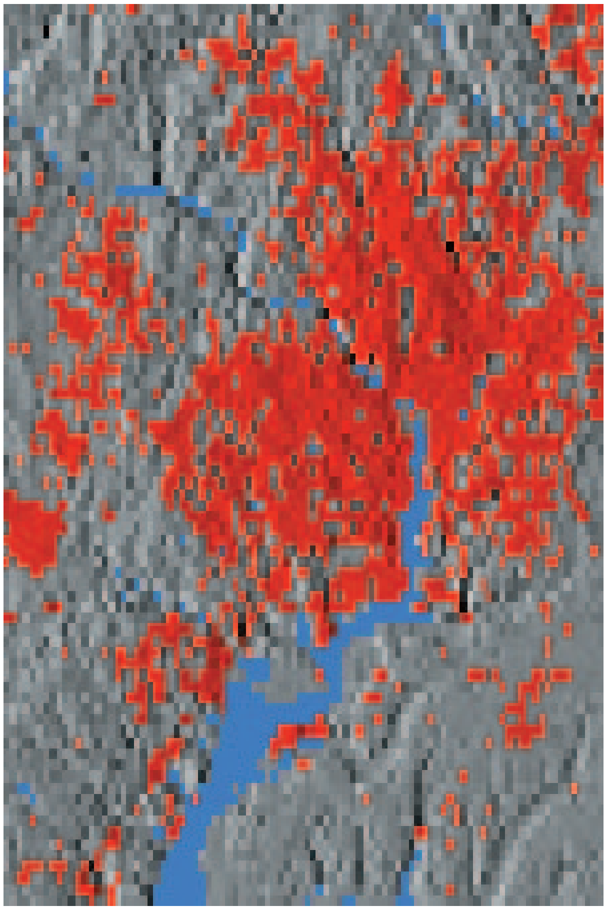
Senior Management Overview

SDTS
Spatial Data Transfer Standard

Prepared under direction of the Federal Systems Integration and Management Center and the SDTS Task Force



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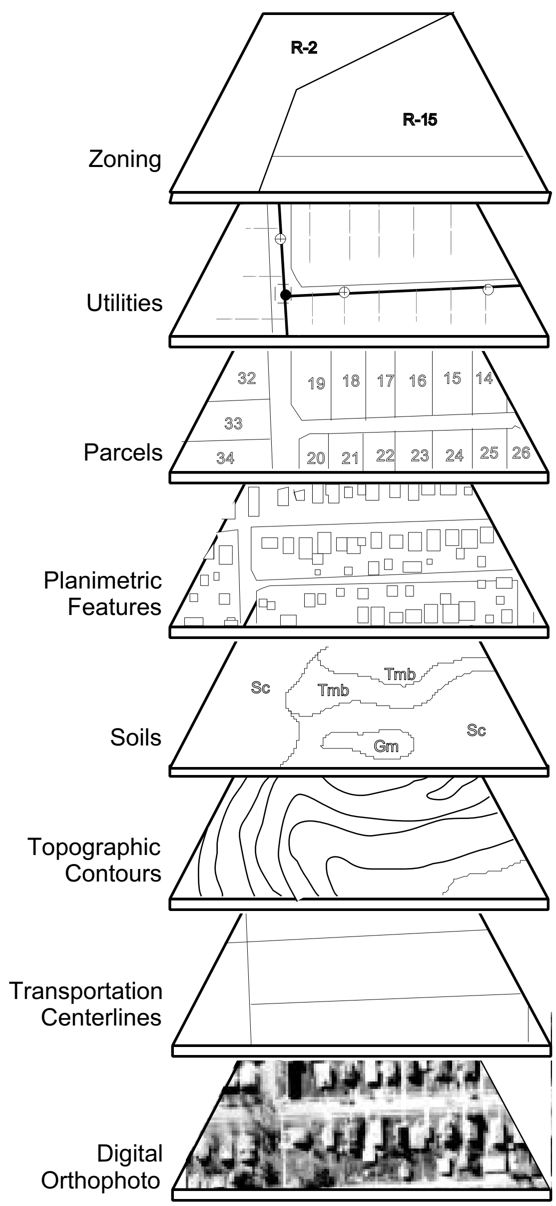
SDTS
Spatial Data Transfer Standard

Introduction

This document will introduce you to the Spatial Data Transfer Standard (SDTS). It will tell you what SDTS is, how it is being implemented, and how it will benefit organizations that use spatial data.

If you are an upper-level manager or official in an organization that uses, distributes, or creates geographic information, this booklet will be useful to you. It will also be of value to you if you are part of a software company, a data conversion firm, or an organization that sells or distributes spatial data.

This document will give you a management-level synopsis of SDTS. For a more thorough discussion of any of the issues mentioned here, refer to the additional readings listed at the end of this booklet.



Spatial data takes many forms, and is used by many organizations in the course of their daily business.

What is SDTS?

The Spatial Data Transfer Standard (SDTS) provides a practical and effective vehicle for the exchange of spatial data between different computing platforms. It has been developed and refined for several years, and its use has now been mandated for federal agencies.

SDTS was ratified by the National Institute of Standards and Technology (NIST) as a Federal Information Processing Standard (FIPS 173). Compliance with FIPS 173 by federal agencies became mandatory in 1994. Many federal agencies, such as the U.S. Geological Survey (USGS), U.S. Census Bureau, and Army Corps of Engineers, now produce and distribute spatial data in SDTS format.

Why Does Spatial Data Matter?

Spatial data is important to the operation of most government agencies and many private companies. It is estimated that federal agencies alone spend more than $4 billion annually to generate or collect spatial data. When the activities of state and local governments, utility companies, and many other spatial data-generating organizations are taken into account, it becomes apparent that much time and money are spent on spatial data. It makes sense, for the sake of efficiency, to encourage the sharing of data.

The need for increased sharing of spatial information was the reason for the creation of the Federal Geographic Data Committee (FGDC), a coordinating body with representation from all federal agencies that are significant generators or users of spatial data.

More recently, the need for a national program of spatial data sharing with participation from governments at all levels and the private sector resulted in the 1994 Executive Order establishing the National Spatial Data Infrastructure (NSDI) program.

Greater sharing of spatial data makes sense because it encourages:

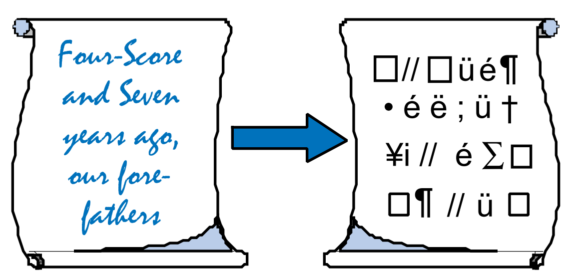
- Consistency in data generation and use
- Less redundancy in data compilation
- Reuse of previously generated data.

SDTS is a mechanism that will help to bring about better use of this spatial data and reduce the costs of redundant data generation.

Challenges in Spatial Data Exchange

Why is it necessary to have a standard exchange format for spatial data? Most computer users have experienced difficulty in transferring files from (say) one word-processing program to another, or from one type of personal computer to another. Even when the raw text is transferred, formatting may be lost, and spurious characters may be added. Transferring spatial data presents similar but more complex challenges.

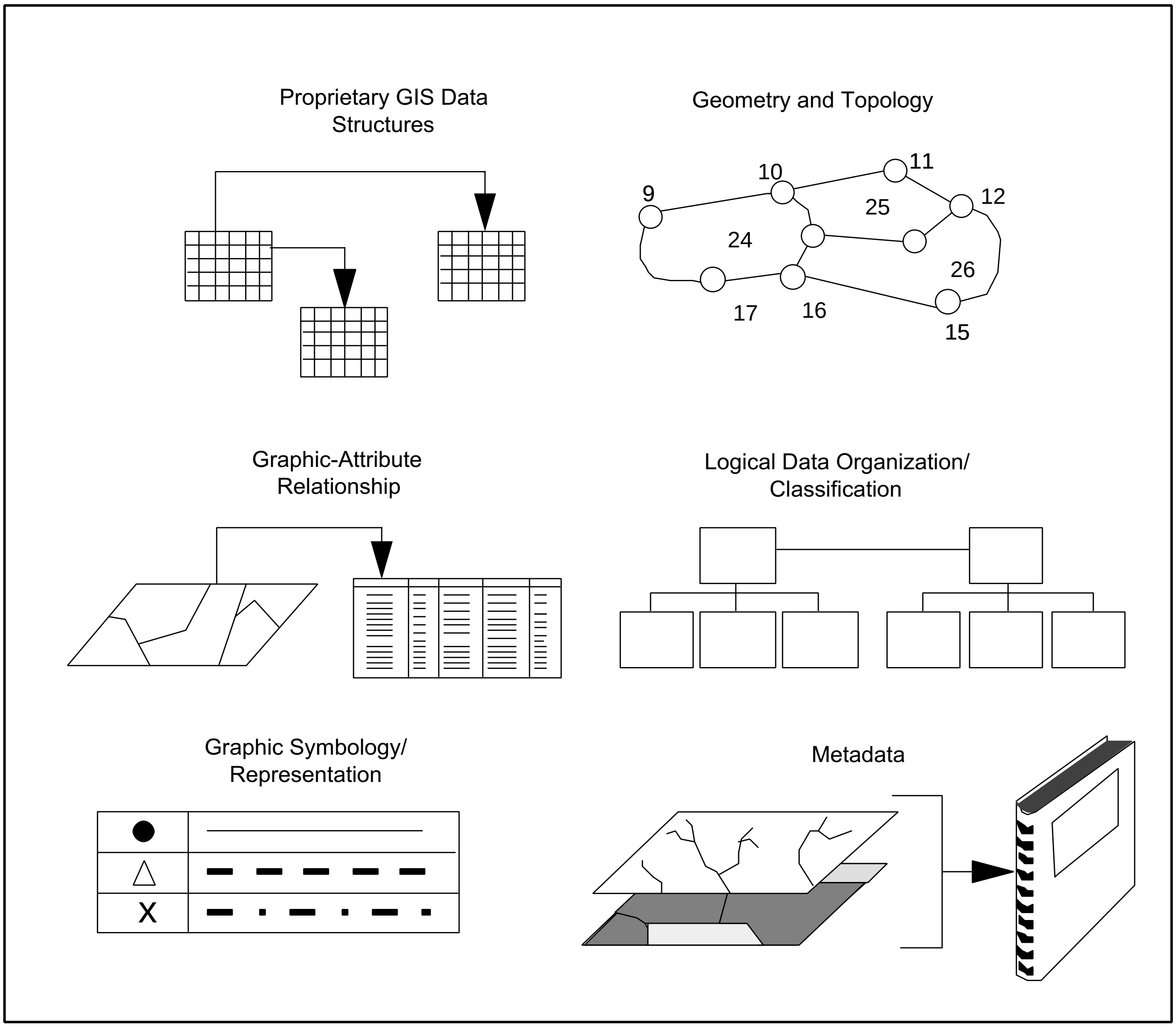
- For example, geographic information system and automated mapping software packages use different proprietary structures to store graphic data.
- Furthermore, spatial databases store not only the graphic representations of features, but the nongraphic attributes associated with those features. These attributes must be included in a data transfer without losing their links to specific spatial features.
- Another complication is the increasingly standard practice of GIS user organizations to build and maintain metadatabases that contain information about the content, quality, and characteristics of a spatial da-



Valuable information can be lost in translation without an effective exchange mechanism.

tabase. This information is important in helping users determine the availability and usefulness of the data, and it should not be lost in translation.

A complete and fully effective spatial data transfer mechanism must provide for the encoding and exchange of all of these and other components of spatial databases among disparate computing platforms. SDTS is designed to accomplish this goal without losing or corrupting any of the data in the transfer process.



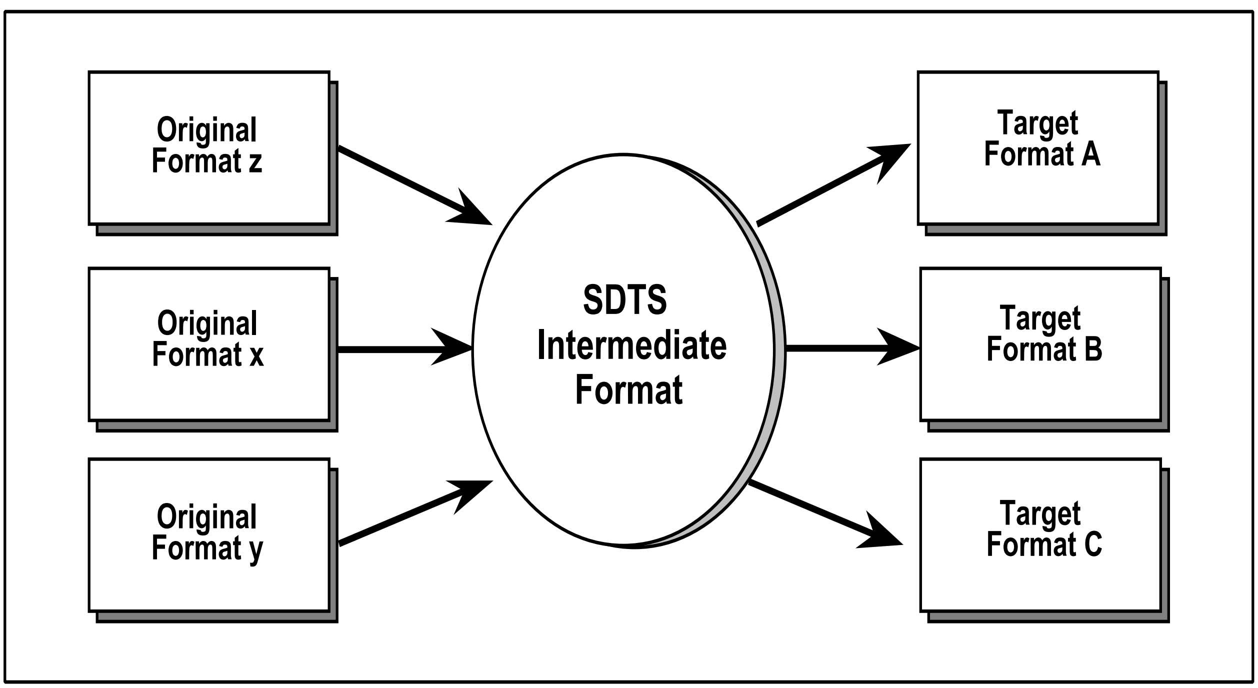
Issues in data transfer.

What Does SDTS Do?

SDTS is a format designed specifically for use when transferring spatial data. Rather than directly exchanging data from one platform to another, SDTS provides an intermediate exchange format. Intermediate exchange is more efficient and reduces software development costs, since only one set of encoding and decoding software is necessary (direct exchange would mean that any GIS software platform would need translators into every other GIS software format). Maintenance of translation software also becomes simpler, since only one set of changes must be made when vendor software and data structures are revised.

How does SDTS accomplish this task? The full SDTS specification defines different “levels” of data, from the real world to the physical encoding of the data.

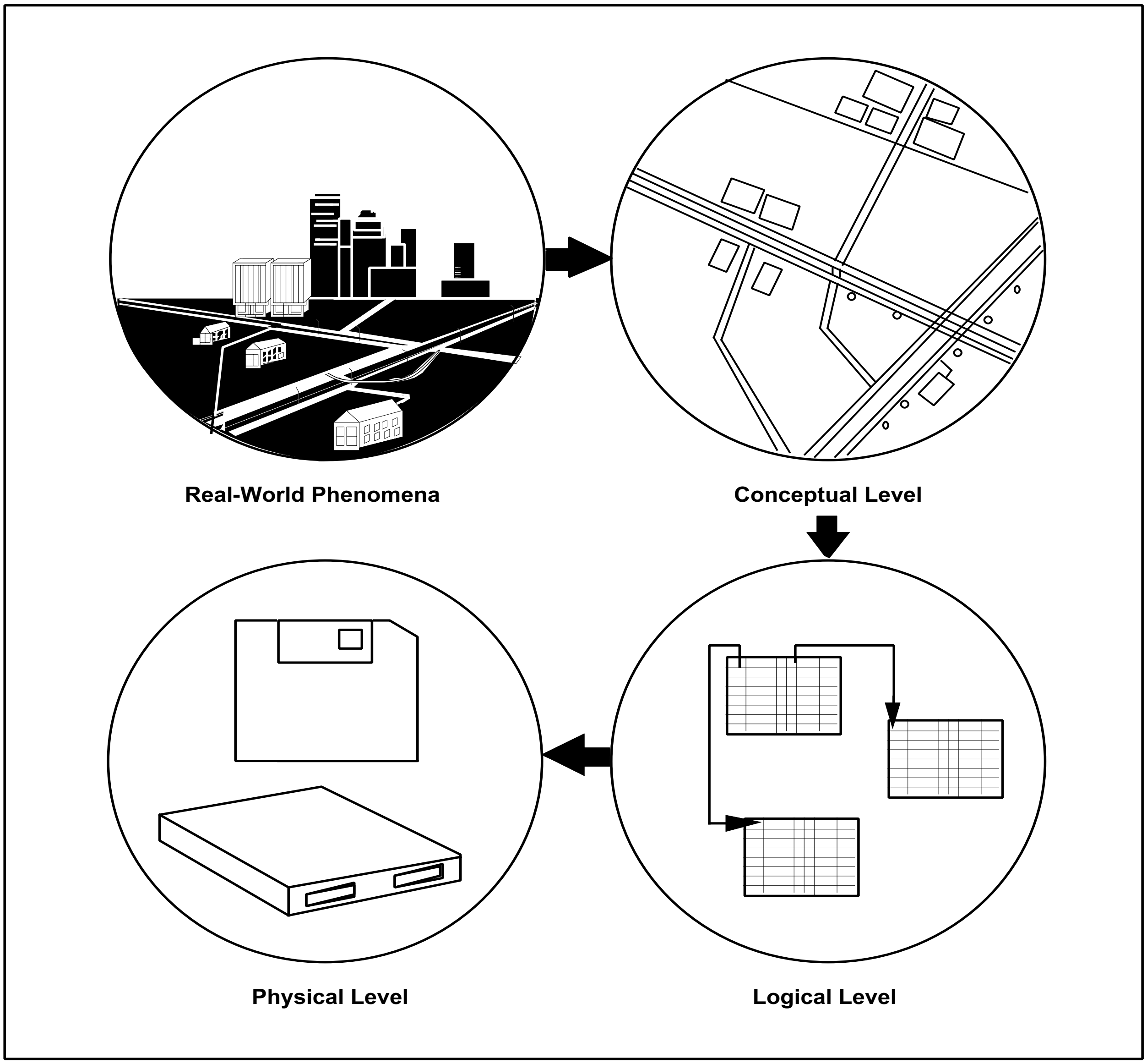
The conceptual level describes a way to represent real-world entities, including their geometric and topological characteristics and relationships. The logical level presents a data format for identifying and encoding information for an SDTS transfer. SDTS



SDTS provides an intermediate exchange format. An SDTS-compliant software needs only one "decoder" and one "encoder."

also defines the physical level with rules and specific formats for physically encoding data on a medium of choice (e.g., magnetic tape).

SDTS provides consistent, standardized ways to record, describe, or format data at each level. When data is translated or encoded into the SDTS intermediate format, recipients of the transferred data can use it without undue difficulty, by translating or decoding it into the format required by the particular software that they are using.



Levels of data.

The SDTS Base Specification

SDTS consists of a "base specification" in three parts.

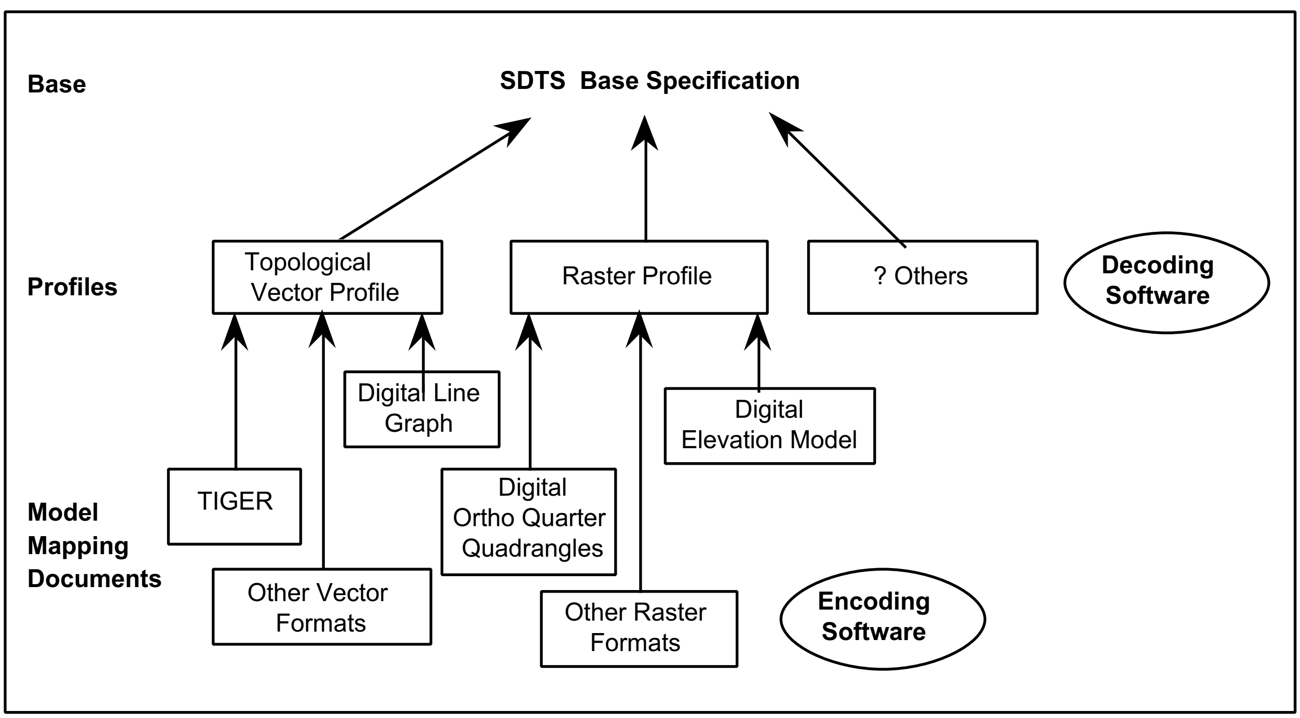
Part 1, Logical Specifications, explains the SDTS conceptual model and SDTS spatial object types, components of a data quality report, and the layout of SDTS modules that contain all needed information for a spatial data transfer compliant with SDTS.

Part 2, Spatial Features, contains a catalogue of spatial features and associated attributes. This part defines common spatial feature terms to ensure greater compatibility in data transfers. The current version of Part 2 is limited to small- and medium-scale spatial features commonly used on topographic quadrangle maps and hydrographic charts.

Part 3, ISO 8211 Encoding, explains the use of a national and international standard for physical data encoding (ISO 8211, also known as FIPS 123) to transfer SDTS on a physical medium (e.g., disk) or through communication lines.

SDTS Profiles

While the base specification provides the essential elements of SDTS, the actual use of the standard for transferring spatial data is

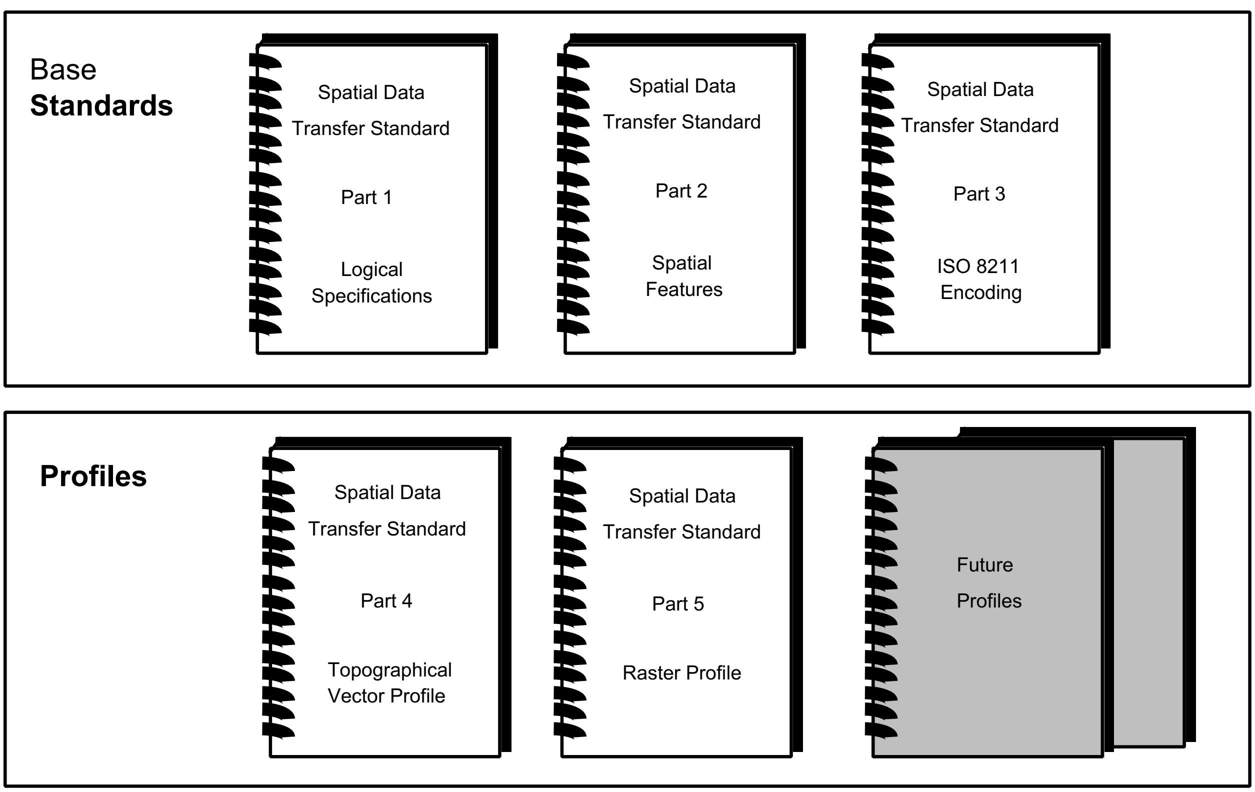


Encoding and decoding.

carried out through the use of "profiles." A profile provides specific rules for applying the SDTS base specification to a particular type of spatial data. A profile can be considered a subset of the SDTS specification that defines the following:

- Restrictions and requirements for use of specific spatial object types
- Restrictions and requirements for use of SDTS modules, including rules for choosing among options present in the base specification
- Module naming and file naming conventions
- Use of ISO 8211 encoding specifications, including allowable options to be used.

One profile, the Topological Vector Profile, (TVP) has been formally approved by NIST as part of FIPS 173. A second profile, the Raster Profile, has been prepared in draft form by the SDTS Task Force with considerable outside review and comment for use by raster data users.



SDTS is composed of the base specification and specific profiles.

Other profiles are being developed. However, the TVP and Raster Profile already cover much of the spatial information used by organizations today that are operating geographic information systems or image processing systems.

Who Must Comply with SDTS?

FIPS 173 has a direct impact on federal agencies. Generally FIPS places the following requirements on federal agencies:

- New computer systems designed for mapping and spatial data processing should have the capability to encode and decode SDTS data.
- New spatial data collection programs should prepare data in SDTS format if this data is likely to be distributed outside of the agency responsible for the data collection.

It may also be appropriate to apply SDTS to some existing systems and spatial databases; however, no wholesale retrofitting is foreseen or required.

FIPS 173 will also affect many other organizations indirectly, since the federal government is both an important supplier and a major user of spatial data. Software firms that want their products to be SDTS-compliant, as well as users and distributors of spatial data in all public and private sectors, will need to understand how SDTS affects them.

Adopting SDTS

How you adopt SDTS depends on what your organization does. SDTS implementation should be considered by any organization that fits one or more of the following roles:

1. **Developer** of GIS or other software that will benefit from SDTS translation routines for transfer of spatial data among different hardware and software environments

2. **Producer/Distributor** of spatial information to groups using multiple systems and software

3. **User/Recipient** of spatial data that may be produced on another computer system.

These roles are explained further in the following table.

The Federal Government's Role in SDTS Implementation

The National Institute of Standards and Technology (NIST) is the designated "maintenance authority" and has overall responsibility for formal approval, revision, and distribution of the SDTS specification as FIPS 173. The National Mapping Division of USGS has the official role of "maintenance agency." This support role includes providing technical assistance to agencies implementing SDTS, support in setting up conformance testing, coordination of revision work, and training and education. The SDTS Task Force, now based at the National Mapping Division Mid-Continent Mapping Center in Rolla, Missouri, has been created to coordinate SDTS activities.

Current SDTS Implementation

SDTS is operational. A number of Federal agencies have progressed considerably with SDTS implementation programs. Several agencies have put in place, or will soon put in place, procedures for access to and distribution of spatial data in SDTS format.

In the long run, effective use of SDTS will depend to a very great extent on the development of easy-to-use software for encoding and decoding SDTS to support the many spatial data formats in use. These formats include those developed by the public sector (e.g., GRASS and DLG), as well as many commercially developed formats for CAD, automated mapping, and GIS applications.

In an effort to convert USGS data to the SDTS format, a set of C++ class libraries for encoding and decoding SDTS data called the SDTS-Common Software Platform (CSP) was developed. This software is public domain.

Role	Sample Organizations	Use/Impact of SDTS[1]
Software Developer	• GIS software company • DBMS software company • Contracted software developers	• **Building of encoding and decoding translation software**
Producer/Distributor of Spatial Data	• Federal government agency • State or local government agency • Mapping/Data conversion contractor • Map publishing companies • Value-added data distributor • Other spatial data producers	• **Use of off-the-shelf encoding software** • **Compiling metadata and data quality information for an SDTS transfer** • Design of encoding translation software if not already available off-the-shelf • Design of new SDTS compliant profiles if required
User/Recipient of Spatial Data	• All government agencies that acquire spatial data from outside sources • Utility companies and private firms that operate GISs • Universities and research institutions • Non-profit organizations	• **Use of off-the-shelf decoding software** • Recommend or create the demand for additional and more versatile translation software (COTS) • Identify requirements for new SDTS compliant profiles, as required

[1]Primary uses and impacts are highlighted in bold print

The table above gives an explanation of roles for SDTS use.

Many automated mapping and GIS software companies have responded to the SDTS requirements by developing translation software (encoding and decoding) for their own proprietary formats. This provides off-the-shelf software for importing and exporting SDTS data for many of the commercial software packages in use today.

Conclusion

Standardization improves efficiency. When American railroads in the nineteenth century adopted a uniform track gauge, travel became quicker and easier. The adoption of standard screw threads helped lower the cost of producing industrial and commercial machinery. Standards are no less important in the "information age." Standardizing spatial data exchange will enable users of spatial data to share the data, reducing the otherwise redundant creation of data sets.

The adjustments necessary to adopt SDTS will be more than compensated for by the efficiencies that the standard will bring to the spatial data user.

Additional Information about SDTS

The SDTS specification itself is

- National Institute of Standards and Technology, *Federal Information Process Standards Publication 173: Spatial Data Transfer Standard (SDTS)*, Gaithersburg, MD: U.S. Department of Commerce, 1992.

Two documents have been prepared as companions to this *Senior Management Overview.* They are

- *SDTS Guide for Technical Managers*
- *SDTS Handbook for Technical Staff*

Both of these documents are available from the USGS. For a more extensive list of SDTS-related articles and publications, please refer to the bibliographies in these two documents.

SDTS information is alsoavailable on-line at:
http://mcmcweb.er.usgs.gov/sdts.