
EEG453 Multimedia systems

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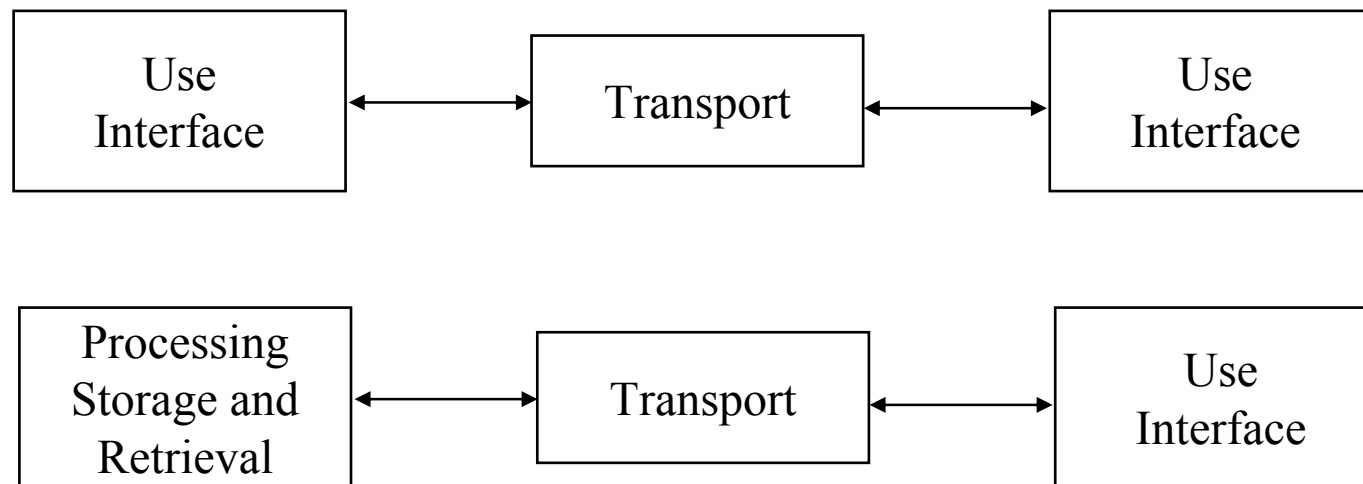
Lecture # (3)

Introduction to Multimedia

Communication networks

Elements of Multimedia Systems

- Two key communication modes
 - Person-to-person
 - Person-to-machine



The application involve either

1. person-to-person communications

In general, two people communicate with each other through suitable **terminal equipment (TE)**

2. person-to-system communications.

while a person interacts with a system using either a multimedia **personal computer (PC) or workstation**. Typically, these are located either in the home or on a desktop in an office and the system is a server containing a collection of files or documents each comprising digitized text, images, audio, and video information either singly or integrated together in some way.

Alternatively, the server may contain a library of digitized movies/videos and the user interacts with the server by means of a suitable selection device that is connected to the **set-top box (STB) associated with a television**.

*** Multimedia networks***

There are five basic types of multimedia communication services:

- 1. Telephone networks,**
 - 2. Data networks,**
 - 3. Broadcast television networks,**
 - 4. Integrated services digital networks, (ISDN)**
 - 5. Broadband multiservice networks (ATM).**
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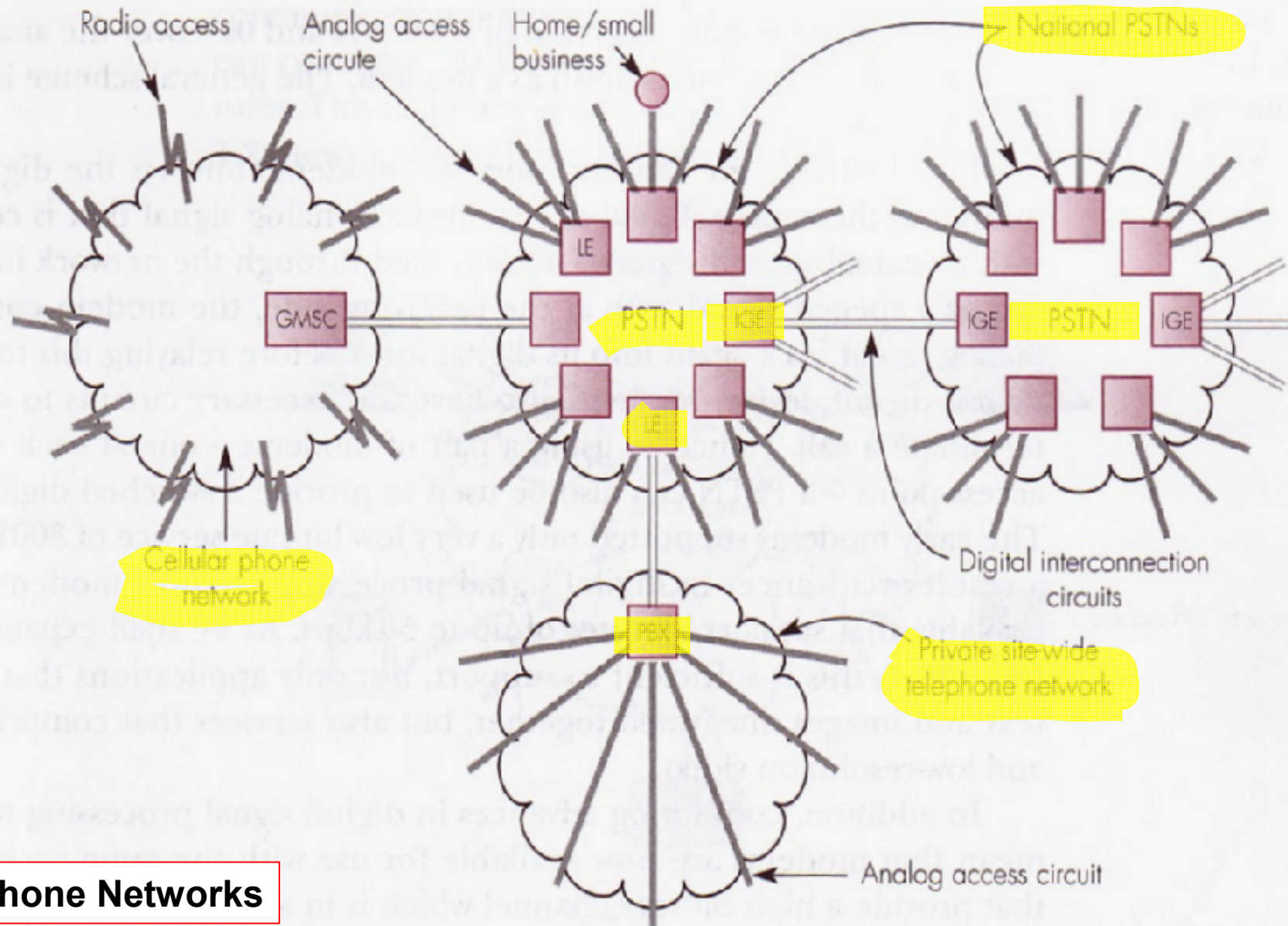
1. Public switched telephone networks (PSTNs)

- PSTNs have been in existence for many years and have gone through many changes during this time.
 - They were designed to provide a basic switched telephone service which, with the advent of the other network types, has become known as a **Plain Old Telephone Service (POTS)**.
 - The term “**switched**” is used to indicate that a subscriber can make a call to any other telephone that is connected to the total network.
 - Initially, such networks spanned just a single country but later the telephone networks of different countries were interconnected so that they now provide an international switched service. Shown in Figure 1.1(a).
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- As we can see, telephones located in the home or in a small business are connected directly to their nearest **local exchange/end office**.
 - Those located in a medium or large office/site are connected to a **private switching office** known as a **private branch exchange** or **(PBX)**. The PBX provides a (free) switched service between any two telephones that are connected to it. (Ex. UOB).
 - In addition, the PBX is connected to its nearest local (public) exchange which enables the telephones that are connected to the PBX also to make calls through a PSTN.
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- More recently, **cellular phone networks** have been introduced which provide a similar service to mobile subscribers by means of handsets that are linked to the cellular phone network infrastructure by radio. The switches used in a cellular phone network are known as **mobile switching centers (MSCs)** and these, like a PBX, are also connected to a switching office in a PSTN which enables both sets of subscribers to make calls to one another.
 - Finally, international calls are routed to and switched by international gateway exchanges (**ICEs**).
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(a)



Telephone Networks

PSTN = public switched telephone network
GMSC = gateway mobile switching center
IGE = international gateway exchange

LE = local exchange/end office
PBX = private branch exchange

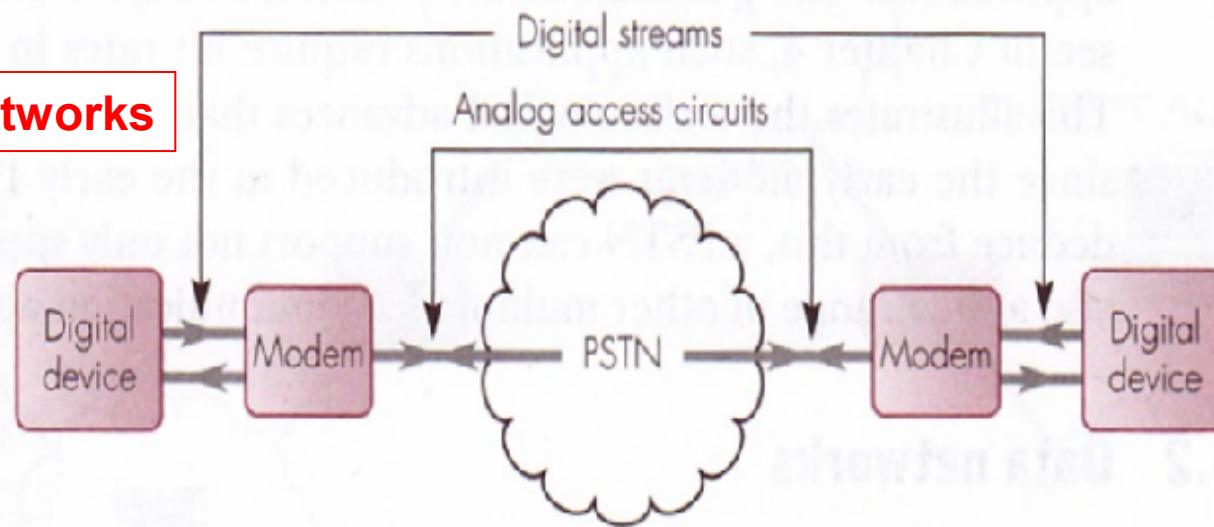
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- The access circuits that link the telephone handsets to a PSTN or PBX were designed, therefore, to carry the **two-way analog signals** associated with a call. Hence, although within a PSTN all the switches and the transmission circuits that interconnect them now operate in a digital mode.
 - to carry a digital signal — a stream of binary 1s and 0s — over the analog access circuits requires a device known as a **modem**. The general scheme is shown in Figure 1.1(b).
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Modem

- Essentially, at the **sending side**, the modem converts the digital signal output by the source digital device into an analog signal that is compatible with a normal speech signal.
- at the **receiving side**, the modem converts the analog signal back again into its digital form before relaying this to the destination digital device.
- The early modems supported only a very low bit rate service of 300 bps but, as a result of advances in digital signal processing circuits, modems are now available that support bit rates of up to 56kbps.
- modems are now available for use with the same access circuits that provide a high bit rate channel which is in addition to the speech channel used for telephony.

(b)

Telephone Networks



(c)

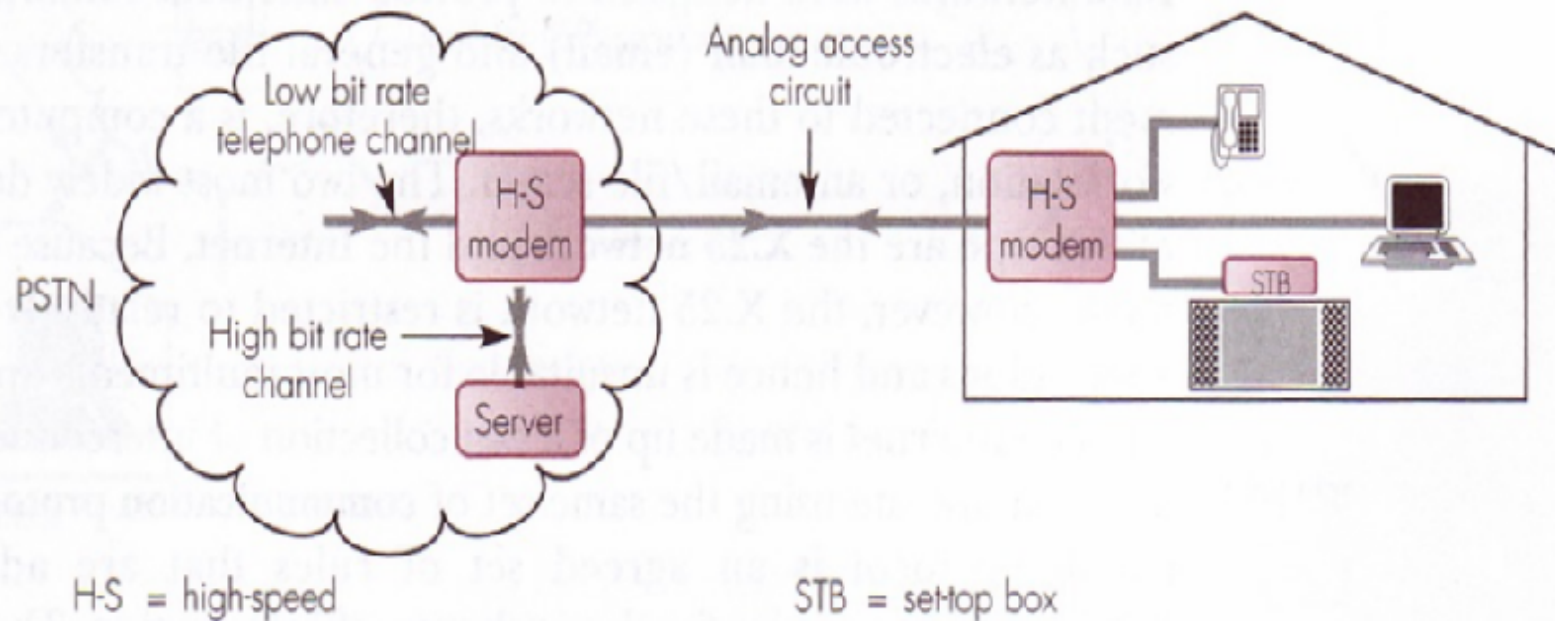


Figure 1.1 Telephone networks: (a) network components; (b) digital transmission using modems; (c) multiple services via an H-S modem.

2. Data networks

- Data networks were designed to provide basic data communication services such as electronic mail (email) and general file transfers. The user equipment connected to these networks, therefore, is a computer such as a **PC**, a **workstation**, or an **email/file server**.
 - The two most widely deployed networks of this type are the **X.25 network** (low bit rate data applications, unsuitable for most multimedia applications) and **the Internet**. (made up of a vast collection of interconnected networks all of which operate using the same set of communication protocols).
 - all the computers that are connected to the Internet can communicate freely with each other irrespective of their type or manufacturer. This is also the origin of the term “**open systems interconnection**”.
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- As we can see, in the case of a user at home or in a small business, access to the Internet is through an intermediate Internet service provider (ISP) network. either through a PSTN with modems or through an integrated services digital network (ISDN)
 - Alternatively, business users obtain access either through a site/campus network if the business comprises only a single site or, if it comprises multiple sites, through an enterprise-wide private network. The same approach is used by most colleges and universities. In the case of a single site/campus, the network is known as a (private) local area network or LAN.
 - For an enterprise-wide network comprising multiple sites the sites are interconnected together using an inter-site backbone network to provide a set of enterprise-wide communication services.
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- The enterprise network is then known as an intranet since all internal services are provided using the same set of communication protocols as those defined for the Internet.
 - The different types of network are all connected to the Internet backbone network through a gateway which, because it is responsible for routing and relaying all messages to and from the connected network, is also known as a router.
 - All data networks operate in what is called a packet mode. Essentially, a packet is a container for a block of data and, at its head, is the address of the intended recipient computer which is used to route the packet through the network.
 - packets are used because the format of the data associated with data applications is normally in the form of discrete blocks of text or binary data with varying time intervals between each block.
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Data networks

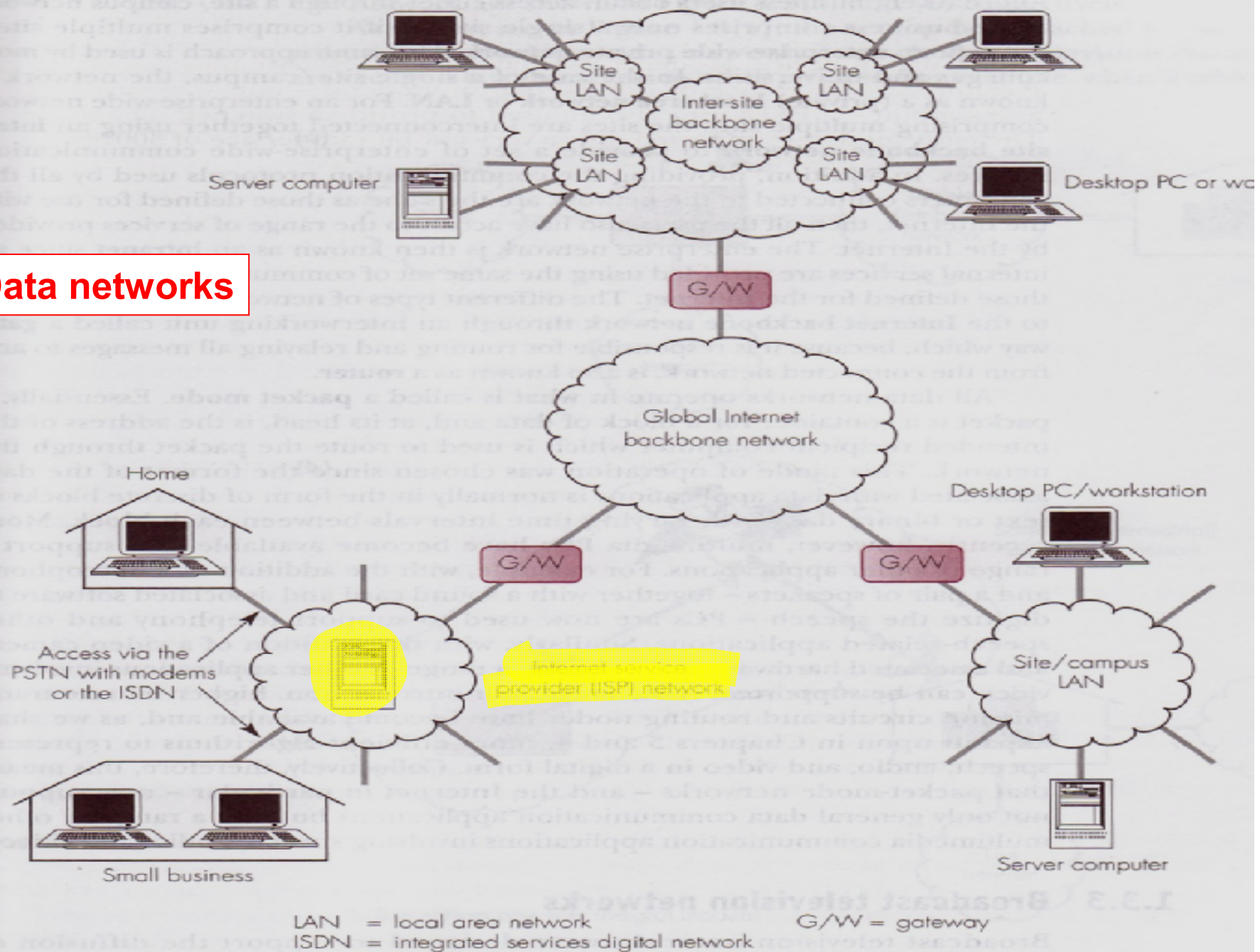
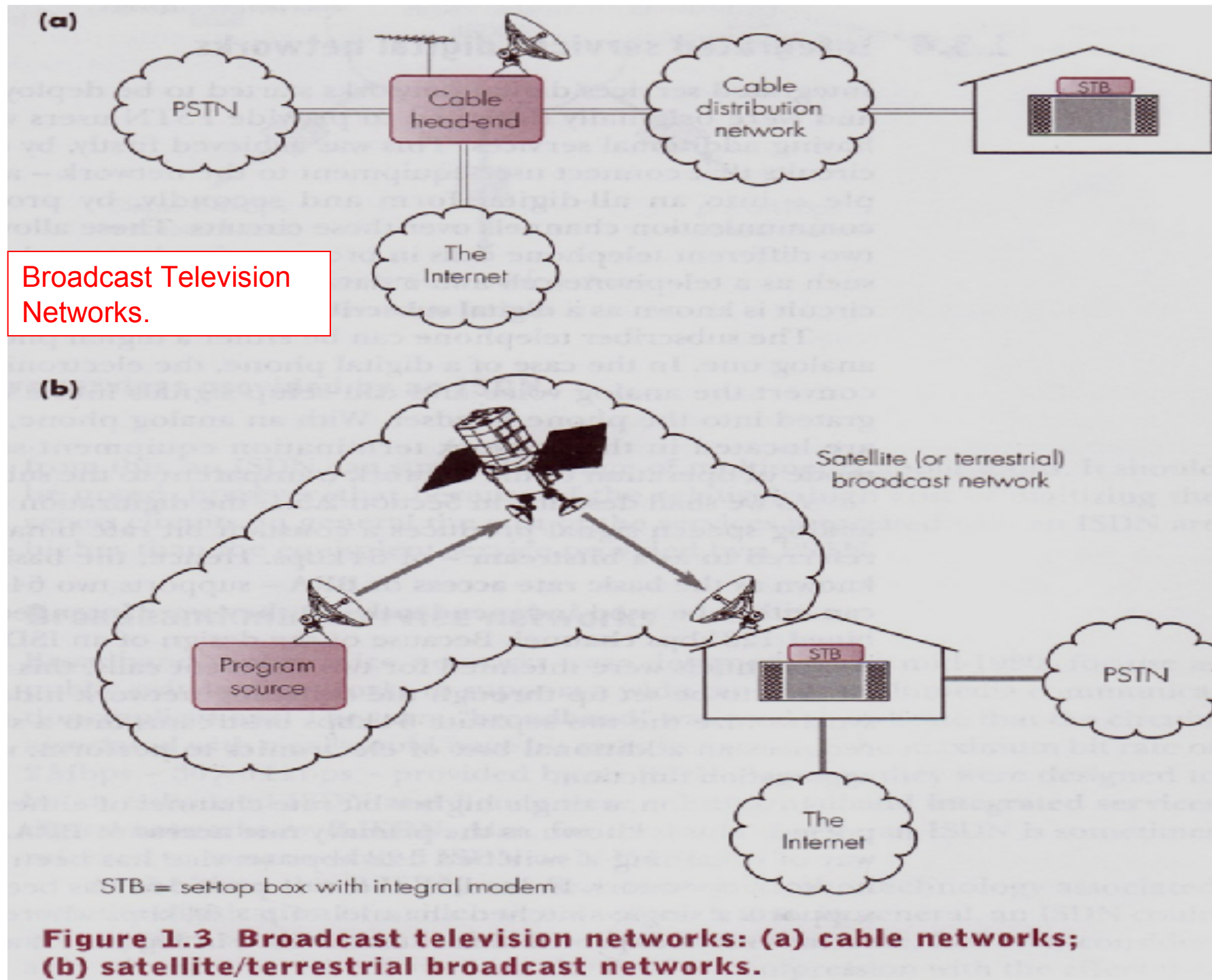
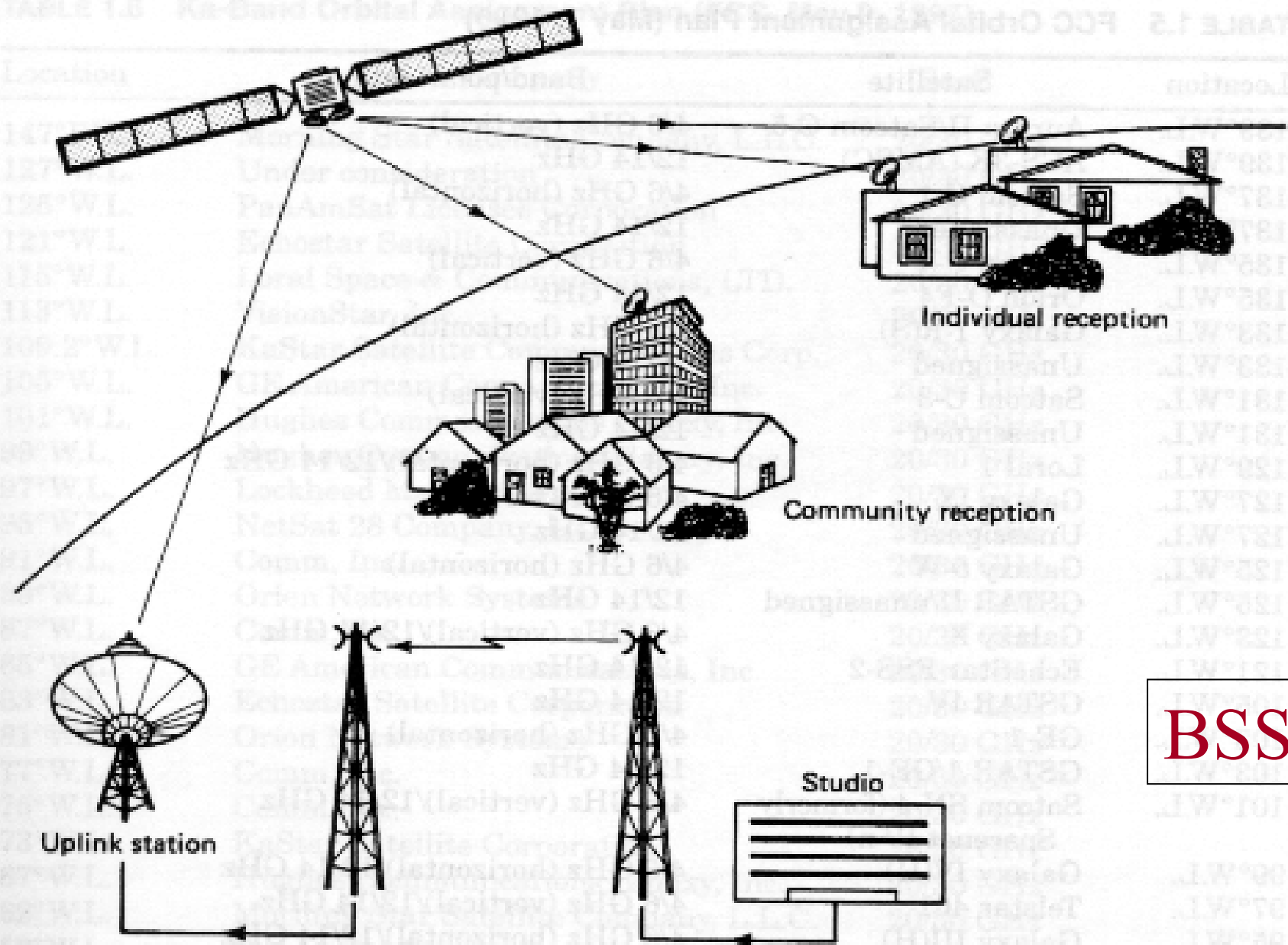


Figure 1.2 A selection of the network types connected to the Internet.

3. Broadcast television networks

- Broadcast television networks were designed to support the diffusion of analog television (and radio) programs throughout wide geographical areas.
 - In the case of a large town or city, the broadcast medium is normally a cable distribution network while for larger areas, a satellite network.
 - when a cable modem is integrated into the STB this provides both the low bit rate channel is used to connect the subscriber to a PSTN and the high bit rate channel to connect the subscriber to the Internet.
 - Hence it provides access to the range of multimedia communication services with both a PSTN and the Internet. Besides, basic broadcast radio and television services. This is the origin of the term **“interactive television”**
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BSS

Figure 1.5 Components of a direct broadcasting satellite system. (From Government of Canada, 1983, with permission.)

By: Dr. Mohab Mangoud

4. Integrated services digital networks

- Started to be deployed in the early 1980s to provide PSTN users with additional services.
 - by providing two separate communication channels over these circuits. These allow users either to have two different telephone calls in progress simultaneously or two different calls such as a telephone call and a data call.
 - With an ISDN, therefore, the access circuit is known as **a digital subscriber line (DSL)**.
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- As shown in the figure, the digitization of a telephone-quality analog speech signal produces a constant bitstream of 64kbps.
 - Hence, the basic DSL of the ISDN — known as the basic rate access (BRA) — supports two 64kbps channels or as a single combined 128kbps channel.
 - In addition, a single higher bit rate channel of either 1.5 or 2Mbps is supported. This is known as the primary rate access (PRA).
 - the service provided has been enhanced and now supports a single switched channel of
 $p \times 64\text{kbps}$ where $p = 1, 2, 3 \dots 30$.
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Integrated Services Digital Networks

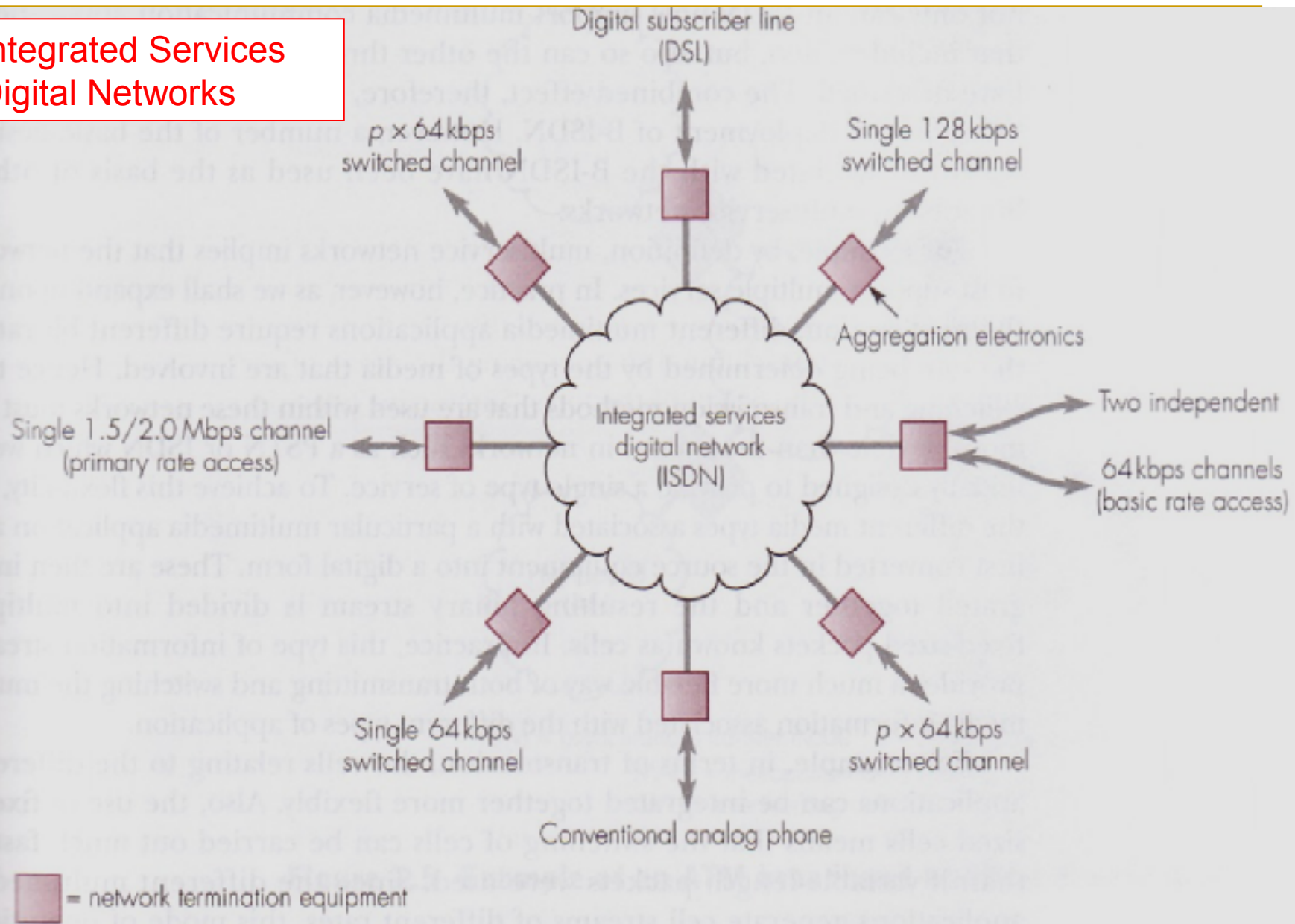


Figure 1.4 Alternative services provided by an ISDN.

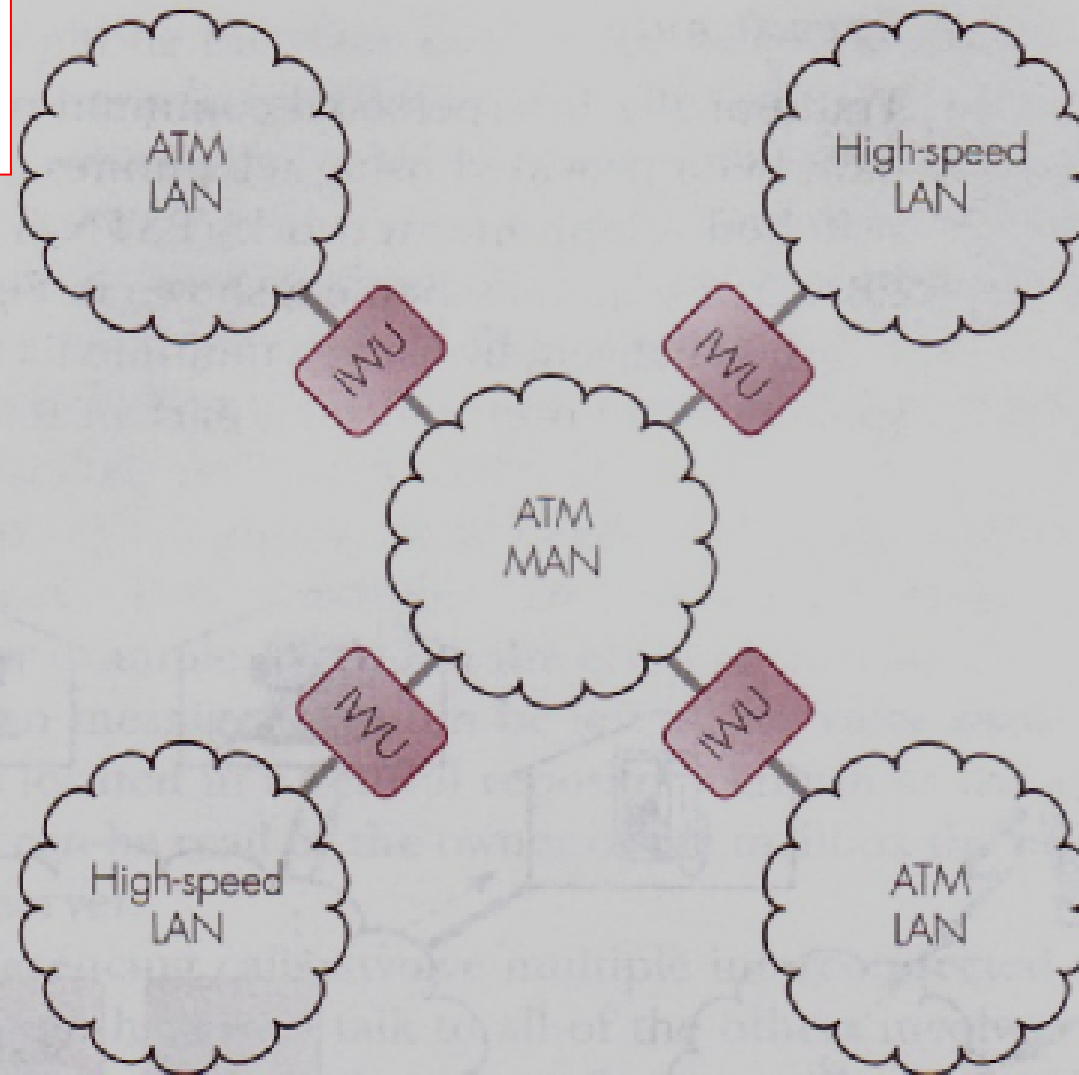
5. Broadband multiservice networks

- Broadband multiservice networks were designed in the mid-1980s for use as public switched networks to support a wide range of multimedia communication applications.
 - The term “**broadband**” was used to indicate that the circuits associated with a call could have bit rates in excess of the maximum bit rate of **2Mbps (30 x 64kbps)** provided by an ISDN.
 - As such, they were designed to be an enhanced ISDN and hence were called broadband integrated services digital networks or **B-ISDN**. Also, for the same reason, an ISDN is sometimes referred to as narrowband TSDN or N-ISDN.
 - At the time the B-ISDN was first conceived, the technology **associated with the digitization of a video signal.**
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- Multiservice networks implies that the network must support multiple services.
 - Different multimedia applications require different bit rates, all the different media types integrated together and the resulting binary stream is divided into multiple fixed-sized packets known as cells.
 - For example, in terms of transmission, the cells relating to the different applications can be integrated together more flexibly.
 - Also, the use of fixed- sized cells means that the switching of cells can be carried out much faster than if variable-length packets were used.
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- that the rate of transfer of cells through the network also varies and hence this mode of transmission is known as the **asynchronous transfer mode (ATM)**.
 - Broadband multiservice networks, also known as **ATM networks** or sometimes **cell-switching networks**.
 - there are ATM local area networks (ATM LANs) that span a single site and ATM metropolitan area networks (ATM MANs) that span a large town or city.
 - the ATM MAN is being used as a high-speed backbone network to interconnect a number of LANs distributed around a large town or city.
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**Broadband
Multiservice
Networks.**



ATM = asynchronous transfer mode LAN = local area network
MAN = metropolitan area network
IWU = interworking unit

Figure 1.5 Example of an ATM broadband multiservice network.