

What is Packet Switching?

(Taken from: http://www.teach-ict.com/technology_explained/packet_switching/packet_switching.html)

This is a method of breaking data files into small packets or chunks in order to send them across a network.

What is the idea behind it?

Telephones have been around for over one hundred years. When you want to make a call to someone else then a dedicated connection is set up between you. Whilst that call is taking place you both have sole use of the telephone line - no one else can use it. Once the call is finished the connection is broken and the line becomes available for somebody else to use.

This method has worked fine for many years. However, as said above, the line is tied up for the whole length of the call. This is called 'circuit switching'

Now imagine if this method were used in networks. For every person using the network a dedicated line would be needed. Large companies can employ thousands of staff around the world, all logged into the company network at the same time. Imagine how much that would cost to set up? Also, what about all that cable?

What about the Internet? Nobody owns the Internet, so who would be responsible for setting up and paying for the lines? And worse still could you imagine just how many lines would be needed for everyone to use the Internet at the same time? Impossible!

So this is where 'packet switching' becomes important.

How does packet switching work?

Imagine that you have a data file, perhaps an email or a document which is 2 Megabytes in size. You want to send this file to someone in another country.

When you send the file, it isn't sent as one document (remember the telephone call), instead it is broken up into lots of small 'data packets'. Our 2MB file would be broken up into chunks of 512 bytes in size.

Before each packet is sent, it is given a 'header' containing the network IP address that it needs to arrive at and also details of the IP address from which it was sent. The header also gives each packet a number and records how many packets the data was split up into.

How do the packets get through the network?

Now comes the clever bit. Try to imagine the Internet as billions of computers all connected together in a huge mesh. There isn't just one way to get from one computer to another, there are literally millions of different routes which can be taken.

So, the packets leave your computer and are sent through the network, knowing where they need to get to. The packets start to head off in different directions taking the least busy path at that instant. A machine called a 'Router' works out which is the next fastest connection and sends each packet on its way. During the course of its journey, a packet will travel through many routers, possibly in many different countries.

This method works extremely well, because if one branch gets too busy or broken, then the packets are automatically routed through another path instead.

What happens when the packets arrive?

When the packets arrive at their destination, they are put back together again in the right order. Remember earlier on we told you that each packet was given a number? This makes it possible to correctly reorder them. The header also contained a record of the number of packets into which the file was split. So, if any packets fail to arrive within a certain length of time then a message is sent back to the original computer asking for a replacement packet.

What happens to lost packets?

Sometimes packets can get lost and keep bouncing around from router to router, never quite getting to their destination.

A system had to be developed to deal with this because eventually the network would choke with these 'lost' packets. So to solve this problem a 'hop' count is also added to the packet header. Each packet is allowed to 'hop' from one router to another a maximum of say 100 times. Each time the packet passes through a router the 'hop number' is decreased by one. If the packet hasn't arrived at its destination within the number of 'hops' allowed then it is deleted by the next router.

Advantages of Packet Switching

- It makes very efficient use of the network - no tied-up lines
- It can easily get around broken bits of the network
- As customers increase, the network only has to expand slowly compared to circuit switching

Disadvantages of Packet Switching

- The time it takes to put back the data package changes each time, which can be a problem for time-critical information such as an emergency signal. The fancy name for this is 'latency'.
- Not very good for small data packages - for example if the data package itself is only 600 bytes long, then two packets of 512 bytes need to be used, plus the address information.

What is the future of Packet Switching?

Packet switching has proven to be so successful that BT is changing its entire telephone network over to it so that eventually all telephone calls will use this technology. This will take many years and billions of pounds.

Questions to think about

Are all packets equally important?

Would you pay more, if you could make your packets have priority over someone else's packets?

How much would you pay?

These are questions that the big telecom companies are wrestling with. It's a bit like the old First and Second class post. You pay extra for first class delivery so that your letter will get to its destination faster.

So, would people pay more for their broadband connections if they could guarantee that their data would be sent and retrieved faster than someone else's data?

This technology is possible, but it is a sensitive issue because it means the internet could be divided up into 'motorways' or 'slow country lanes', causing another form of 'digital divide'.