Chapter 4
Multimedia Data and Its Encoding

“The new world”
- From the heraldic motto of Christopher Columbus (1446 – 1506)

The rapid development of digital communication technology in the areas of diversity and performance is ongoing – with no end in sight. The trend toward the integration of classic media continues. Verbal communication and data transmission have now become inseparable in modern mobile networks. The debut of digital technology has made it no longer necessary to distinguish between different types of media, such as text, graphic, audio or video. Encoded and in digital form, they all take the same shape of an extremely long series of zeros and ones and can be transferred indiscriminately via the same medium. In order to convert this stream of 0s and 1s back to its original media expression, methods and procedures of encoding and decoding are necessary. This task is taken on by powerful computers, which in the future will appear less in the form of a standard monitor and keyboard and more as an integrated system component of nearly all everyday devices. Today the computer is the window to the digital world and functions as an integrative communication medium. It allows multimedia data communication via the standard interface of the World Wide Web (WWW) with its simple and intuitive user interface – the browser. In the following chapters, we will take a closer look at the encoding of multimedia data. We will also examine the data formats developed for its transmission through the digital network and in the WWW. The most important media formats for audio, image and video data will be our focus.

4.1 Media Variety and Multimedia – A Question of Format

The computer was not originally designed as a communication medium. The punched cards first used for input and output would have been much too cumbersome. A long time passed before the computer was developed to the point where the medium of general information such as text or images, could
be printed as output or displayed on a monitor. Already very early in the computer’s development, telex or text printers were used as output media, before the introduction of plotters or graphic-capable screens. These could output digitally calculated images. It is only in the last 20 years that capabilities of displaying high-resolution graphics in true color, moving images and animation with real-time video output have evolved, as well as the ability to reproduce and produce sound – up through artificial voice synthesis. With the additional development of computer networks and the Internet the computer has become the universal communication medium we know today. The constantly growing capabilities of the computer combined with a continuous decrease in manufacturing costs has turned the computer into a consumer product for the mass market. The computer has found a place in nearly every household. Our lives today could simply not function without it. Vannevar Bush (1890 – 1974) was one of the pioneers of computer development. In 1945 Bush was Director of the Office of Scientific Research and Development, an institute of the U.S. government responsible for all military research programs, among them the coordination of the Manhattan Project for the development of the atomic bomb. Bush’s vision of the computer as a universal communication medium took concrete form in his Memex system [34], which we have looked at previously. Bush envisioned the Memex (Memory Extender) as an electromechanical apparatus for the storage of books, personal records and communication. It offered fast, flexible and goal-oriented access to all data and its shared links. Today’s hypermedia systems expand on this idea, allowing access to a number of different media types and formats, for example text, image, audio or video information. These various media formats are described as multimedia.

All types of media that are to be processed by a computer must first be digitally (binary) encoded. A distinction is made between the following traditional expressions of computer displayable media types:

- **Text**
  To encode alpha-numeric information – that is, encoding the displayed information by means of characters and letters of different alphabets - many different procedures exist. For example, ASCII, the 7 bit standard, which dates back to the days of the telegraph, or the 32-bit Unicode, which can be used to encode nearly all alphabets in the world. Closely related to the nature of the code is the required memory space. Many codes are redundant in order to ensure a certain degree of security in the face of transmission errors.

- **Graphics**
  Based on the complexity of the displayed visual information, different procedures are used for encoding image information. The range extends from simple procedures for monochromatic images to those for so-called true color display.