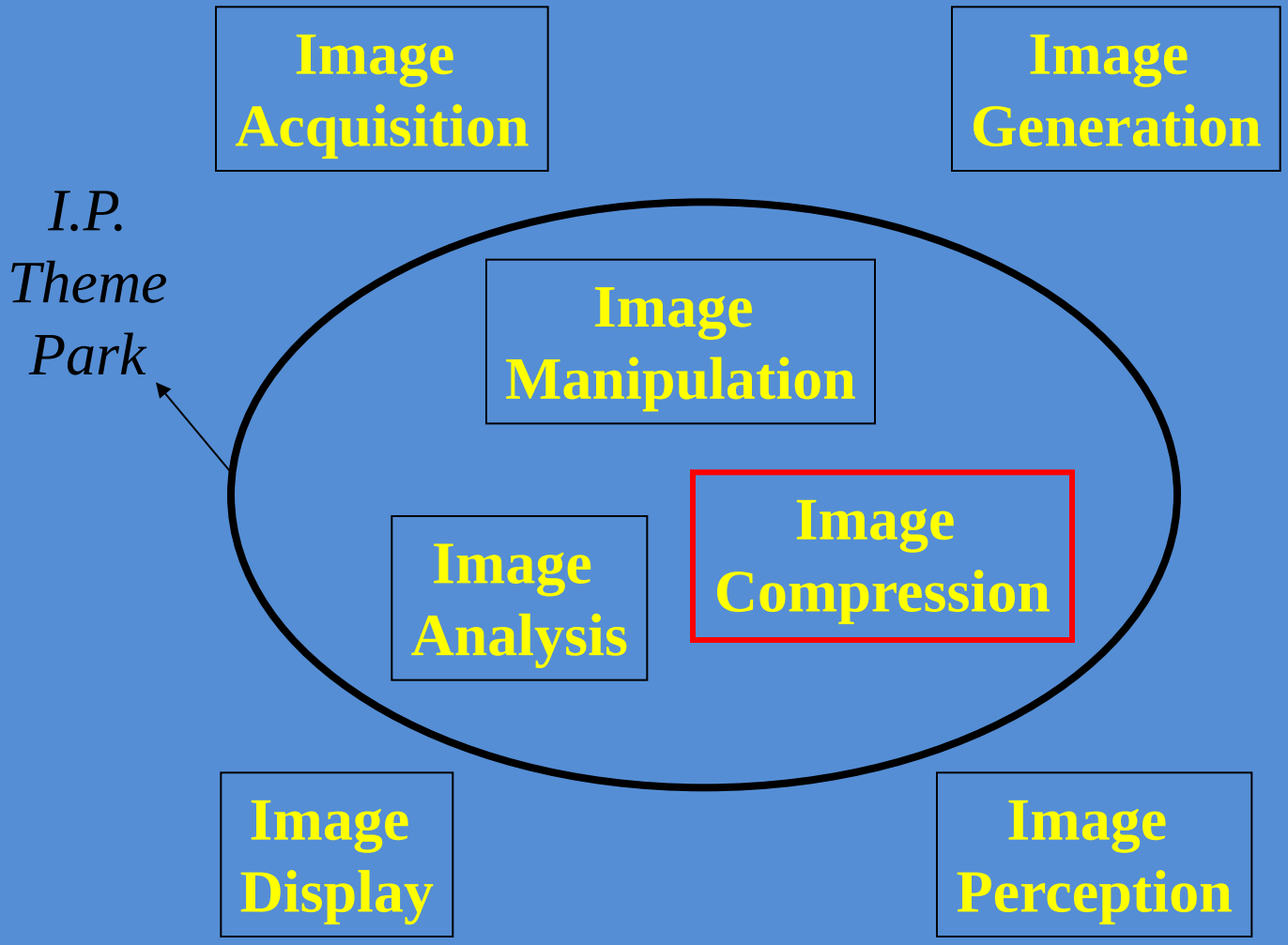
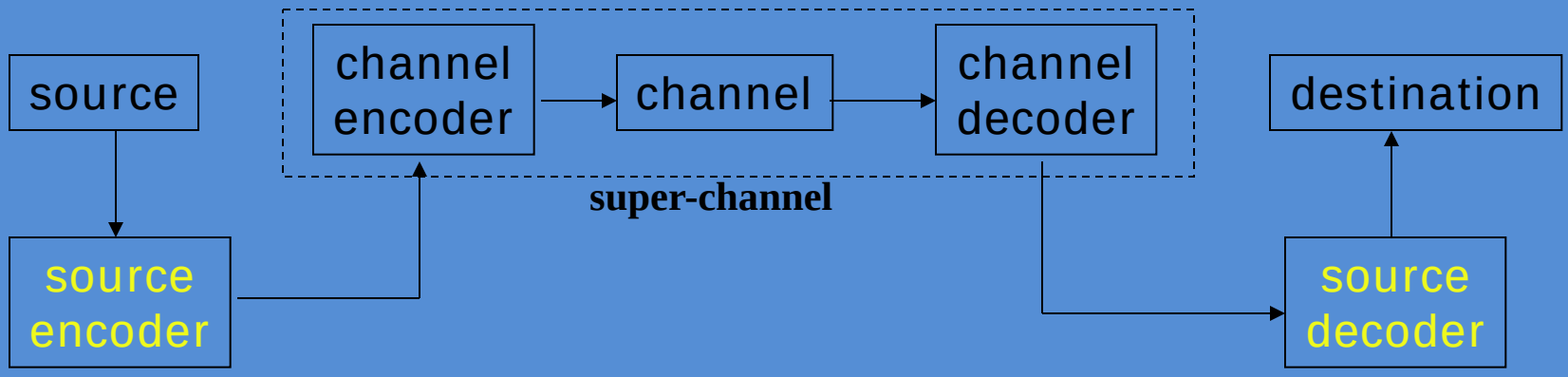


Image Acquisition
Image Generation
I.P. Theme Park
Image Manipulation
Image Analysis
Image Compression
Image Display
Image Perception

The Art of Image Compression

- Why are images compressible?
  - Redundancy in images (NOT random)
- How data compression works?
  - Probability theory and statistics
  - Shannon's information theory
- What about the future of image compression?

Shannon's Picture on Communication (1948)



The goal of communication is to move information from here to there and from now to then

Examples of source:

Human speeches, photos, text messages, computer programs ...

Examples of channel:

storage media, telephone lines, wireless transmission ...

Lossless vs. Lossy Compression

- Lossless: zero error tolerance
  - No information loss
  - Shannon's entropy formula
  - For photographic images, compression ratio is modest (about 2:1)
- Lossy: the goal is to preserve the visual quality of images
  - Information loss visually acceptable
  - Shannon's rate-distortion function
  - For photographic images, compression ratio is typically around 10-100

Popular Lossless Image Compression Techniques

- WinZip

  Based on the celebrated Lempel-Ziv algorithm invented nearly 30 years ago

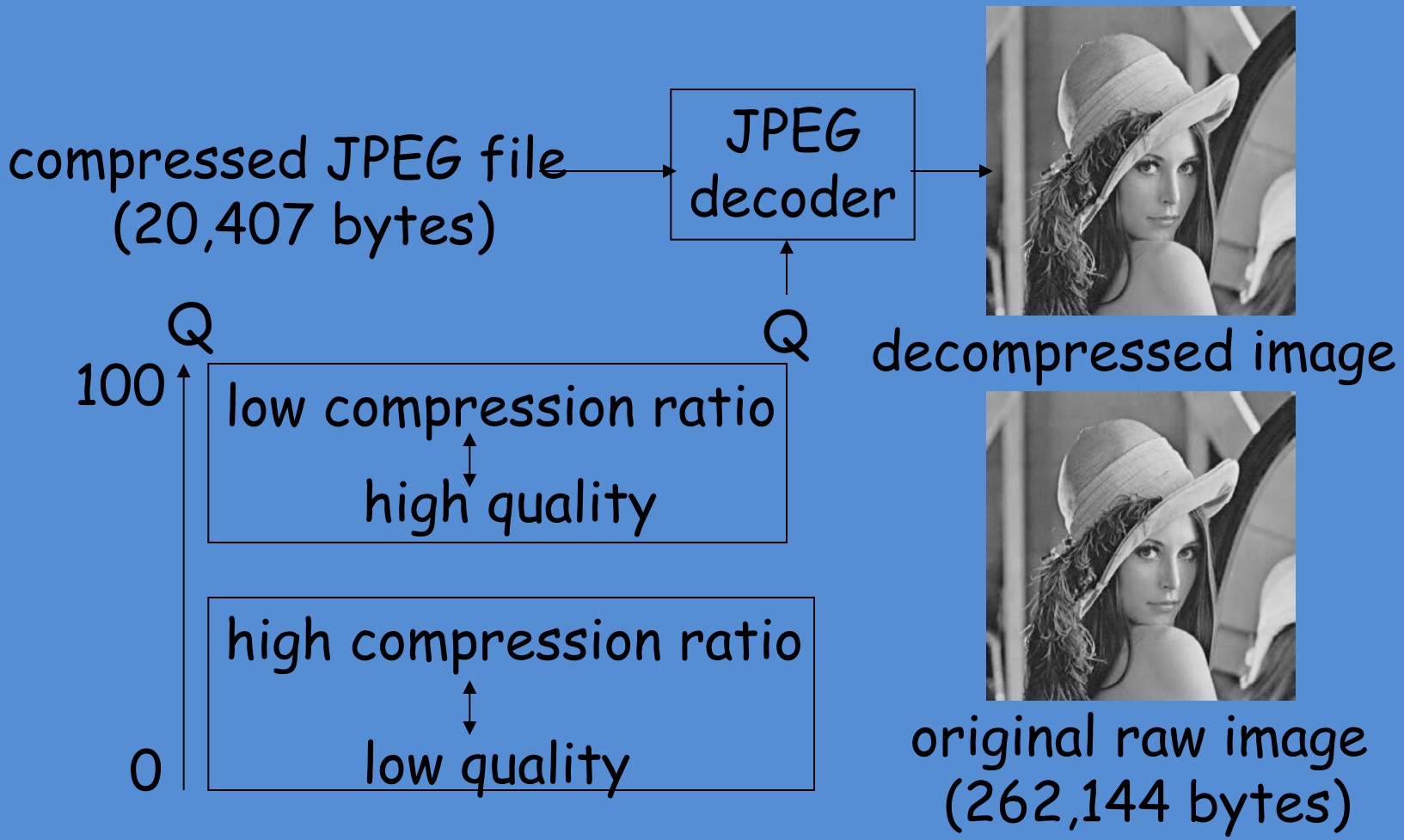
- GIF (Graphic Interchange Format)

  Based on an enhanced version of LZ algorithm by Welch in 1983
  Was introduced by CompuServe in 1987 and made popular until it was not royalty-free in 1994

- PNG (Portable Network Graphics)

GIF Liberation Day: June 20, 2003

Lossy Image Compression



From JPEG to JPEG2000

discrete cosine transform based

JPEG (CR=64)

wavelet transform based

JPEG2000 (CR=64)

Summary

– Image compression: Lempel-Ziv, Huffman coding, run-length coding and JPEG