

Lecture 2

Friday, 09/03/99

- Types of Digital Multimedia
- Compression
- Coding, Quantization, Bit assignment (material in the course reader)

Types of Digital Multimedia

—Text:

Unformatted or plain text:

limited character set, 1
byte/char

Formatted or rich Text:

multiple fonts, sizes, 2
byte/char

This is an unformatted
text also called plain
text.

All the characters have
the same style and font
and their pitch is the
same.

Regular human computer
interfaces use plain
text.

An advantage is that
vertical
alignment
is easier.

This is an an example of
rich text.

Characters can have different styles
and their pitch is variable.

They may also use different fonts.

They may also
respect certain
formatting rules.

Example of plain and rich text

Example of formatted Text:

64 lines/image }
80 char/line }

→ $80 \times 64 \times 2 \times 8 = 84 \text{ Kbits}$

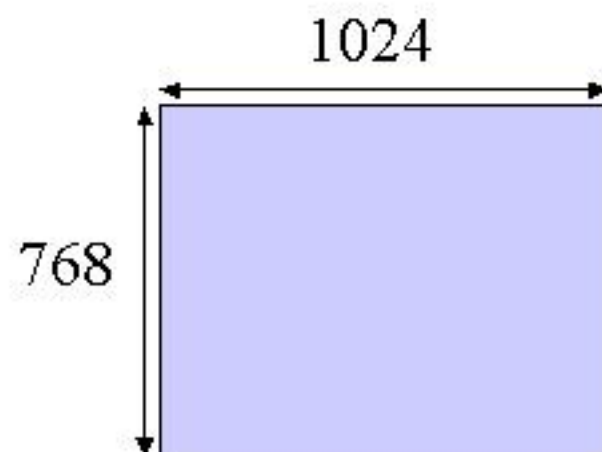
→ over 14.4K modem, 5.7 sec

—Graphics:

- Assembly of objects such as lines, curves or circles etc..
Generated either by human or computer GUI.
- Objects are revisable: stretched, rotated, deleted, translated.

—**Image:** Composed of pixels, not easily revisable.

Example of images:



Colors: R G B

8 bits/color, 24 bits/pixel

$1024 \times 768 \times 24 \cong 18.8 \text{ Mb}$

14.4 kb/s \longrightarrow 21 min

28.8 kb/s \longrightarrow 10 min

Graphics	Images
Graphics are revisable documents	Images are not revisable
The document format must retain structural information	The document format is unaware of any structural information
The semantic content is preserved in the representation	The semantic content is not preserved
Described as objects	Described as bitmaps formed of individual pixels

Table: Summarized comparison between computerized images and graphics

Type		Origin	
Name	Storage form	Name	Production technique
Still image	Bitmap	Scanned still image	<ul style="list-style-type: none"> • Scanning of printed pages • Capture by analog still video camera followed by digitization • Capture by digital still image camera • Capture by analog video camera and A/D conversion by computer video board
		Synthesized still image	<ul style="list-style-type: none"> • Manual creation with paint program • Screen capture (grabbing of a bitmap from a portion of computer screen) • Conversion of graphics to bitmaps
Graphics	Objects	Computer graphics	<ul style="list-style-type: none"> • Generation by program • Manual creation with graphics editor • Generation by program

Table: Type and origin of still images and graphics

—Moving Image:

- captured by camcorder
- 15-16 fps makes human eyes feel real
- camcorder captures moving image

—Moving Graphics (animation):

- object with time dependent direction

—Speech, Audio

Type		Origin		
Name	Storage form	Name	Feature	Production technique
Moving image	Bitmap	Captured motion video	Capture from the real world	<ul style="list-style-type: none"> • Scanning of printed pages • Capture by analog still video camera followed by digitization • Capture by digital still image camera • Capture by analog video camera and A/D conversion by computer video board
		Synthesized motion video	Computer-assisted creation or generation	<ul style="list-style-type: none"> • Manual creation with paint/draw program • Screen capture (grabbing of a bitmap from a portion of computer screen) • Conversion of graphics to bitmaps • Generation by program
Moving graphics	Objects and timing relationships	Computer animation	Each view computed at display time	<ul style="list-style-type: none"> • Manual creation with animation authoring tools • Generation by program

Table: Type and origin of moving images and graphics

Format	Sampling rate (kHz)	Bandwidth (kHz)	Frequency Range (Hz)	Bit rate (kbps)
Telephony	8.0	3.0	200-3,200	64
Teleconferencing	16.0	7.0	50-7,000	256
Compact disk	44.1	20.0	20-20,000	1,410
Dig. Audio Tape	48.0	20.0	20-20,000	1,536

Table: Digital Audio Formats

Enabling Technologies

1. Compression

Why Compression?

(a) large storage (b) slow storage device

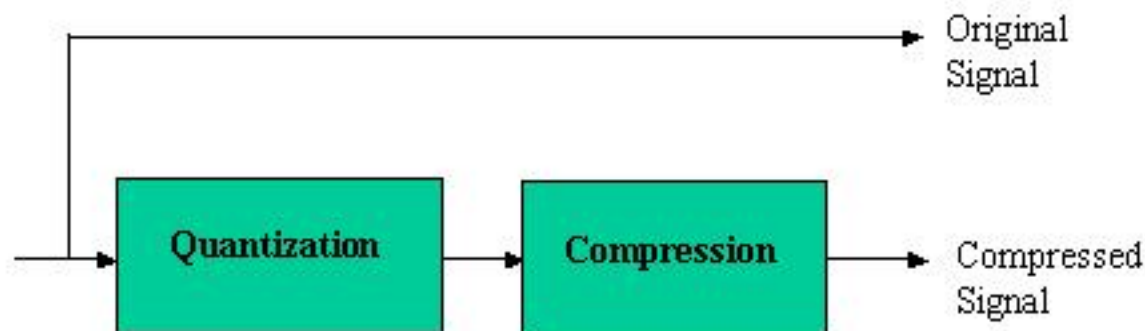
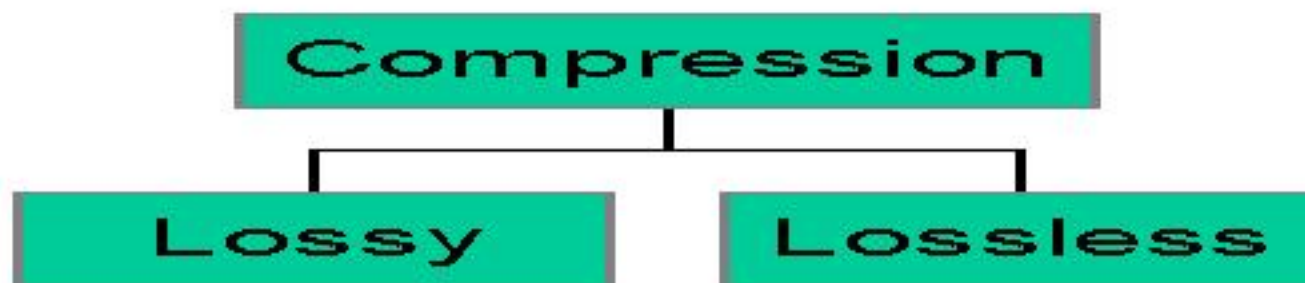
(c) network bandwidth

ex: 620×560 pixel frame of color video

24 bits/pixel \longrightarrow 1MB

30 f/s \longrightarrow 30 MB/s data rate of storage device; CDROM 300 KB/s

30 min \longrightarrow 50 GB storage



Lossy — the compressed signal is different from the original signal

Lossless — the compressed signal is same as the original signal

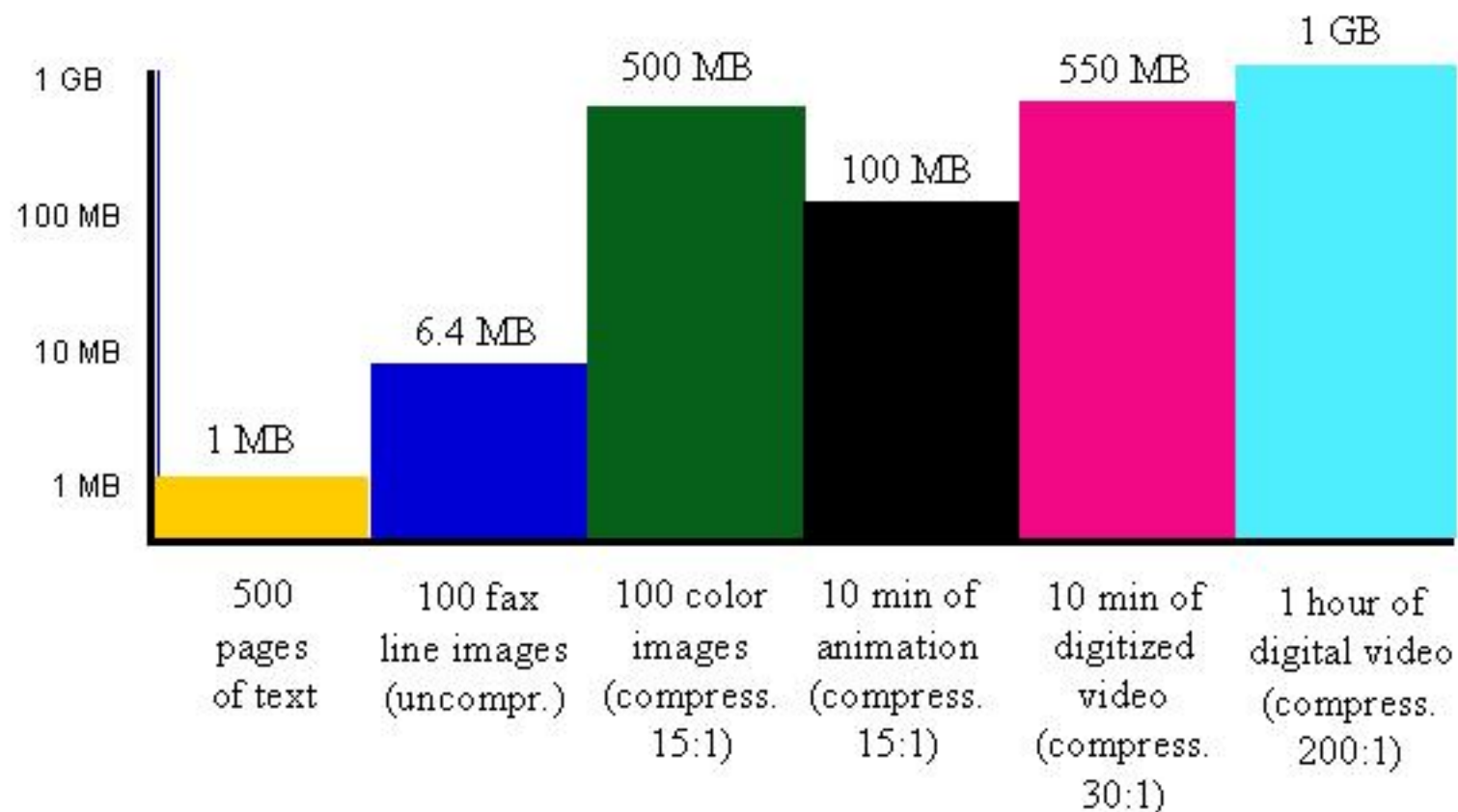
Table: Comparison of Storage requirements for various data types

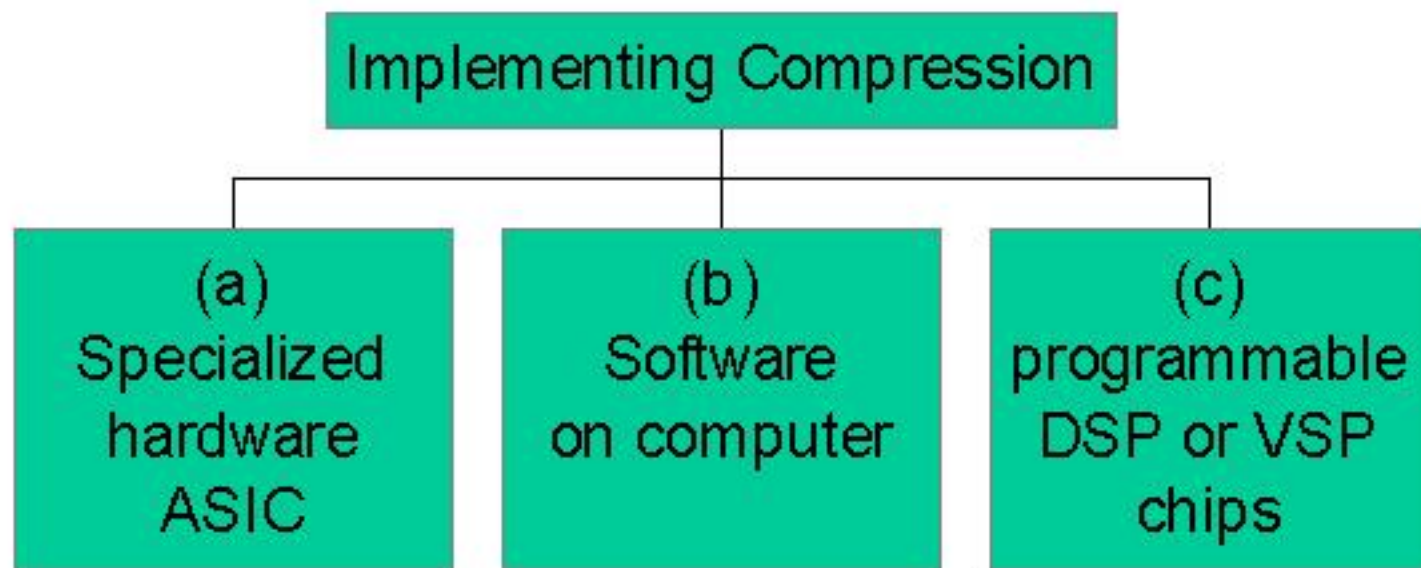
	Text	Image	Audio	Animation	Video
Object type	ASCII EBCDIC	Bitmapped graphics Still Photos Faxes	Noncoded stream of digitized audio or voice	Synched image and stream at 15-19 frames/s	TV analog or digital image with synched streams at 24-30 frames/s
Size and bandwidth	2 KB per page	Samples: 64 KB per image Detailed (color) 7.5 MB per image	Voice/phone 8KHZ/ 8 bits (mono) 6- 44KB/s Audio CD DA 44.1KHZ/ 16 bit 176 KB/s	2.5 MB/s for 320x640x16 pixels/frame (16 bit color) 16 frames/s	27.7 MB/s for 640x480x24 pixels per frame (24-bit color) 30 frames/s

KB= Kbytes MB= Mbytes

Figure: Storage requirements for a typical multimedia application with compressed images and video

Storage Requirements





(a) takes more design effort for the specific task. (b) suffers from slow speed. So (c) is a compromise between the first two. A guest lecture on (c) will be given later on.