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Multimedia Technology

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Contemporary and Forward Looking

Multimedia Technology

LEARNING UNIT 8

MULTIMEDIA COMMUNICATIONS AND COMPRESSIONS



LEARNING OUTCOMES

- Describe the development in multimedia communication.
- List out five basic type of communication networks.
- Examine technological advancement and challenges in communication.
- Discuss why do we need compression.
- Differentiate between lossy and lossless compression.
- Explain several image and video compression techniques.



Changing Trends : From ? To ?

- mode of communications expands from **people-to-people** communications to include **people-to-machine** communications
- from **narrowband** voice telephony to seamlessly integrated, high quality, **broad-band** transmission of multimedia signals
- basic access method: from **wireline** connections to combinations of wired and **wireless** (copper cable, fiber, cell sites, satellite, and electrical power lines)



Driving Forces

- **Increasing** availability of almost unlimited bandwidth
- Evolution into **modern POTS** (plain old telephone service) and packet and further into an integrated structure.
- **Ubiquitous** (anywhere, anytime) access to network.



Driving Forces

- Digitization devices

such as cameras,
video capture devices,
3G mobile-phone

Smart terminals such as sophisticated screen phones,
digital telephones, multimedia PC.

Increasing amount of memory and computing power.



Classification of Distributed MM Application.

1. Conversational Service
2. Messaging Service
3. Retrieval Service
4. Distribution Service
5. Collection Service



Classification of Distributed MM Appl.

- **Conversational** service
 - direct interactive real-time communication (synchronous communication)
 - exchange of discrete and continuous media between two partners
 - **example**: joint document editing with video and audio support
- **Messaging** service
 - indirect one-to-one communication (asynchronous)
 - using intermediate storage facilities
 - **example**: e-mail, SMS



Classification of Distributed MM Appl.

- **Retrieval** services
 - individual request to multimedia databases
 - **examples**: WWW, Video-on-Demand
- **Distribution** services:
 - One-to-many (multi- or broadcast) communication
 - With or without user presentation control, e.g., selecting form of access to different parts of the information
 - **examples**: 3G mobile-phone
- **Collection** services:
 - many-to-one communication
 - **example**: monitoring of distributed sensor stations



Multimedia Communication Services Provider

Five basic types that provide multimedia communication services:

- Telephone networks;
- Data networks;
- Broadcast TV networks;
- Integrates services digital networks;
- Broadband multiservice networks.



Multimedia demands:

- Large files
- Synchronization constraint
- Huge storage capacity
- Complex processing
- Short respond time

Technology Aspects of MM Systems

- **accessing** multimedia signals by matching the user to the machine; GUI (graphical user interface), SLI (spoken language interface), media conversion, agents
- **compression** and **coding**
- **organizing**, storing, retrieving, streaming multimedia signals issues
- **searching** multimedia archives and databases based on machine intelligence
- **browsing** multimedia archives and documents based on human intelligence



Technology Assumptions

- **user interface** is critical to usability of most applications
- **multimedia experience** (user experience, Garrett 2000) is shared between people and machines
- multimedia processing is a lot more than **compression and coding**
- multimedia applications need to be **standard-based**
- handling (**delivery, display**) of multimedia signals is crucial



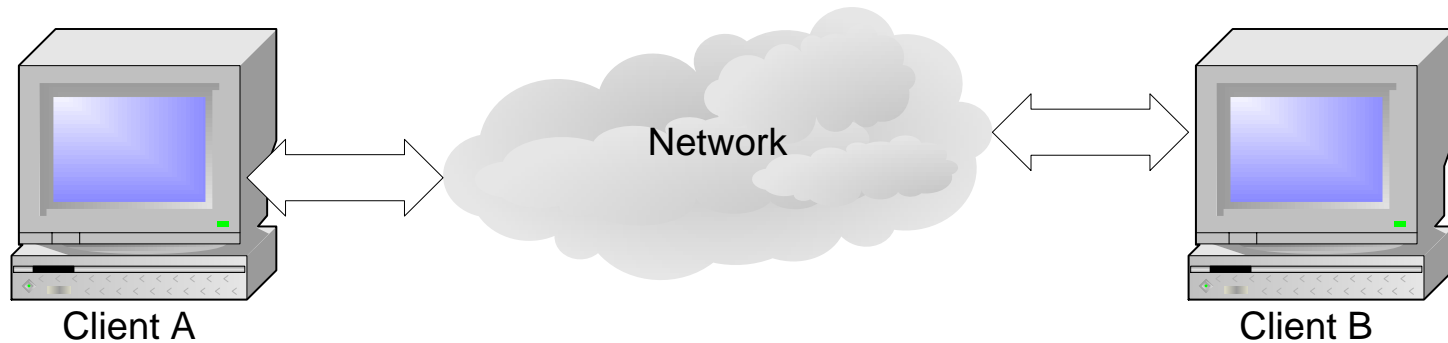
Multimedia Communications Component

- Server
 - Accept the connection
 - Maintain connection states
- Client
 - Request the connection to server
 - Implementing the network heartbeat
- Communication medium
 - Data Packet Size
 - Data Compression



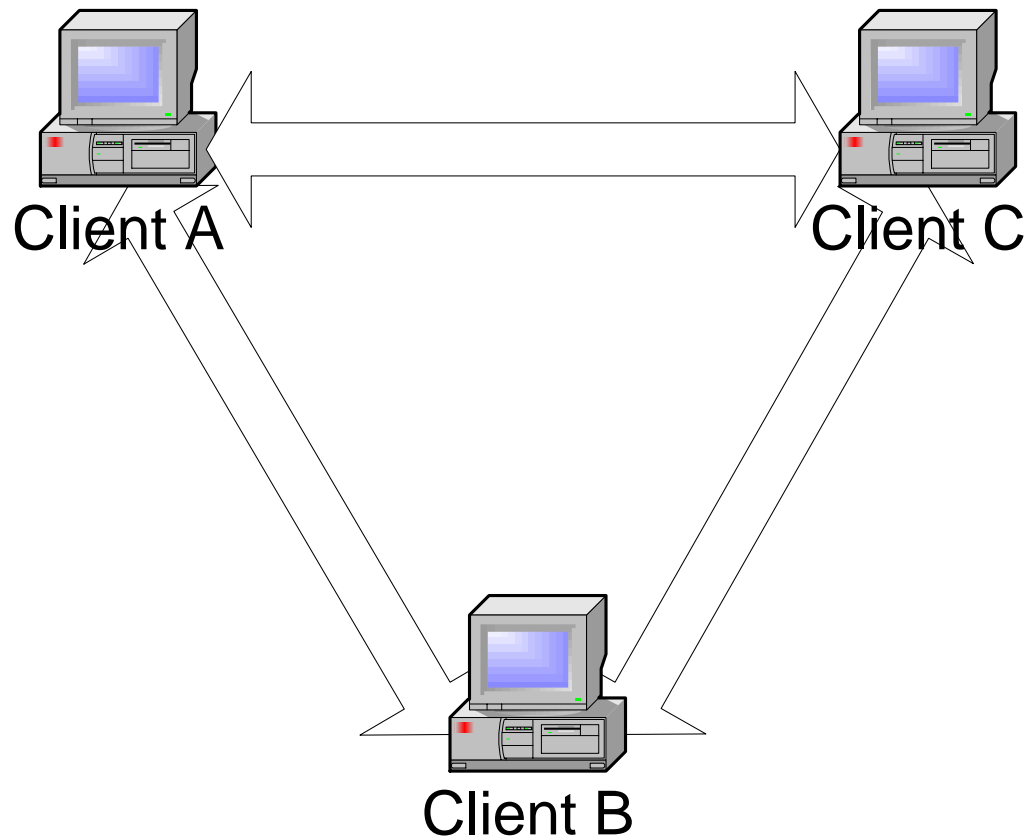
Multimedia Communications Architectures

- Client-Client (Peer-to-Peer)
- Server Network (Server Pool)
- Client-Server



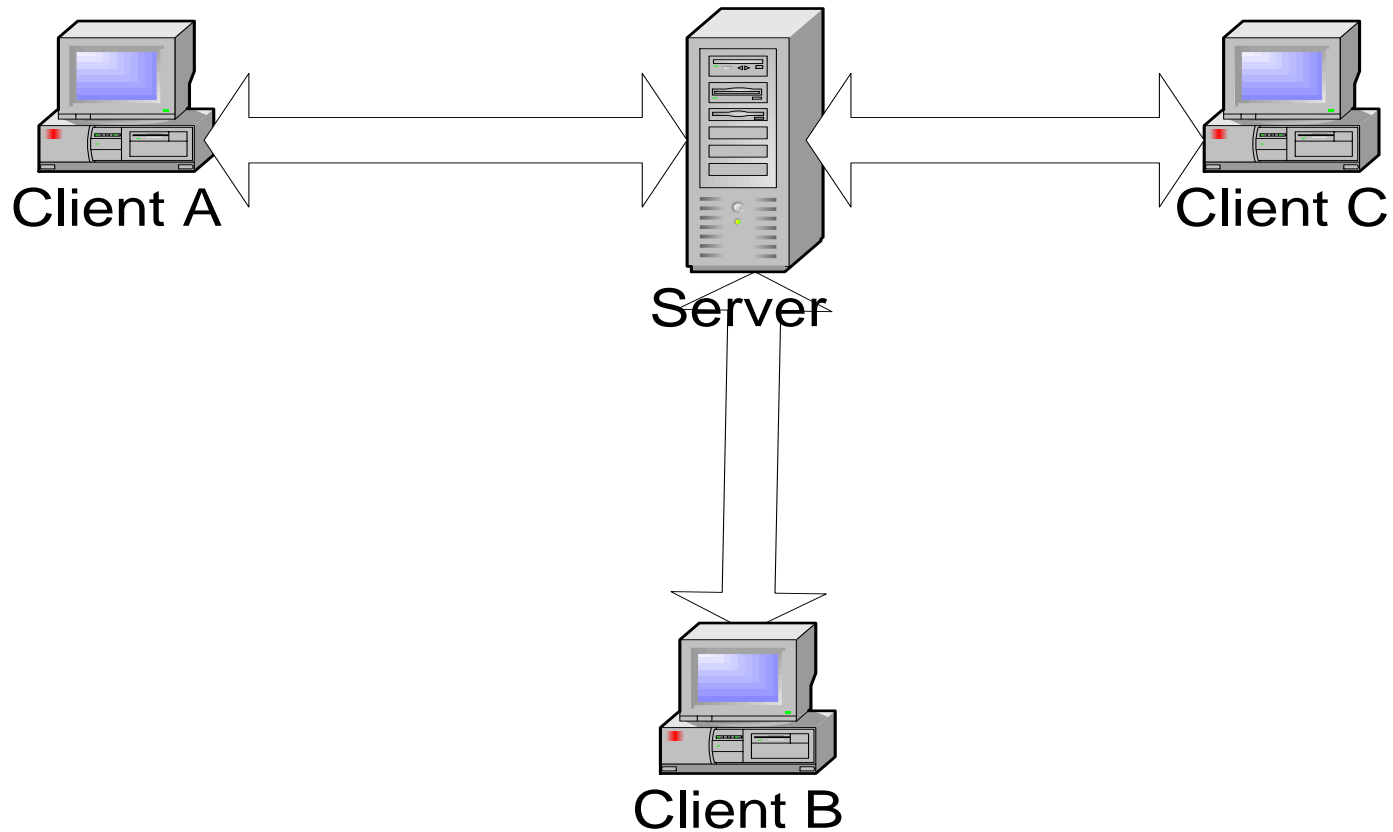
Multimedia Communications Architectures

Client-Client (Peer-to-Peer)



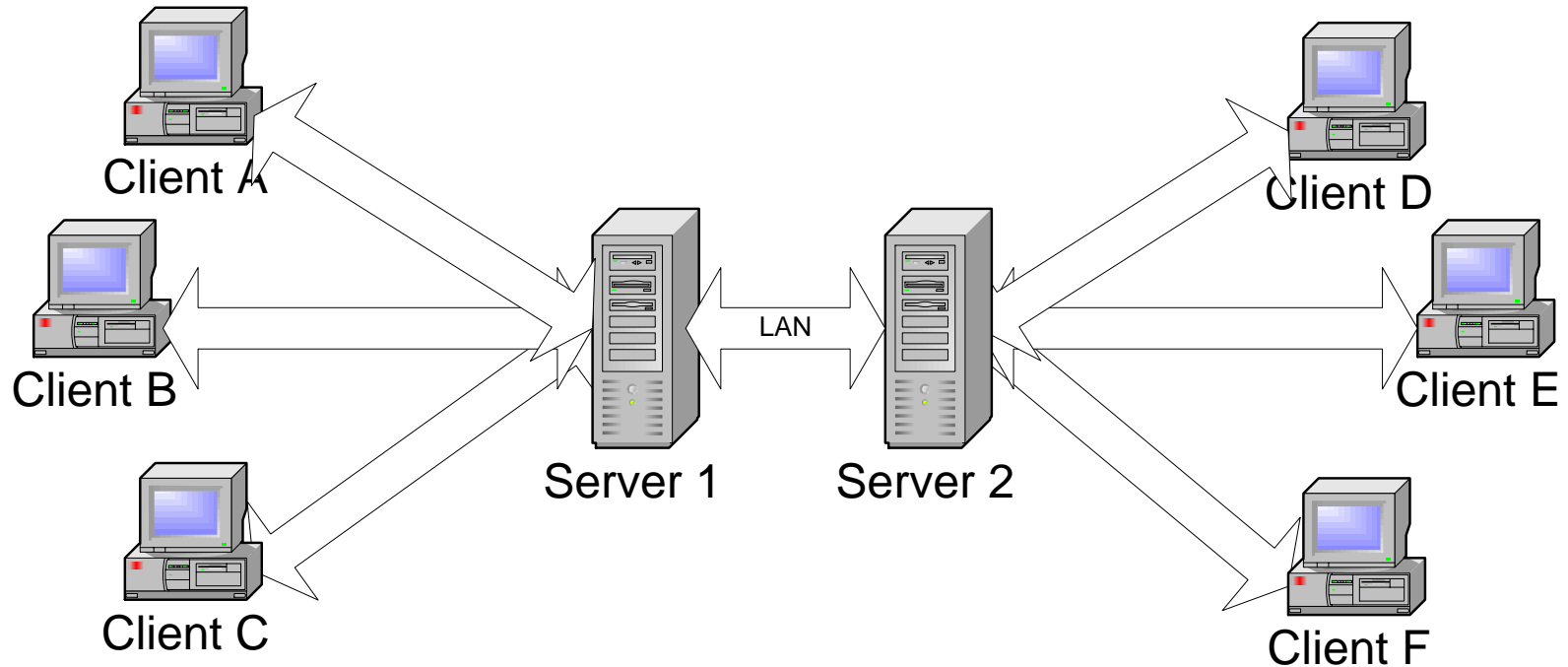
Multimedia Communications Architectures

Client-Server example : UPU Online



Multimedia Communications Architectures

Server Network (Server Pool)



Why Choose Client-Server for WWW?

- Advantages
 - Easier to connect
 - Simplicity
 - Easier to develop
 - Security/Administration
- Disadvantages
 - Server requirements (high bandwidth, high performance)
 - Reliability (single point failure)



Multicast Applications : *How it works ?*

- sending the same data to multiple sites at the same time,
- One promising type of **multicast application** is multicast file transfer applications.
- A multicast file transfer application delivers a file simultaneously to multiple receivers
- which is more effective than repeatedly delivering a copy of the file to each receiver.

read more <http://multicast.internet2.edu/wg-multicast-applications.shtml>



MM Design Considerations for the Web

- Web designers must always be **considerate** of the consumer. (**User-Centered Design**)
- Use images, animations, video, or sound **only when relevant** to your message.
- there are **technical limitations** to the delivery of audio-visual content
 - long-duration video and video requiring **smooth** motion or clear details require large amounts of **bandwidth**
 - A significant amount of down **sampling** and **compression** is required to create a file that is small enough



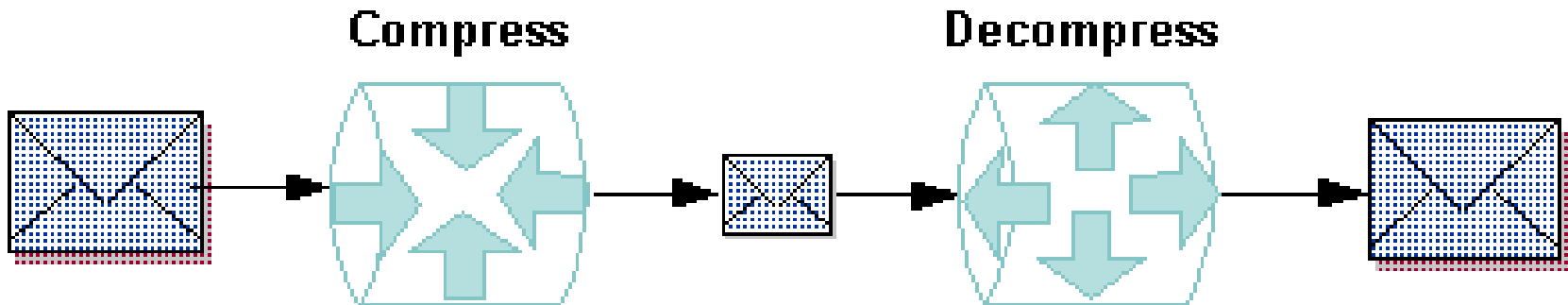
MM Design Considerations for the Web

- Inform your users
- important to give users enough information to make an informed decision *before they click*, so that they know what to expect and are prepared to receive your materials.
- High-demand content such as large multimedia files should not be part of your basic page design.
- These materials should appear on secondary pages
- give users status information and controls



WHAT IS COMPRESSION?

- a way of **re-encoding data** to hold more information in less space than when uncompressed.
- the **process of shrinking** an application buffer so it can be transmitted more quickly across a network or to a remote domain.



Source : http://docs.oracle.com/cd/E13203_01/tuxedo/tux80/atmi/intatm19.htm

What's problem?

- handle **large amounts** of multimedia data
 - Text
 - Image
 - Video /animation
 - audio
- It should be clear that multimedia **data compression** is indispensable for various applications.
- In order to treat uniformly all the media, **data compression scheme** is required.



WHAT IS COMPRESSION?

- We can classify compression :
 - by why it employs redundancy or
 - by the method it compresses the data
- Compression basically employs redundancy in the data
- Compression can be categorized in two broad methods:
 - **Lossless** compression
 - **Lossy** compression



Why compress data ?

- Data compression allows effectively **faster** transfer of information
- **better usage**
 improves network performance
- enhances **security** because it involves scrambling the data.
- Need high **storage** capacity
- Multimedia files are **large**



COMPRESSION METHODS

- **Lossless Compression**

- Algorithm aim is to **reduce the amount** of source information to be transmitted.
- data is compressed and can be reconstituted (uncompressed) **without loss** of detail or information.
- referred to as **bit-preserving** or reversible compression systems.
- **perfect** for **text** or code where we cannot afford to lose even a single byte of data. (such as those used in .ZIP files)
- usually work on a basis of **finding common patterns** in the data and representing these with less data than the less common patterns.



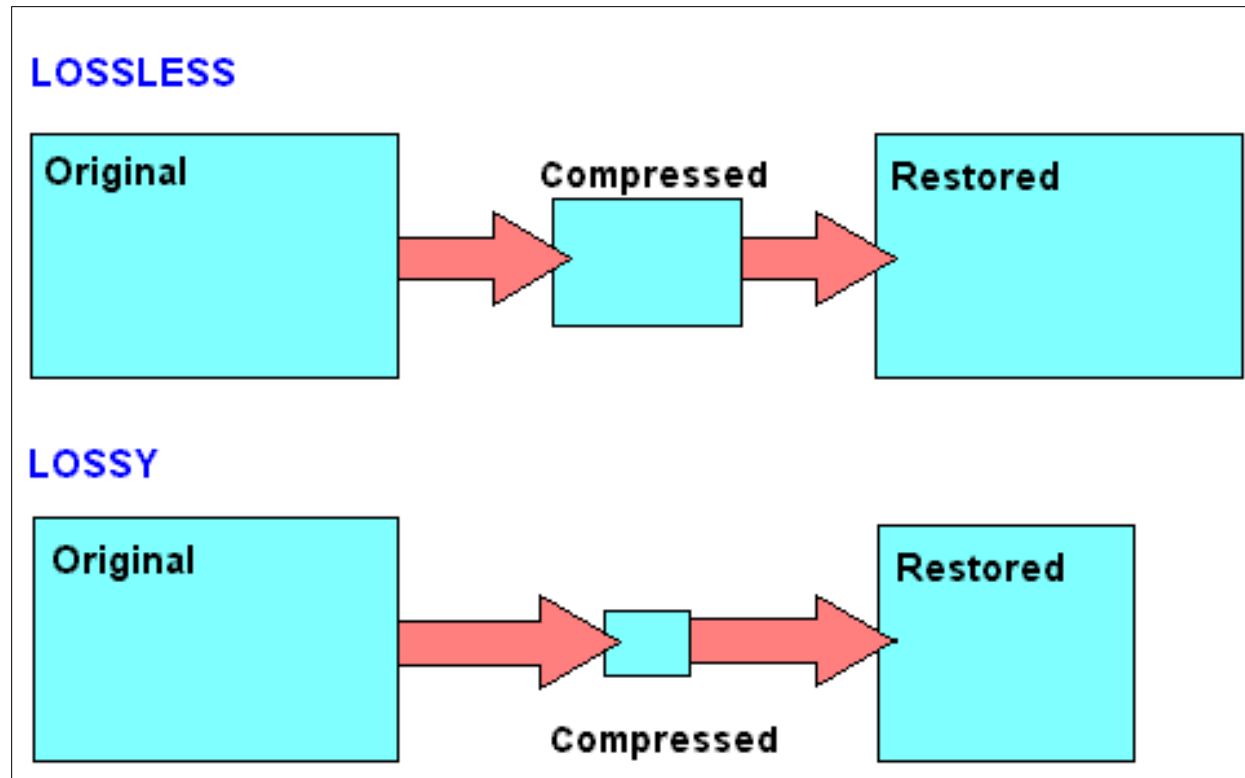
COMPRESSION METHODS

- **Lossy Compression**

- not to reproduce an exact copy of the source after decompression.
- to obtain the **best possible fidelity** for a given bit-rate or minimizing the bit-rate to achieve a given fidelity measure.
- **Video** and **audio** compression techniques are most suited to this form of compression.
- The techniques take advantage of our human limitations
- make **adjustments to the data** which will enable the lossless techniques to compress the data many times more effectively without much apparent loss of the original sound.



Lossy and Lossless Compression



Lossy and Lossless Compression

Lossy	Lossless
Some data is lost	No data is lost
Irreversible	Reversible
Eliminating redundant information	The originally data remains
JPEG	TIFF, GIF and PNG
Cause the image to become “pixelated”	Without losing image quality



Image and Video Compression



JPEG
80% compression
= 27.5 Kb



JPEG
20% compression
= 6.6Kb

Source : [http://www.blc.lsbu.ac.uk/aa/aa/Communication/Visuals/Visuals2_HTI\(43\)/V2_PP-5.jpg](http://www.blc.lsbu.ac.uk/aa/aa/Communication/Visuals/Visuals2_HTI(43)/V2_PP-5.jpg)



Image and Video Compression



JPEG versus GIF compression

Source : http://warc.calpoly.edu/images/diagrams/jpg_vs_gif.jpg

Summary

- Mode of communications expands from people-to-people communications to include people-to-machine communications
- Ubiquitous (anywhere, anytime) make a driving forces to access to multimedia network.
- Multimedia communications component consist of server, client and communication medium
- Lossy compression is usually larger in magnitude compared to lossless techniques. Lossless compression reduce the number of data bits where it allows the exact original data to be reconstructed from the compressed data.

