

MULTIMEDIA

Unit 1

1.1 Introduction

- Any kind of system that supports more than **one kind of media**
- Multimedia means integration of **continuous media** (e.g. audio, video) and **discrete media** (e.g. text graphics , images) through which digital information can be conveyed to the user in appropriate way.
 - **Multi** - many; much; multiple
 - **Medium** - a interleaving substance through which something is transmitted or carried on
- Classification based on perception (text, audio, video) is appropriate for defining multimedia

1.1 Introduction..

- **Multimedia** is defined as the **computer based** interactive environment that incorporates text, images, graphics, sound, audio, animation, video and virtual reality (VR).

1.1 Introduction..

Time always takes separate dimension in the media representation

- Based on **time-dimension** in the representation space, media can be
 - Time-independent (***Discrete***)
 - Text, Graphics
 - Time dependent (***Continuous***)
 - Audio, Video
 - Video, sequence of frames (images) presented to the user *periodically*.
 - Time dependent a periodic media is not continuous!!
- Discrete & Continuous here has no connection with internal representation!! (Relates to the viewers impression...)

1.1 Introduction..

- Multimedia is ***any*** combination of ***digitally manipulated*** text, art, sound, animation and video.
- A more strict version of the definition of multimedia do not allow just any combination of media.
 - It requires
 - Both continuous & discrete media to be utilized
 - Significant level of independence between media being used

1.1 Introduction..

- **Multimedia** is interactive when the end-user is allowed to control what and when the elements are delivered.
- Interactive Multimedia is Hypermedia, when the end-user is provided with the structure of linked elements through which he/she can navigate.

1.1 Introduction..

- **Multimedia** is ***linear***, when it is not interactive and the users just sit and watch as if it is a movie.
- **Multimedia** is ***nonlinear***, when the users are given the navigational control and can browse the contents at will.

1.2. The Medium Aspect

1.5 Media Combination and Independence

- **Multimedia System:** one way of defining multimedia can be found in the meaning of composed world multi-many, much multiple.
- **Medium:** An intervening substance through which something is transmitted or carried on.
- **Computer System medium:**
 1. Text
 2. Image
 3. Sound
 4. Video

1.2. The Medium Aspect

1.5 Media Combination and Independence....

Medium is defined as means for distribution and presentation of information.

Examples of a medium are text, graphics, speech, and music. Media can be classified with respect to different criteria.

We classify media according to perception, representation, presentation, storage, transmission, and information exchange.

1.2. The Medium Aspect

1.5 Media Combination and Independence....

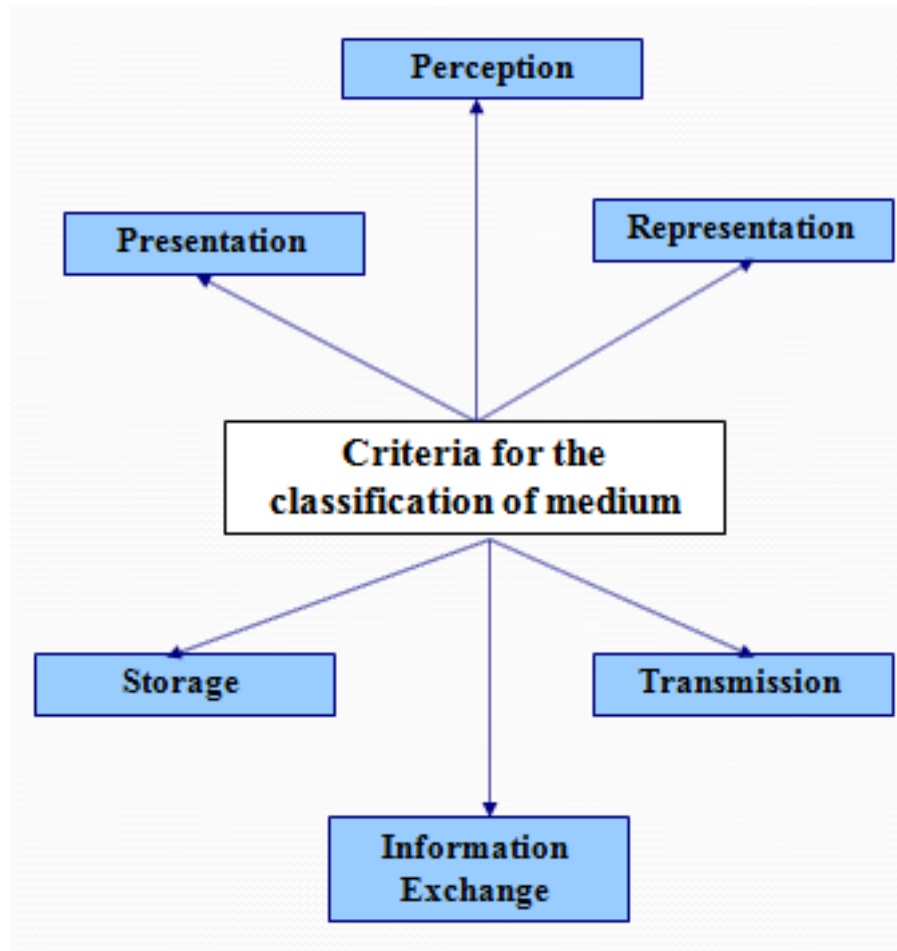


fig : Classification of Medium/Media

1.2. The Medium Aspect

1.5 Media Combination and Independence....

Classification of Media :

1. The perception media
2. The representation Media
3. The presentation Media
4. The storage media
5. The transmission media
6. The information Exchange media

1.2. The Medium Aspect

1.5 Media Combination and Independence....

Classification of Media :

1. The perception media

Perception media help human to sense their environment. The central question is how human perceive information in a computer environment. The answer is through **seeing** and **hearing**.

- **Seeing**: For the perception of information through seeing the usual such as text, image and video are used
- **Hearing**: For the perception of information through hearing media such as music, noise and speech are used.

1.2. The Medium Aspect

1.5 Media Combination and Independence....

Classification of Media :

2. The representation Media

Representation media are defined by internal computer representation of information. The central question is ***how the computer information is coded?*** The answer is that ***various format are used to represent media information*** in computer.

- Text, character is coded in ASCII code
- Graphics are coded according to CEPT (Conference of European Postal and Telecommunications Administration) or CAPTAIN (Character and Pattern Telephone Access Information Networks) video text standard.
- Image can be coded as JPEG format
- Audio video sequence can be coded in different TV standard format (PAL, NTSC, SECAM and stored in the computer in MPEG format)

1.2. The Medium Aspect

1.5 Media Combination and Independence....

Classification of Media :

3. The Presentation Media

Presentation media refer to the tools and devices for the input and output of the information. The central question is, through ***which the information is delivered by the computer and is introduced to the computer.***

- **Output media:** Paper, screen and speaker are the output media.
- **Input Media:** Keyboard, mouse, camera, microphone are the input media.
- **Digital Media:** Soft copy presentation.
- **Paper Media:** Hard copy presentation.

1.2. The Medium Aspect

1.5 Media Combination and Independence....

Classification of Media :

4. The storage media

Storage Media refer to the data carrier which enables storage of information. The central question is, how will information be stored? The answer is hard disk, CD-ROM, etc.

1.2. The Medium Aspect

1.5 Media Combination and Independence....

Classification of Media :

5. The transmission media

Transmission Media are the different information carrier that enables continuous data transmission. The central question is, over which information will be transmitted? ***The answer is co-axial cable, fiber optics as well as free air.***

1.2. The Medium Aspect

1.5 Media Combination and Independence....

Classification of Media :

6. The information Exchange media

Information exchange media includes all information carrier for transmission, i.e. all storage and transmission media. The central question is, ***which information carrier will be used for information exchange between different places?*** The answer is combine uses of storage and transmission media. E.g. Electronic mailing system.

1.3. Main properties of Multimedia

The uses of term multimedia are not every arbitrary combination of media. The main properties of multimedia system are:

- 1. Combination of media*
- 2. Computer support integration*
- 3. Communication systems*
- 4. Independence*

1.3. Main properties of Multimedia..

1. Combination of media

simple text processing program with in corporate image is often called a multimedia application.

Because ***two media are processed through one program***. But one should talk multimedia only when both continuous and discrete media are utilized. So text processing program with incorporated images is not a multimedia application.

1.3. Main properties of Multimedia..

2. Computer support integration

Computer is idle tools for media combinations. The system should be capable of computer-controlled media processing. The system should be programmable by a system programmer or even a user.

3.Communication System

Communication-capable multimedia systems must be approached. A reason for this is that most of today's computers are interconnected; considering multimedia functions from only the local processing viewpoint would be a restriction, if not a step back.

1.3. Main properties of Multimedia..

4. Independence:

An important aspect of different media is their level of independence from each other. In general there is a request for independence of different media but multimedia may requires several level of independence.

E.g. A computer controlled video recorder stores audio and video information's. There is inherently tight connection between two types of media. Both media are coupled together through common storage medium of tape. On the other hand for the purpose of presentation the combination of DAT (digital audio tape recorder) signals and computer available text satisfies the request for media independence.

1.4. Definition of Multimedia

Multimedia- Applications

Multimedia plays major role in following areas

- Instruction (Teaching)
- Business
 - Advertisements
 - Training materials
 - Presentations
 - Customer support services
- Entertainment
 - Interactive Games
- Enabling Technology
 - Accessibility to web based materials
 - Teaching-learning disabled children & adults
- Fine Arts & Humanities
 - Museum tours
 - Art exhibitions
 - Presentations of literature

1.4. Definition of Multimedia

Usages of Multimedia Application:

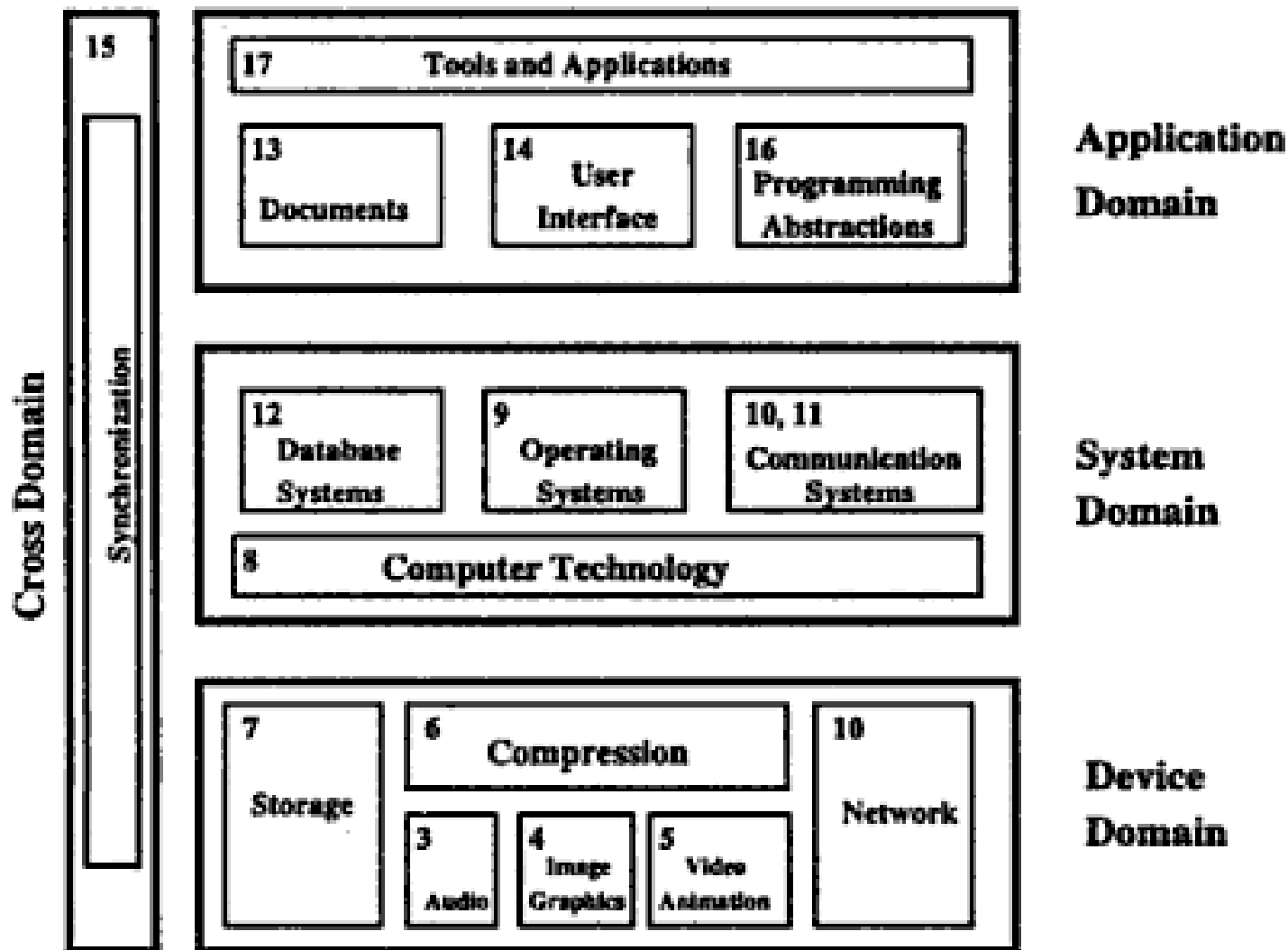
1. Education
2. Training
3. Entertainment
4. Advertisement
5. Presentation
6. Business Communication
7. Web page Design

1.4. Definition of Multimedia

Multimedia Tools:

- Text Editing Tools
- Drawing and Painting Tools
- Image Editing Tools
- Audio Editing Tools
- Video Editing Tools
- Animation and 3D Modeling Tools
- OCR (optical character recognition)Tools
- Voice Recognition Tools

Global Structure of Multimedia System



Global Structure of Multimedia System

1. Device domain
2. System domain
3. Application domain
4. Cross domain

Global Structure of Multimedia System

1. Device domain

It deals with interaction between multimedia application and multimedia devices

such as AGP(Accelerated Graphics Port) Card, Sound Card etc.

Basic concepts for the processing of digital audio and video data are based on digital signal processing. Different methods for the processing of image, graphics and animation are described.

The audio techniques section includes music MIDI (Musical Instrument Digital Interface) and speech processing.

Global Structure of Multimedia System

2. System domain

The interface between the device domain and the system domain is specified by the computer technology.

To utilize the device domain, several system services are needed. Basically, three services exists.

These services are mostly implemented in software. The operating system, serves as an interface between computer hardware/system and all other software components.

It provides the user with a programming and computational environment, which should be easy to operate.

The database system allows a structured access to data and a management of large databases. The communication system is responsible for data transmission according to the timing and reliability requirements of the networked multimedia.

Global Structure of Multimedia System

3. Application domain

Provides functions to the user to develop and present multimedia projects.

This includes software tools, and multimedia projects development methodology.

The services of the system domain are offered to the application domain through proper programming abstractions. Another topic embedded in the application domain is document handling.

Global Structure of Multimedia System

4. Cross domain

It turns out that, some aspects such as ***synchronization aspects***, are difficult to locate in one or two components or domains. The reason is that synchronization, being the temporal relationship among various media, relates to many components across all domains.

1.6. Traditional Data Stream Characteristics

In multimedia communication system data of discrete and continuous media are transmitted and information access takes place.

This transmitted information is divided into small individual unit known as ***packets***.

Packets can carry information of either continuous or discrete media

A sequence of individual packets transmitted in a time dependent fashion is called a *data stream* . The data stream will be used as a synonym ***data flow***.

1.6. Traditional Data Stream Characteristics

Transmission of information carrying different media leads to data stream with very different features.

The attributes of **synchronous**, **asynchronous** and **isochronous** data transmission conforms the field of computer communication and switching. Transmission of the data packets takes place in any of the following transmission modes:

Asynchronous Transmission mode:

Synchronous Transmission mode:

Isochronous Transmission mode:

1.6. Traditional Data Stream Characteristics

Asynchronous Transmission mode:

- The asynchronous transmission mode provides for **communication with no timely restriction (limit)**.
- Packets reach **the receivers as fast as possible**.
- All information of discrete media can be transmitted as asynchronous data stream.
- If an asynchronous mode is chosen for **transmission of continuous media, additional technique must be applied to provide the time restriction**.
- E.g.: Ethernet, protocol of worldwide internet for e-mail transmission.
- **No time bound** (E.g. postal service)
- E.g. mail system.

1.6. Traditional Data Stream Characteristics

Synchronous Transmission mode:

- The synchronous transmission mode defines the ***maximum end to end delay for each packet of the data stream.***
- This upper bound will never be violated. (E.g. Ping operation)
- Moreover, a **packet can reach the receiver at any arbitrary(random) earlier time.** So most of the time the receiver has to hold the packet temporarily
- **A packet has a start frame and the end frame.**
- Start frame is used to tell the receiving station that a new packet of characters is arriving and used to synchronize the receiving station's internal clock.
- The end frame is used to indicate the end of packet.
- For retrieving uncompressed video at data rate 140Mbits/s & maximal end-to-end delay 1 second the receiver should have temporary storage 17.5 Mbytes

1.6. Traditional Data Stream Characteristics

Isochronous Transmission mode:

- **Defines maximum & minimum end-to-end delay**
- This means the delay jitter for individual packet is bounded.
- Isochronous transmission mode **minimizes the overhead of the receiver.**
- Upper time bound + lower time bound **(E.g. TV systems)**
- Data will reach destination in between these upper and lower bound time.
- Less storage buffer at receiver is needed than the synchronous transmission mode.
- Storage requirements at the receiver reduces

1.6. Traditional Data Stream Characteristics

Data stream characteristics for continuous media

Characteristics for continuous media can be classified according to:

Time interval between a complete transmission of consecutive packets

Periodicity

- (a) Strongly Periodic
- (b) Weakly Periodic
- (c) Aperiodic

Variation in amount of consecutive packet amount

- (a) Regular
- (b) Weakly regular
- (c) Irregular

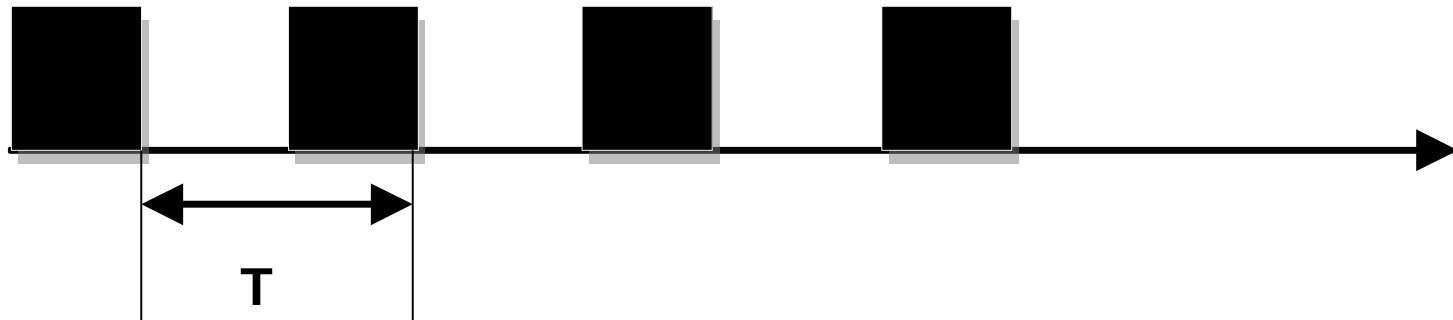
Contiguous packets

- (a) Continuous
- (b) Discrete

1.6. Traditional Data Stream Characteristics

Time interval based characteristics:

(1) Strongly periodic data stream transmission:

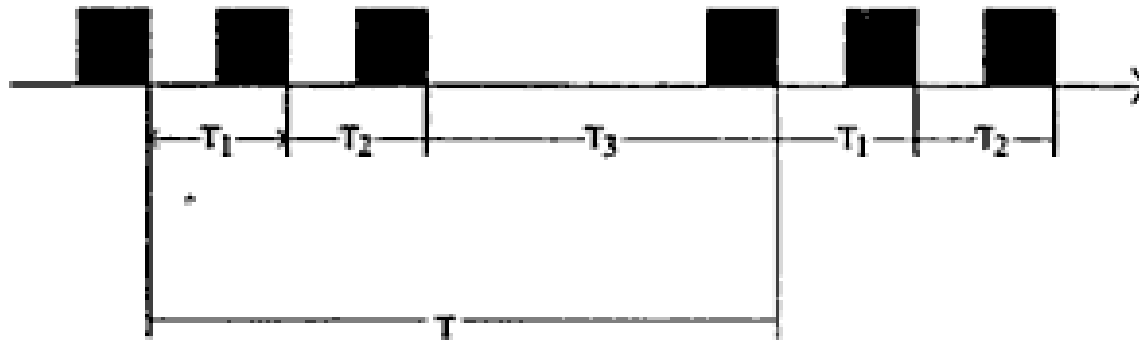


Time interval between two consecutive packets is constant. E.g. PCM-coded speech used in traditional telephone switching systems. It is also called strongly periodic.

1.6. Traditional Data Stream Characteristics

Time interval based characteristics:

(2) Weakly periodic data stream transmission:

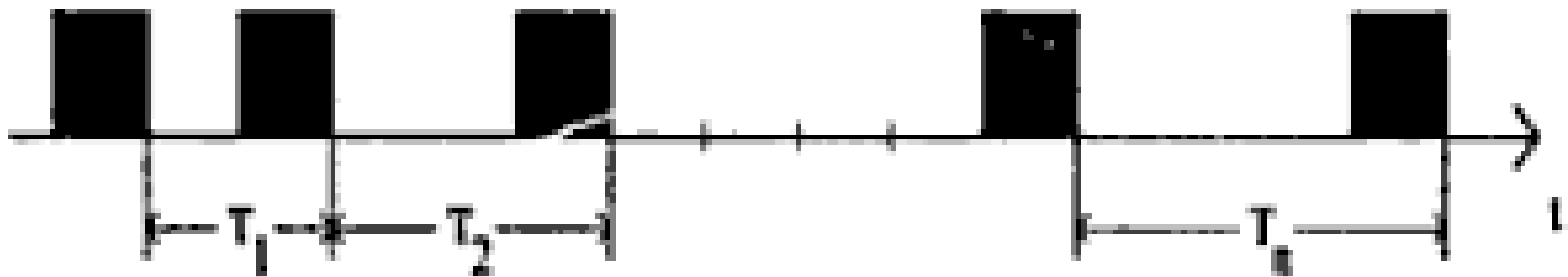


Time interval between the consecutive packets is of periodic nature. Duration of time interval between two consecutive packets can be described by using a periodic function with finite period. But, time interval between two consecutive packets is not constant.

1.6. Traditional Data Stream Characteristics

Time interval based characteristics:

(3) *Aperiodic data stream transmission:*

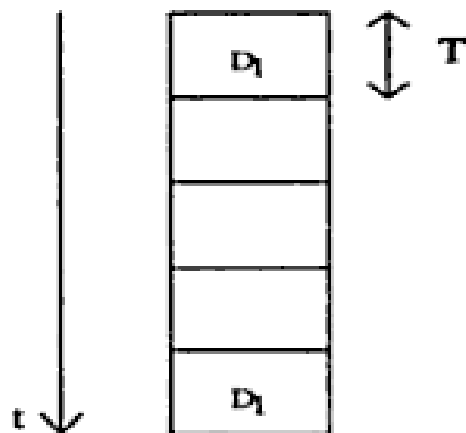


Sequence of the time interval between packets is neither strongly nor weakly periodic. e.g. Cooperative application with shared Window.

1.6. Traditional Data Stream Characteristics

Packet Amount based characteristics:

(1) Strongly regular data stream

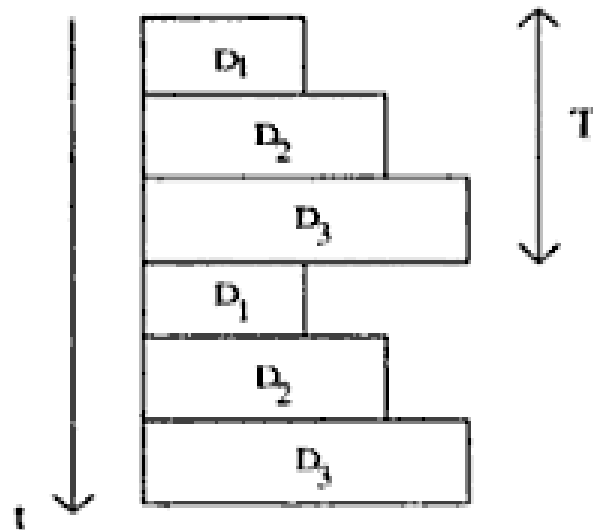


Data size of all the packets is constant. Amount of the data stays constant during the life time of a data stream. E.g. Uncompressed digital data transmission, video stream taken from a camera in uncompressed form, and the audio stream from an audio CD.

1.6. Traditional Data Stream Characteristics

Packet Amount based characteristics:

(2) *Weakly regular data stream:*

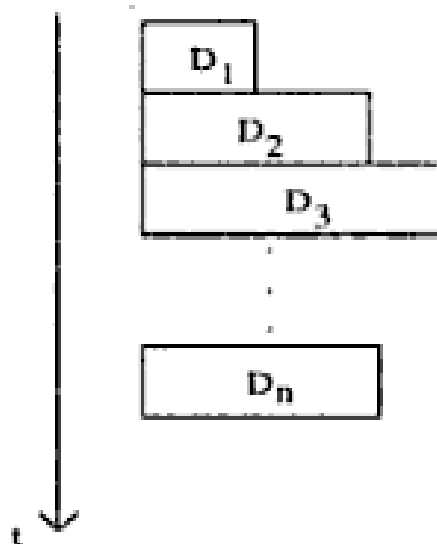


Data size of the packets changes periodically (with time). E.g. compressed video stream

1.6. Traditional Data Stream Characteristics

Packet Amount based characteristics:

(3) Irregular data stream



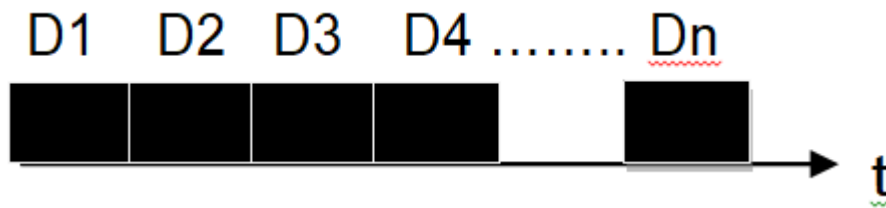
Data size of the packets is neither constant nor changing periodically according to a periodic function. Transmission and processing is more complicated.

1.6. Traditional Data Stream Characteristics

Contiguous packets based characteristics:

It characterizes continuity, or connection between consecutive packets. Is consecutive packets transmitted directly one after another, or is there a gap between the packets.

(1) *Continuous data stream*

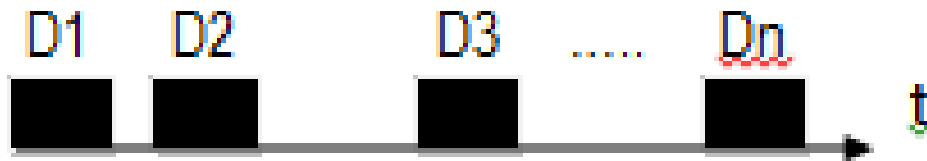


Packets are transmitted without intermediate gaps. Also called connected information transfer. It allows maximum data throughput. E.g. B-channel of ISDN with 64 Kb audio data transmission

1.6. Traditional Data Stream Characteristics

Contiguous packets based characteristics:

(2) *Discrete data stream:*



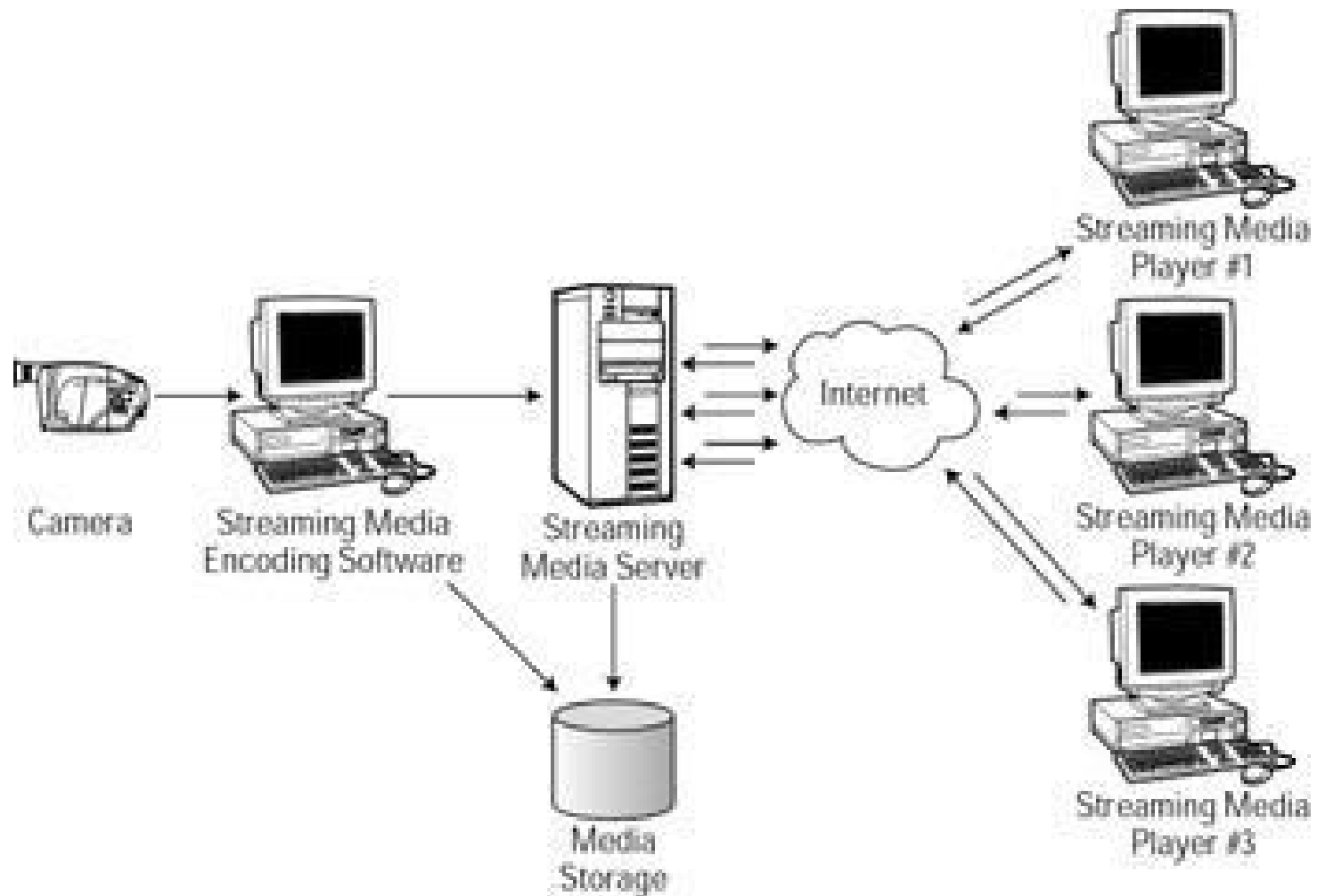
Gap exists among the packets. Also called unconnected data stream. Duration of the gap may vary.

1.6. Traditional Data Stream Characteristics

Streaming Media

- Popular approach to continuous media over the internet
- Playback at users computer is done while the media is being transferred (no waiting till complete download!!!)
- You can find streaming in
 - Internet radio stations
 - Distance learning
 - Cricket Live!!!
 - Movie Trailers

Streaming Media



1.7. Information Units

Continuous media consists of a time dependent sequence of individual information units. Such an information unit is called a LDU (logical data unit). With respect to time there can be Closed LDU and Open LDU.

- *Closed LDU*
 - Predefined duration is present.
 - E.g. data stream characteristics of audio samples in the computer.
- *Open LDU*
 - Duration is not known in advance.
 - E.g. Data stream sent from camera/ microphone to computer.

1.7. Information Units..

The most general names and best-known information units are the symphony and the movie. LDU is the whole symphony, individual sentences, individual notes, grouped samples of $1/75$ second duration or just individual samples.

An example is an uncompressed video sequence consisting of individual video clips which presents a specific scene. Such a scene is comprised of a sequence of image. An image can be divided into group of pixels. Each pixel consist luminance and chrominance values. The image is therefore not the only possible LDU of a video sequence. A scene or a pixel also can be an LDU.

References:

- Multimedia: Computing, Communications and Applications”, Ralf Steinmetz and Klara Nahrstedt, Pearson Education Asia
- “Multimedia Communications, Applications, Networks, protocols and Standards”, Fred Halsall, Pearson Education Asia
- “Multimedia Systems”, John F. Koegel Buford, Pearson Education Asia

Assignments:

1. Define multimedia. Explain the application areas of multimedia. [8 marks/ 2015 fall]
2. What is Multimedia? Explain global structure of multimedia system. [8 marks/ 2014 fall]
3. Define application domain? Explain the different criteria that are used to classify media in the multimedia system. [8 marks/ 2013 fall]
4. Define Multimedia System. Explain properties of Multimedia System. [8 marks/ 2012 fall]
5. Write short notes
 1. Data stream with Transmission mode
 2. Data stream characteristics for continuous media
 3. Information unit