal with your e-mail consistently, even though you either have to, or want to, use different computers to do this. For example, if you want to read your personal e-mail from your work computer (which you would only do at lunch time, of course) but also you want to be able to read it from home, then using an e-mail program to move your mail from your mailbox to a particular computer is inconvenient. You won't be able to deal the e-mail you moved at work onto your work computer, if you are now at home.



¹² **Offline** is term used to mean 'while you are not connected (to the Internet)'. If you have broadband or cable, you are always connected, but if you use dialup, you don't want to be connected for long periods, because it costs you more money and other people can't use the telephone line while you're connected.

This is where webmail really comes into its own. Using the computer's web browser (that is, the web browser on *any* computer connected to the Internet) you can deal with your mail as it sits in your mailbox. This works because your mailbox is hosted on an Internet Computer, and that computer can be accessed from anywhere in the world, all you need is an access point, that is, a (personal) computer that has a connection to the Internet. In this case, that (personal) computer might be your friend's, whom you are visiting overseas, or it could be an Hotel's computer or a computer in an Internet Café.

The above diagram shows the *principles* of webmail, in that you are actually using a web site (hosted by a web server on one Internet Computer) to deal with your e-mail that is on another Internet Computer that provides your mail service. However, in real-life, the two Internet Computers may in fact be the same computer that provides both services. In the diagram, the mail stays where it is, although **messages**¹³ sent back and forth will contain information about your mail, including a copy of the **body**¹⁴ of an e-mail if you request to see it.

Comparison - Using an E-mail program versus Webmail

Characteristic	E-mail program	Webmail
Where mail is stored	Usually moved to your (personal) computer and deleted from the mailbox.	Stays in the mailbox until you delete it.
Capacity	The amount of mail you can store on a personal computer is limited only by the capacity of your computer, which generally means "almost unlimited".	Mailboxes are almost always severely limited in capacity (ie less than a tenth or hundredth of the capacity of your computer)
Speed	Once the mail has been moved to your computer, accessing it is as fast as your computer.	Accessing the mail in your mailbox will always be limited by the speed of your connection into the internet.
Facilities available	Advanced - The E-mail program usually has advanced functionality that you can use to search, sort and manage your e-mail.	Limited - Some advanced capabilities that are relatively easy to do on your own computer, the webmail web site will have difficulty providing. For example, linking your email with contact lists and calendar entries.
Access	You can only access your received e-mail from your computer. If you receive some e-mail to another computer, you will create yourself a difficulty in managing the mail over multiple computers.	The mail stays in the mailbox, which you can access for <i>any</i> computer connected to the internet, provided it has a web browser (and it may need to be configured to allow cookies).
Best use	Everyday use from home or work	When temporarily travelling. You can delete the SPAM and other mail you don't need to keep, reply immediately to urgent mail, etc. When you return to home/work, you can read the mail that remains in the mailbox, using an e-mail program and then all your mail is consolidated in one place again.

¹³ The term **messages** in this context, is used to describe the communications that are being passed back and forth between the mail services and the web server and your (personal) computer.

¹⁴ When we talk about the **body** of an e-mail, we mean the actual text of the e-mail, as opposed to the information in the header of the e-mail, which contains the name of the sender, the name(s) of the other recipients (if any), the date and time the e-mail was sent, and so on. The analogy with s-mail, would be that the header equates to what's on both sides of the envelope, and the body of the e-mail equates to the entire contents, ie what's inside the envelope.

Conclusion

Netsite Australia hosts web sites that we design and maintain, but we can also host web sites that are designed and maintained by our customers.

To determine the disk space and bandwidth allowance required for your web server, you need to compromise between how much excess capacity you want to have in reserve, in case it is required, and how much unused capacity you want to pay for. This is a decision best discussed with a **Netsite Australia** consultant.

Please contact **Netsite Australia** to find out about our Web Hosting plans, or visit our web site at <http://netsite.net.au/>

This and other documents can be found at <http://netsite.net.au/>

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