In innumerable ways, geodesy contributes to the functioning of a modern society. While that contribution is critical, it is not necessarily well known or understood by most outside the geodetic community. Geodesy defines the coordinate infrastructure underlying many of the functions of modern society. Like the wooden frame of a house, that infrastructure is the unseen framework upon which different “layers” of spatial information (e.g., the geometric data and thematic description of spatial elements such as points, polygons, lines, 3D objects, and their topologies – i.e., how they relate to each other —, and imagery from space and airborne platforms) are constructed so that they align with each other perfectly. This infrastructure is known as SDI, and geodesy defines the foundation of the SDI. In this chapter the terms “spatial” and “geospatial” will be assumed to be inter-changeable. In many countries, the importance of SDI has risen to the level of government mandate. In parallel with this SDI development, Positioning, Navigation and Timing (PNT) is increasingly needed in many aspects of life, in many business and engineering applications, and to aid decision-making at all levels of government and private enterprise. Due to the globalization and interoperability requirements, spatial data and positioning are increasingly required with respect to a global reference frame. Both, spatial data and (geo)positioning rely on geodesy and increasingly on global geodesy. “Georeferencing” is defined here as the process of assigning coordinates (or “positioning”) to an entity (point, line, polygon, etc.).

4.1 Spatial data infrastructure

In the U.S., for example, the government’s Office of Management and Budget (OMB) issued circular A-16 (“Coordination of Geographic Information and Related Spatial Data Activities”). This document establishes that the Federal Geographic Data Committee (FGDC) be in charge of establishing the National Spatial Data Infrastructure (NSDI). Furthermore, it identifies the National Oceanic and Atmo-
spheric Administration (NOAA) as the “lead agency” in providing “geodetic control” for the federal government in support of the NSDI. The geodetic control is specifically referred to as the National Spatial Reference System (NSRS). Because no other agency inside of NOAA is responsible for geodetic control (nor specifically the NSRS), the naming of NOAA as the lead agency effectively translates into the National Geodetic Survey (NGS), an office within NOAA. This means that in the United States, NGS must define, maintain and provide access to the NSRS - that is, make sure that everyone who needs to reference anything spatially (e.g. to “position” anything), can do so consistently with others.

One important aspect for georeferencing for military and civilian activities all over the world is the use of a globally consistent reference frame such as the ITRF. As the most accurate realization of ITRS, the ITRF provides a single, accessible 3-D reference frame for geospatial data from a variety of sources. Another global reference system currently still used for many applications is the WGS 84. As pointed out in Section 2.2, the realizations of WGS 84 (through GPS) today are closely aligned to ITRF and supported by ITRF.

Local maps and geodetic control are still commonly used worldwide and the conversion of this information into a common system provides users with the ability to unambiguously georeference with respect to locations on or above the Earth’s surface. It also minimizes possible errors when using modern satellite-based geopositioning technologies such as GNSS. Hence increasingly national, and even local, datums are “compatible” with ITRF, i.e. these datums are Earth-centered, Earth-fixed, and their relationship to the very accurate, high integrity ITRF is determined to a high level of confidence. In many countries and regions, the relations between the national or regional frames are monitored on a continuous basis by the national agency responsible for operational geodesy in that country.

In Australia, SDIs are being developed largely within individual government jurisdictions: federal, state and territory and, increasingly, local government. The Australia and New Zealand Land Information Council (ANZLIC), the peak Spatial Information Council comprising senior government officials from the Australian Government, eight State and Territory governments, and New Zealand, coordinates the development of the Australian Spatial Data Infrastructure (ASDI). ANZLIC has a number of standing committees to advise it on technical issues, amongst which the Intergovernmental Committee on Surveying and Mapping (ICSM) develops and promotes data standards across the jurisdictions. The most tangible component of the ASDI is the Australian Spatial Data Directory (ASDD), comprising 25 geographically distributed and independently maintained nodes, collectively containing over 40,000 metadata records. Groups of agencies are coming together to develop coordinated SDIs in response to major national priorities. Australian Government agencies, for example, have formed the Australian Ocean Data Center Joint Facility to coordinate marine data. The Australian SDI comprises a diverse set of organizations and locations and relies heavily upon the Australian National Geospatial Reference System (NGRS) to link them together and provide seamless coordinate sets for the entire continent. For this reason the responsibility for maintenance of the national geodetic infrastructure, and provision of the linkage to the international