Complex Data Structures and their Role in the Organisation of Information Systems

Károly I. Boda

It is widely known that the accumulated knowledge of mankind rapidly grows, at a rate that often seems to be very hard to handle. Those who use the Internet, and especially the Web with its hypermedia capabilities, have to cope day by day with more or less difficulties in finding the relevant, or at least the adequate information they need. As a consequence, the various ways of organising the knowledge stored in different computers and networks are, with no doubt, of great importance. The ultimate aim of these efforts is to increase the effectiveness and efficiency of information retrieval (its relevance, completeness, etc.); the issue is, however, discussed only to a relatively small extent and chiefly in general for its importance in recent publications, compared to the amount of information available on other, mainly technical, questions of the Internet and the Web, including multimedia, programming of the Web, etc.

Setting out from some basic principles of information systems which have been used widely and proved effective long since, in this presentation a general and abstract model is discussed in detail as well as its applications for comparing various information systems with each other, and for establishing their efficiency, or stage of development. The *Multi-layer Architecture of Information Systems* (MAIS) model describes information systems as complex structures built of four layers. The function of layers can be generally outlined as forming abstract objects and object structures in different levels of knowledge in order to describe, or reflect different parts of an application, emphasising different characteristics of reality.

The four layer of the MAIS model are as follows:

- index layer;
- logical/conceptual layer;
- textual layer;
- hipertextual layer.

In representing the content of information systems, the abstraction level (e.g. concepts, abstract or syntactic objects, models, semantic schemes, and paradigms, roughly) and complexity of layers are different. The layers are complex structures, the components of which are related to each other in horizontal level (i.e. within layers), and vertical level (i.e. across layers).

The function of layers can be outlined as follows:

- the index layer identifies the attributes, or characteristics of abstract objects described by the information system;
- the logical/conceptual layer identifies the abstract objects and their high-level structures, described by the information system;
- the textual layer contains concrete representations of abstract objects and their structures, described by the information system;
- the hipertextual layer implements various links between segments of the textual layer, organising their content in high level; besides, the links and series of links establish contacts with the index layer and logical/conceptual layer, respectively.

Examining the layer structure of special, well-tried information systems, the detailed functions of each layer can be expressed. In this presentation the realisation of layers are reviewed as well as their relation with complex data structures applied in the information systems listed below. The information systems, as well as other means and methods of organising knowledge in traditional and modern way (i.e. by computers), which have been taken into consideration in developing the MAIS model, are as follows:

- traditional, "linear" texts, i.e. books, articles, reports, etc.; their structure and organisation, as well as various methods for analysing and processing them in computer linguistics, content analysis, and literary texts analysis; bibliographies, word frequency statistics, concordances, etc.;
- encyclopedias, lexicons, mono- and bilingual, "active study", etc. dictionaries, thesauruses;

- library information systems, bibliographic and full text information retrieval systems;
- relational database systems;
- multimedia dictionaries and encyclopaedias (e.g. ENCARTA, BOOKSHELF);
- expert systems;
- hipertext/hypermedia systems, the World Wide Web itself.

As an application of the consequences drawn from the construction and study of MAIS model, in the presentation the organisation level of World Wide Web, and some future trends are outlined. The examples discussed above as well as presentations of interactive systems (e.g. through the Web, if the need arises) are intended to illustrate and back up significant parts of the above considerations.