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PACKET SWITCHING TECHNIQUE IN NETWORK TECHNOLOGY

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Abstract

Packets and packet switching were invented to communicate within networks effectively, i.e., to multiplex, digital networks. We easily grasp the concepts of circuit switching, such as a voice telephone call, message switching, and the paper-based postal system, because they are common and historical examples. Recently, we discovered that digital techniques for transmission and switching information are far superior, faster, cheaper, and less prone to error than the analog techniques devised in earlier times. These digital methods allowed for the invention of packets and packet switching, making digital technology even more effective. Networks are built in layers, so will first examine some important layering models for different kinds of digital networks. We will also discuss how addresses fit into our layering schemes. Next, we briefly describe circuit and message switching before surveying the primary topic of packet switching.

INTRODUCTION

Switching is a technique that inspects data packets as they are received, and forward them to destination.

A switching system is a collection of switching elements arranged and controlled in such a way as to setup a communication path between any two distant points. A switching center of a telephone network comprising a switching network and its control and support equipment is called a central

office.

In computer communication, the switching techniques used are packet switching and circuit switching.

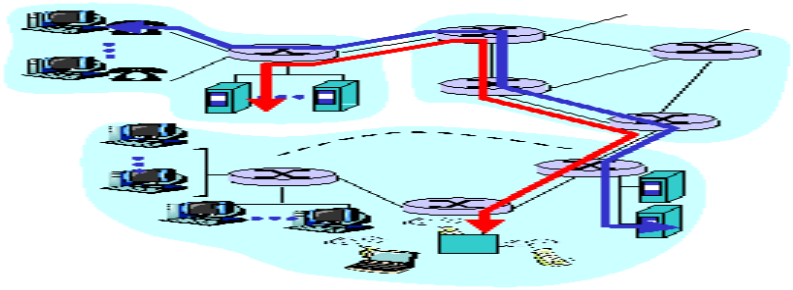
Packet switching is a digital networking communications method that groups all transmitted data regardless of content, type, or structure into suitably sized blocks, called packets. The concept of switching small blocks of data was first explored by Paul Baran in the early 1960s. Independently, Donald Davies at the National Physical Laboratory (NPL) in the UK had developed the same ideas a few years.

There are two basic switching techniques used in networks:

- Circuit switching
- Packet switching

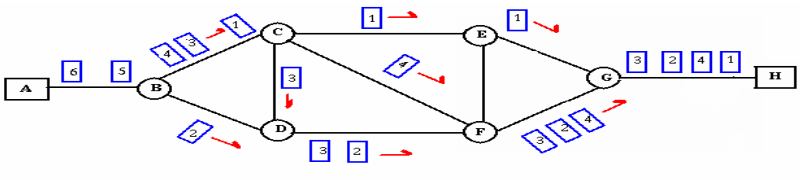
CIRCUIT SWITCHING

Circuit switching is the most familiar technique used to build a communication network. It is used for ordinary telephone calls. It allows communications equipment and circuits, to be shared among users. Each user has sole access to a circuit (functionally equivalent to a pair of copper wires) during network use. After completion of the connection, a signal confirming circuit establishment is returned



Circuit switching

PACKET SWITCHING



Packet switching

The concept of packet switching was first developed in the early 1960s, apparently independently, by researchers at the Massachusetts Institute of Technology (MIT) and Rand Corporation.

Packet switching is the dividing of messages into *packets* before they are sent, transmitting each packet individually, and then reassembling them into the original message once all of them have arrived at the intended destination.

Packets are the fundamental unit of information transport in all modern computer networks, and increasingly in other communications networks as well. Each packet, which can be of fixed or variable size depending on the protocol, consists of a *header*, body (also called a *payload*) and a *trailer*. The body contains a segment of the message being transmitted.

The header contains a set of instructions regarding the packet's data, including the sender's IP address, the intended receiver's IP address, the number of packets into which the message has been divided, the identification number of the particular packet, the protocol (on networks that carry multiple types of information, such as the Internet), packet length (on networks that have variable length packets) and synchronization (several bits that help the packet match up to the network).

Packets are *switched* to various network segments by *routers* located at various points throughout the network. Routers are specialized computers that forward packets through the *best* paths, as determined by the routing algorithm being used on the network, to the destinations indicated by destination IP addresses in

the packet headers. During transport from one host to another, packets may be routed out of order and across a variety of paths to get to the desired end point.

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.

A control packet will include a *packet type* field that identifies its control function, together with additional control information related to that function. The *call request* packet, for example, includes the following additions fields:

- *Calling DTE address length* - a 4-bit field that specifies the length of the calling DTE's address
- *Called DTE address length* - a 4-bit field that specifies the length of the called DTE's address
- *DTE addresses* - the calling and called DTE addresses (variable)
- *Facility length* - length of the facility field in bytes
- *Facilities* - a sequence of facility specifications, each consisting of an 8-bit facility code and zero or more parameter codes

Differences between circuit switching and packet switching:

Circuit Switching	Packet Switching
Circuit switching is scheme in which the network sets up a circuit between nodes and terminals before the communication starts.	Packet switching is a network communication method in which the data get transmitted in blocks, regardless of type and content, called packets.
Required dedicated transmission path	No dedicated path required
The system decides on which route to follow, based on a resource-	Each packet has to find its own route to the destination, determined using

optimizing algorithm, and transmission goes according to the path.	the source and destination address
Messages are not stored	Packets may be stored until delivered to destination
The route is dedicated and exclusive	There is no dedicated route. Each packet travels independent of each other.
Fixed bandwidth use	Dynamic use of bandwidth
No overhead bits after call setup	Overhead bits in each packet
Once connection is established, communication is fast and less error free	The packet needs to be re-transmitted every time when it gets lost, damaged before it is received in this method
Guaranteed the full bandwidth for the duration of the call. Inefficient.	Efficient, as the whole bandwidth is not reserved.
Guaranteed Quality of Service	
More suitable for voice	More suitable for data
Expensive to implement and expand	Cheaper to implement and expand

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 is not 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 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 are many ways to get from one computer to another, and 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 instance. A machine called a 'router' works out 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 through many countries.

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

LITERATURE REVIEW

In large networks there might be multiple paths linking sender and receiver. Information may be switched as it travels through various communication channels

Elena (2002), Optical packet networks are networks, where the switching operations are performed optically, and the data remain in the optical domain through transmission. There have already been several implementations of optical packet switching in a laboratory environment, but commercial solutions are not expected within the few next years. This is due to the infancy of optical devices.

In Packet Switching, Packets are fundamental units of information transported in all modern computer networks, and increasingly in other communications networks as well. Each packet, whether of a fixed or variable size depending on

the protocol, consists of a *header*, body (also called a *payload*) and a *trailer*. The body contains a segment of the message being transmitted.

Fragouli (2008), The header contains a set of instructions related to the packet's data, consisting of the sender's IP address, the intended receiver's IP address, the number of packets into which the message has been divided, the identification number of the particular packet, the protocol (on networks that carry multiple types of information, such as the Internet), packet length (on networks that have variable length packets) and synchronization (several bits that help the packet match up to the network).

3.0 Research question

- What is packet switching
- What is the idea behind it?
- How does packet switching work?
- How do the packets get through the network?
- What happens when the packets arrive?
- What happens to lost packets?

The idea behind packet switching

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.

How 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 is not 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.

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How 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 are several ways computers could communicate in networks, 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 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 packet fails 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. 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.

AIM OF THE STUDY

- To understand the principles of transferring messages from one device to another
- To understand control of data in a network
- To understand the idea behind some text missing in sms messages

EXPECTED RESULT

A system had to be developed to deal with this because eventually the network would choke with these 'lost' packets. 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 has not arrived at its destination within the number of ‘hops’ allowed then it is deleted by the next router.

CONCLUSION

This method has worked properly 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 and 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 possible.

So this is where 'packet switching' becomes important.

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