3 Non-geometry standards

Chapter 3 explains all ISO 19100 standards apart from ISO 19101 (Reference model) and the geometry-oriented standards that are ISO 19107 (Spatial schema), ISO 19123 (Schema for coverage geometry and functions), ISO 19125-1 (Simple feature access – Part 1: Common architecture), and ISO 19136 (Geography Markup Language). The ISO 19101 is explained in chapter 2. The other four standards are explained in detail in chapter 4.

3.1 Infrastructure standards

The infrastructure standards set rules that apply to all pieces of the ISO 19100 family. They define the “infrastructure” for the development of the standards themselves and for the development of application schemas and profiles. The infrastructure standards include the conceptual schema language (ISO/TS 19103), the terminology (ISO 19104), the conformance and testing (ISO 19105), and the profile (ISO 19106). Originally, the ISO 19102 (Overview) was meant to provide a general introduction to the ISO 19100 family. The project was later cancelled because it was difficult to continuously update it while standards evolved. The Internet and textbooks such as this, may provide a much better access to the ISO 19100 standards.

3.1.1 Conceptual schema language (ISO/TS 19103)

Today, if experts meet to discuss the design of a computer system they would talk in a conceptual schema language. Admittedly, they speak in English, French, or German, or any other language of the world, but a conversation like this remains informal and fuzzy until someone starts drawing a diagram, mostly in UML, the Unified Modelling Language, in order to express the ideas with the formal tools of classes or packages and their relationships. Therefore, it is essential for everybody who works in this field to be able to communicate in a conceptual schema language. The ISO/TS 19103 (Conceptual schema language) defines a UML profile for geographic information. This book assumes the reader has a basic knowledge of UML and focuses on the extensions of UML for geographic information.
**Background**

A conceptual schema language is based upon a conceptual formalism that provides the rules, constraints, inheritance mechanisms, events, functions, processes and other elements that make up a conceptual schema language. For the ISO 19100 family of standards the applicable conceptual formalism is the object-oriented modelling as described by OMG (OMG 2003). A conceptual schema language has to be capable of representing 100% of the semantics in a domain of discourse (see section 2.2.3). The 100%-requirement refers to the level of detail that is appropriate for modelling the domain in question. Traditional conceptual schemata such as the Entity-Relation model cannot describe numerical or logical relationships between values of concept. Therefore they are not able to meet the 100% requirement.

The UML has become the strongest of several conceptual schema languages that have been developed over the last decade. The roots of UML were independent but similar to developments by three well-known American “software methodologists”: Booch, Rumbaugh, and Jacobson. These three later pooled their efforts and created a company, Rational Software Corporation, that has become the leading developer of software engineering tools. UML is about to become an International Standard prepared by the ISO/IEC JTC1/SC7 (ISOIEC47 2003). Today Rational Software Corporation is a division of IBM.

EXPRESS is a conceptual schema language being used in the field of mechanical engineering and was standardised by the ISO/TC184 (Industrial automation systems and integration) (ISOIEC25 1994). Conceptual schemas in UML are based on graphical and lexical elements, whereas the schemas of EXPRESS primarily rely on text. According to the standards of the ISO 19100 series, both languages are available for the modelling of geographic information. UML is preferred however, as it has turned out to be far more feasible for modelling geomatics. Therefore, this book uses UML as the only conceptual schema language.

**UML elements for geographic information**

The ISO/TS 19103 (Conceptual schema language) requires the use of UML as it is defined in the ISO/IEC 19501-1. Specific rules and recommendations have been established for the following aspects: classes, attributes, datatypes, operations, associations, and stereotypes. In addition, naming conventions and modelling guidelines maintain the unique appearance of the whole family of ISO 19100 standards (see annex E).

**Classes**

Normative models use class-diagrams and package diagrams. Other UML diagram-types, such as use-case diagrams, may be used for information. All normative models contain complete definitions of attributes, associations, operations, and appropriate data type definitions.

According to the ISO 19100 family, a class is viewed as a specification and not as an implementation. Attributes are considered to be abstract, and do not have to be di-