Multimedia Communication

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Abstract: Multimedia communication presents information in an interesting, creative way that helps many different types of learners internalize the data. Info graphics are a common example of multimedia communication. These large images are set up like posters and have text, statistics, graphs, charts and images that provide information. Visual learners who need these graphs, charts and images are able to get just as much from the info graph as learners who focus on numbers who, for instance, hone in on the statistics.

Websites are also prime examples of multimedia communication. Websites can include all of the different types of media to present a single topic or idea, and they are interactive so that the user can easily find the information and navigate the pages. Many informative websites include videos that offer succinct, engaging clips.

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I. Introduction

Multimedia communication is particularly useful in the classroom with students who have grown up with technology and know- how to work it. Students are comfortable with multimedia since the Internet itself is filled with all types of media, and they can find a multimedia type that specifically benefits their communication and learning styles

Types of Multimedia Communication: Through the proliferation of technology in modern-day homes, people communicate in a variety of ways through multimedia. The term "multimedia" itself can take many forms, but it always relates to the way computers present different elements. Multimedia is common on a variety of kinds of websites and if you use a computer, you use multimedia communication daily.

Text Communication

Text communication encompasses a variety of forms and is one of the most common forms of multimedia communication in a computer user's day-to-day activities. Text communication includes such areas of Internet use as reading a website, reading and writing email messages and instant messaging. Text communication is also the oldest form of multimedia communication, as the first computers displayed text only.

Image Communication

Though images might not seem to be a form of communication in the same way that text is a form of communication, it is a legitimate form of multimedia communication that many users enjoy daily. Examples include browsing an online photo album, opening and viewing images attached to an email and looking at photos that accompany stories on news websites.

Audio Communication

A common form of Web-based multimedia communication is audio communication. This form involves receiving a message through an audio format, such as listening to an online radio station or playing a music file. If you use the Internet to stream a radio station broadcast, for example, you are engaging in a form of audio communication. Audio communication often combines with other forms of multimedia communication. A slideshow, for example, can feature text, images and audio together.

Video Communication

As its name indicates, video communication is a form of multimedia communication through video. It is common on many websites, including YouTube and the websites of television stations. Since high-speed Internet has become common, video communication has increased as users are able to access this form of multimedia communication. Types of video communication include .AVI, MPEG, WMV and QuickTime files.

Fig1.video communication

II. Literature Survey

Media types:

1.The information flow associated with the different applications can be either continuous or block mode.

2. In the case of continuous media:

Mode of operation : streaming : The information stream is generated by the source continuously in a timely-dependent way and played out directly as it is received at the destination. e.g. audio, video The continuous media is called real-time media as it's generated in a time-dependent way. The source stream can be generated at a constant bit rate (CBR) or a variable bit rate (VBR).

3. In the case of block-mode media: • Mode of operation: downloading • The source information comprises a single block of information that is created in a time-independent way. • E.g. text, image • The delay between the request being made and the contents of the block being outputted at the destination is called round-trip delay. (should be <few seconds)

Communication Modes

- The transfer of the information streams associated with an application can be 1 of the 5 modes: • Simplex: 1 direction only • Half-duplex: flows in both directions but alternately • Full-duplex: flows in both directions simultaneously (1-to-1 transmission) • Broadcast: 1-to-all transmission • Multicast: 1-to-many transmission
- In duplex communications, if the flows in the 2 directions are equal, the information flow is symmetric. Otherwise, it's asymmetric

Network types:

- There are 2 types of communications channel associated with the various network types: circuit-mode & packet- mode.

Channels in circuit-mode:

- • Operates in a time-dependent way • Also known as a synchronous communications channel since it provides a constant bit rate service.

Channels in packet-mode:

- Operates in a time-varying way • Also known as an asynchronous communications channel since it provides a variable bit rate service.

Circuit-mode:

- This type of network is also known as a circuit-switched network.
- A circuit-mode network comprises an interconnected set of switching offices/exchanges to which the subscribers/computers are connected.
- Prior to sending any information, the source must first set up a connection through the network.
- The bit rate associated with the connection is fixed.
- The messages associated with the setting up and clearing of a connection are known as signaling messages.
- There is a call/connection setup delay.
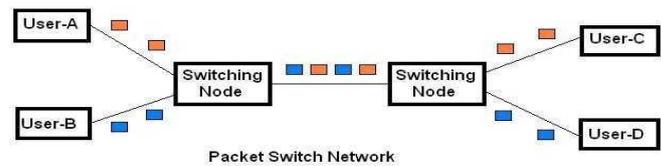
Examples: PSTN and Packet-mode:

fig.2• telephone networks

- 'Switched' means that a subscriber can make a call to any other telephone that is connected to the total network.
- data networks
- It's designed to provide basic data communication services such as email and general file transfer.
- Two most widely deployed networks of this type are the X.25 network and the Internet.
- The X.25 network is restricted to relatively low bit rate data applications only.
- The Internet is made up of a vast collection of interconnected networks all of which operate using the same set of communication protocols.
- Communication protocol • is an agreed set of rules that are adhered to by all communication parties for the exchange of information. • defines (i) the sequence of messages for the exchange of information and (ii) the syntax of these messages.
- A user may access to the Internet through an intermediate Internet service provider (ISP) network
- A network is called intranet if all internal services are provided using the same set of communication protocols.
- Different types of network are connected to the Internet backbone network through an internetworking unit called a gateway.
- A gateway is also known as a router as it is responsible for routing and relaying all messages to and from the connected networks.
- All data networks operate in packet mode.
- A packet is a container for a block of data and the information for routing the packet to the destination through the network.
- This mode is 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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  Broadcast television networks

System

- Broadband multiservice networks
- Designed in mid-80s for use as public switched networks to support a wide range of multimedia communication applications.
- "Broadband" means it can support a bit rate higher than that an ISDN can support (>2Mbps).
- This type of network is also known as broadband ISDN (B-ISDN) while ISDN is known as narrowband ISDN (N-ISDN).
- Switching and transmission methods that are used in these networks must be more flexible as they are designed to support multiple services.
- All media types are converted into digital form and integrated together, and the resulting stream is divided into fixed-sized packets known as cells.
- Switching fixed-sized cells can be carried out much faster than switching variable-length packets.
- Different multimedia applications generate cell streams of different rates and hence the rate of transfer of cells through the network varies. This mode of transmission is known as asynchronous transfer mode (ATM).
- This type of network is also known as ATM network or cell-switching network
- There are 2 types of packet-mode networks: connection-oriented (CO) and connectionless (CL)
- This type of network is also known as a packet-switched network.
- A connection-oriented network: • A connection-oriented network comprises an interconnected set of packet-switching exchanges (PSEs). • Prior to sending any information, a connection is first set up through the network. • The connection utilizes only a variable portion of the bandwidth of each link and hence it's known as a virtual connection or a virtual circuit (VC).

- Each PSE has a routing table which defines a packet coming from which input link will be delivered to which output link. • Examples: X.25, ATM network

Connectionless network:

- The establishment of a connection is not required and the two communicating terminals/computers can communicate and exchange information as and when they wish.
- Each packet must carry the full source and destination addresses in its header in order for each PSE to route the packet onto the appropriate outgoing link.
- The term router is normally used rather than PSE
- Example: Internet
- Basic mode of operation (Common to PS networks):
- When a packet is forwarded to a PSE/router, it's stored in a buffer, checked, discarded if there is any problem (due to congestion or error), or else forwarded to next PSE/router if the outgoing link is available.
- Each PSE/router has a routing table and it's used to determine the outgoing link to which a packet from a particular incoming link should forward.
- This mode of operation is called store-and-forward as a packet has to wait in a PSE/router until the outgoing link is available.
- The service offered by a packet-switched network is said to be a best-effort service as the transmission of a packet is not guaranteed to be successful.
- Mean packet transfer delay: The mean of overall transfer delay of a packet across the network
- Delay variation or jitter : the variation about the mean packet transfer delay
- Multipoint conferencing
- It's implemented in one of the 2 ways: centralized and decentralized.
- The centralized mode is used with circuit-switched networks such as a PSTN or an ISDN.
- The decentralized mode is used with packet-switched networks which support multicast communications. (e.g. LAN, intranet and the Internet)
- A third mode known as the hybrid mode can be used.
- Network QoS
- the network Quality of Service (QoS) parameters • are the operational parameters associated with a communications channel through a network, and • collectively determine the suitability of the channel in relation to its use for a particular application.

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- Circuit-switched network: (CBR network)
- The QoS associated with a CBR channel that is set up through a circuit-switched network include: • The bit rate • The mean bit error rate • The transmission delay
- The mean bit error rate (BER) of a channel is the probability of a bit being corrupted during its transmission across the channel in a defined time interval.
- Issue of the block size: • In practice, most networks provide an unreliable service (best-effort service). • Information is partitioned into blocks during its transmission so as to minimize the propagation of error. • Any blocks containing bit errors will be discarded. • A reliable service can be offered by using error detection and block retransmission, which results in high transmission overheads and additional delay. • The choice of the block size is a compromise between the delay and the overhead in this case.
- The transmission delay associated with a channel is determined by the bit rate, the codec delay and the propagation delay.
- The propagation delay is determined by (i) the physical separation of the 2 communicating devices and (ii) the velocity of propagation of a signal across the transmission medium
- Packet-switched network
- The QoS parameters associated with a packet-switched network include: • The maximum packet size • The mean packet transfer rate • The mean packet error rate • The mean packet transfer delay • The worst-case jitter • The transmission dela
- Mean packet transfer rate is a measure of the average number of packets that are transferred across the network per second
- Mean bit rate of the channel = mean packet transfer rate x mean packet size
- Mean packet error rate (PER) is the probability of a received packet containing bit errors.
- Mean packet transfer delay is the summation of the store-and-forward delay that a packet experiences when it travels along the route.
- The transmission delay • includes the codec delay and the signal propagation delay • is the same whether the network operates in a packet mode or a circuit mod

When packet-switched network is used:

- A technique known as buffering is used to overcome the effect of jitter in a packet-switched network.
- The effect of jitter is overcome by retaining a defined number of packets in a memory buffer at the destination before playout of the information bitstrem is started.
- Buffering delay plus the time for playing a packet must
- A network is called intranet if all internal services are provided using the same set of communication protocols.
- Different types of network are connected to the Internet backbone network through an internetworking unit called a gateway.
- A gateway is also known as a router as it is responsible for routing and relaying all messages to and from the connected networks.
- All data networks operate in packet mode.
- A packet is a container for a block of data and the information for routing the packet to the destination through the network.
- This mode is 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. Broadcast television networks:
- designed to support the diffusion of analog television (and radio) programs throughout wide geographical areas.
- Broadcast media include • Cable distribution network : for a town or city • Satellite network : for larger areas • Terrestrial broadcast network : for larger areas
- The traffic is 1-way or asymmetric.
- It generally works with a low bit rate return channel offered by a cable network for interaction purposes to provide a range of additional services such as home shopping and games playing.
- The subscriber accesses the cable distribution network through a set-top box.

Integrated services digital networks

- Designed to provide PSTN users with the capability of having additional services.
- This was achieved by (i) converting the access circuits that connect user equipment to the network into an all-digital form, and (ii) providing 2 separate communication channels over these circuits.
- This all-digital access circuit is known as a digital subscriber line (DSL)
- The digitization of a toll-quality analog speech produces a constant bit rate bitstream of 64kbps. (64kbps is hence used as a basic unit.)
- Options of service: • Basic rate access(BRA) : supports 2 independent 64kbps channels or 1 128kbps channel (with an aggregation unit to synchronize 2 64kbps channels) • Primary rate

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access (PRA) : supports 1 1.5/2.0Mbps channel • It can also support a single switched channel of px64kbps, where p=1,2...30.

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 Multimedia application

CategoryMediaApplication descriptions

SpeechTelephony, voice-mail, teleconferencing

ImageFacsimile

TextElectronic mail

Text and imagesComputer-supported cooperative working

Speech and videoVideo telephoney, video mail, videoconferencing

Interpersonal communications

Text, image, audio and video

Multimedia electronic mail, multiparty video games etc.

Interactive applications over the Internet

Text, image, audio and video

Information retrievaal (news, weather, books, magazines, video games, product literature etc.)

Electronic commerce

Audio/CD-on-demand

Movie/video-on-demand

Analog and digital television broadcasts

Entertainment services

Text, image, audio and video

Interactive television

 Application and network terminology

Media types

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III. Conclusions

• Circuit-switched network: (CBR network)

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• Issue of the block size: • In practice, most networks provide an unreliable service (best-effort service). • Information is partitioned into blocks during its transmission so as to minimize the propagation of error. • Any blocks containing bit errors will be discarded. • A reliable service can be offered by using error detection and block retransmission, which results in high transmission overheads and additional delay. • The choice of the block size is a compromise between the delay and the overhead in this case.

• The transmission delay associated with a channel is determined by the bit rate, the codec delay and the propagation delay.

• The propagation delay is determined by (i) the physical separation of the 2 communicating devices and (ii) the velocity of propagation of a signal across the transmission medium.

Application and network terminology

• We review some of the terminology used in relation to the different media types and • the terminology and operational characteristics of the different type of communication channels provided by different networks.

Media types

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Multimedia System

Digital Video •Composed of a series of still image frames and produces the illusion of movement by quickly displaying one frame after another. •The Human Visual System (HVS) accepts anything more than 20 frames per second (fps) as smooth motion. •The challenges are the massive volume of data involved and the needs to meet real time constraints on retrieval, delivery and display. •A digitized video comprises both images and audio and need to be synchronize in time. •The solution is to reduce the image size, use high compression ratios; eliminates spatial and coloursimilarities of individual images and temporal redundancies between adjacent video frames.

Colour Model •A system for representing colours is called a colour model. •Colour models are usually designed to take advantage of a particular type of display device •The range of colours that can be represented by a colour model is known as a colourspace. •The RGBcolour model is used in computer system because of the CRT colour monitor. •8-bit resolution per pixel is used which corresponding to 256 different shades of each primary colour. •In telecommunication engineering, YUV(YCBCR)is used. •Y is luminance which represent the brightness of the image and CBCRare chromEnabling Technologies for Multimedia Communication •High speed digital network ŠE.g. optical backbone for network to network service and Ethernet / Digital Subscriber Line (DSL) / Cable broadband services to the public in Hong Kong •Video compression ŠAlgorithms like MPEG 2 and MPEG 4 are available for high and low bit rate applications •Data security ŠEncryption and authentication technologies are available to protect users against eavesdropping and alternation of data on communication lines. •Intelligent agents ŠSoftware programs to perform sophisticated tasks such as seek, manage and retrieve information on the network

Multimedia Application -Speech Interpersonal communications involving speech –telephony –a real time application. People using telephones that connected either to a PBX, PSTN, ISDN or cellular phone network. A wide installation base and highly demanded service area. Using a multimedia PC equipped with a microphone and speakers, the user can take part in telephone calls through

the PC. This is known as computer telephony integration (CTI) This requires a modem / telephone interface and associated software for connecting to switching network. For the public or private packet networks that supports voice services, they are known as voice over IP (VoIP) service; teleconferencing calls is one of the applications.

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Application -PC Fax PC fax is use a PC instead PC instead of a normal fax machine tosend an electronic version of a document that is stored directly within the PC's memory. As with telephony, this requires a telephone interface card and associated software. Email to fax gateway (free international fax):-http://www.tpc.int/

> Workstation
>
> Workstation Workstation
>
> Analog or digital access circuits
>
> Fax machine
>
> Fax   Fax
>
> Internet
>
> Multimedia System 030728.ppt30
>
> Multimedia Application –Speech
>
> Multimedia Application

Tele-conferencing callsor an audio-conferencingcallsinvolve multiple interconnected telephones /PCs. Each person can hear and talk to all of others involved in the calls. It required a central unit known as an audio bridgewhich provide the support to set up a conferencing calls automatically. Teleconferencing Voice over IP (VoIP) Internet was designed to support computer-to-computer communications –delay is not a concern. The industry is developing the application of packet network to carry voice / speech Multimedia Applications GIS Geographic information systems (GIS)refer to those computer systemsthat are being used in scientific investigations, analysis, management, development and planning of geographically data and resources.

Multimedia application in GIS allows the user to visualize and interact with scientific data more effectively.

GIS is similar to CAD except a continuous and large data set, heterogeneous, GIS geometry is primarily obtained by remote sensing or surveying, lines of fractal nature like the coastlines where delay and equipment cost is a major problem.

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