

2.0 Introduction

2.1 Purpose of the Document

The purpose of this document was to provide for the extensive review of the National Integrated Land System (NILS) Concept of Operations and User Requirements by the NILS partners and others involved with cadastral land records. Meetings were held in Portland, OR; Phoenix, AZ; Denver, CO; Atlanta, GA and Washington, D.C. to facilitate the review. The document was also available on the Bureau of Land Management (BLM) web page at www.blm.gov/nils, and the comment period was from November 29, 1999 until January 15, 2000.

NILS is an initiative to provide a business process method to collect, maintain, and store parcel-based information that meets the needs of the widest possible spectrum of land title and resource information providers and customers. NILS is being managed in a partnership environment. The primary partners are BLM, the U.S. Forest Service, states and counties and private industry. A list of participants is included in Appendix B. In addition, NILS has an advisory group, called the Parcel Consortium, which includes BLM, U.S. Forest Service, ESRI, Inc., Oakland County, MI and Fairview Industries.

2.2 Background

2.2.1 Department of the Interior, Bureau of Land Management

The mission of the Bureau of Land Management (BLM) is "to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations." BLM, which is part of the Department of the Interior, manages about 264 million acres of public lands. BLM also manages another 300 million acres of subsurface mineral resources that underlie lands administered by other government agencies or are owned by private interests. These lands are located in 28 states, primarily in the West and Alaska.

The BLM maintains land and mineral records for the Nation's public and Indian lands, including over one billion documents such as land surveys, surveyor notes, tract books, Master Title Plats (MTP), Historical Indices land patents, mining claims, oil and gas leases, and land and mineral case files. Many of these paper documents are deteriorating and some are becoming illegible. Most of the original records and plats are manually maintained and stored in a number of locations throughout the western United States and several locations in the East. Some of the information contained in these documents has been entered into various databases beginning in the 1970s.

When the energy boom began in the early 1980s, BLM found it could not handle the paper workload demand and recognized the need to become more efficient and cost effective by automating many of its public land tenure records. BLM began an effort to automate its land and mineral records. This proposed system was called the Automated Land and Mineral Record System (ALMRS) but this system was never completed.

2.2.2 Department of Agriculture, U.S. Forest Service

The U.S. Forest Service, Department of Agriculture, manages approximately 191 million surface acres of land scattered throughout the United States. In 1958, the Forest Service began a modernization effort to update its land status records that resulted in the establishment of the standard Land Status Atlas, containing status maps and a summary of tabular records of title, partial interests, rights and use restrictions pertaining to Forest Service lands. In the 1990s the Forest Service began its current effort to modernize the Forest Service land records with a project called the Automated Land Project (ALP), which is being implemented throughout the agency.

2.2.3 States, Local Governments, and Private Land Owners

Land records management is also a critical business process for states, counties, townships and cities in the U.S. These are the agencies that interact with private land owners to do the following:

- Manage natural resources (state departments of natural resource management, large private land owners)
- Process land use and development permits (state departments of environmental protection, local governments)
- Record deeds and subdivisions (county recorders, registers)
- Maintain cadastral maps (county assessors)
- Manage infrastructure and rights-of-way (state and local government departments of public works, surveying, engineering, etc.)

All these agencies require powerful tools to access and manage land records and cadastral data as an integral part of daily business operations.

2.2.4 Common Tools and Data Models for Shared Management of the Landscape

Over the last two decades, land managing agencies at all levels of government have found it increasingly difficult to share information, maintain current records and to provide accurate and timely land tenure information to public customers or to support the decision-making process. Population growth, public scrutiny, complex title and use transactions, legal challenges, deteriorating, difficult to access records in a climate of decreased financial support have forced all agencies to consider alternative, more effective technologies.

2.3 The NILS Vision

The NILS vision is to provide a business process method to collect, maintain, and store parcel-based land information that meets the common, shared business needs of the widest possible spectrum of land title and resource information providers and customers. The goals of NILS include the following:

- Provide a comprehensive, integrated, common data model and framework for the management of cadastral land tenure records

- Improve access to land title record information, including ownership, uses and boundaries
- Provide graphic display for land management information
- Facilitate land information data sharing and cooperative collection efforts
- Improve response time to land information queries
- Support the ability to provide a common digital portrayal of land and resource parcels across all jurisdictions
- Provide for the ability to efficiently update information with new or better sources of information
- Provide framework for decision support for collaborative ecosystem management
- Facilitate data sharing, cooperative collection, joint and multi-use land management and distribution of data
- Provide the ability to link parcel-based information with other resource information using geographic information system (GIS) technology to facilitate analysis (Figure 2.1)
- Improve the quality of the information needed to manage and display land, including subsurface information, land descriptions, parcels, control, and coordinates
- Integrate positional and descriptive land information for both surveyed and unsurveyed boundaries
- Provide the ability to link alphanumeric (attribute) data with a graphic representations of where the activity occurs (Figure 2.2)

Figure 2.1. Linking Parcel-Based Ownership, Restriction, Rights, Uses, Administration, Case, and Customer Information Using GIS to Facilitate Analysis

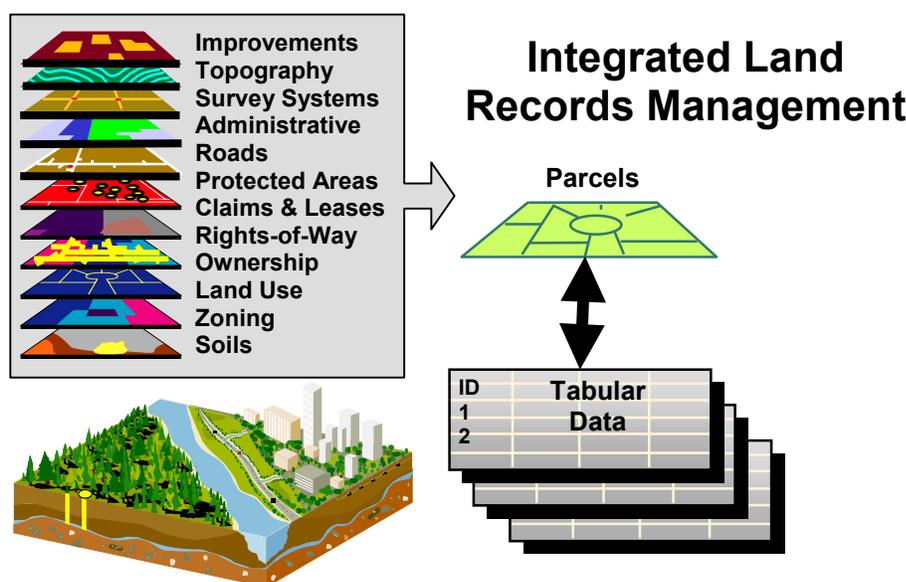
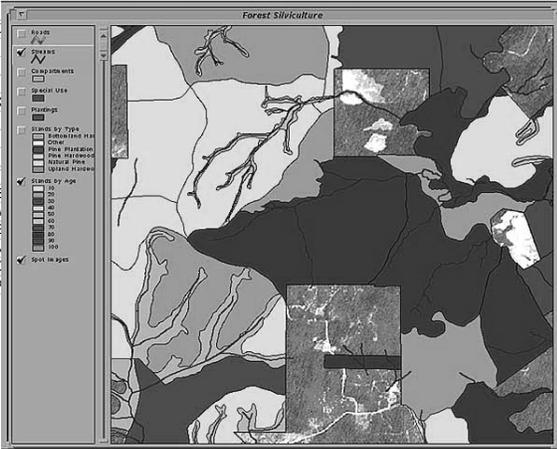


Figure 2.2. Linking Attribute Data and Geographic Data

Land Management agencies and organizations need the ability to link alphanumeric (attribute) data and (geo)graphic representations. This is an example of BLM's attribute data from the LR 2000/Case Recordation System

| Land Id | System Id | Blm Admin State | Meridian | Township | Range | Section | Aliq Part | Sur Type | St Acreage | Geo State |
|----------|-----------|-----------------|----------|----------|-------|---------|---------------------------|----------|------------|-----------|
| 8603 | CR | NM | 23 | 0230N | 0130W | 21 | NE; | A | | NM |
| 8605 | CR | NM | 23 | 0290N | 0100E | 1 | S2NE,SE; | A | | NM |
| 8614 | CR | NM | 23 | 0290N | 0100E | 10 | N2N2,S2SE; | A | | NM |
| 8617 | CR | NM | 23 | 0290N | 0100E | 13 | N2,NESW,N2SE,SESE; | A | | NM |
| 8619 | CR | NM | 23 | 0290N | 0100E | 17 | NE,SENW,SW,N2SE,SESE; | A | | NM |
| 8630 | CR | NM | 6 | 0340S | 0420W | 14 | E2,SW,S2NW; | A | | KS |
| 8635 | CR | NM | 23 | 0300N | 0120W | 19 | SENE; | E | | NM |
| 8641 | CR | NM | 23 | 0200S | 0250E | 2 | L4,SWNW,NWSW; | E | | NM |
| 8656 | CR | NM | 23 | 0150N | 0060E | 711 | PT OF LOTS 1-5,S2NW,SE; | 1 | | NM |
| 8771 | CR | NM | TX | 141 | | | BLK 79 T 1,SEC 5-8,17-20 | 1 | | TX |
| 8772 | CR | NM | TX | 141 | | | 29,30 BLK 80 T 1,SEC 1,12 | 1 | | TX |
| 25646600 | ST | NM | 23 | 0040N | 0340E | 15 | XXXX | A | 160 | NM |
| 25646603 | ST | NM | 23 | 0040N | 0360E | 27 | XXXX | A | 160 | NM |
| 25646604 | ST | NM | 23 | 0030N | 0340E | 20 | XXXX | | | |
| 25646611 | ST | NM | 23 | 0040N | 0360E | 17 | XXXXXX | | | |
| 25646612 | ST | NM | 23 | 0040S | 0310E | 19 | X X | | | |
| 25646613 | ST | NM | 23 | 0040S | 0310E | 19 | X | | | |
| 25646614 | ST | NM | 23 | 0040S | 0310E | 19 | X | | | |
| 25646615 | ST | NM | 23 | 0030N | 0350E | 14 | XX | | | |
| 25646619 | ST | NM | 23 | 0050S | 0310E | 7 | X X | | | |
| 25646620 | ST | NM | 23 | 0050S | 0310E | 7 | X | | | |
| 25646621 | ST | NM | 23 | 0050S | 0310E | 7 | X | | | |
| 25821482 | ST | NM | 23 | 0030N | 0260E | 20 | OF LND F | | | |
| 26403128 | ST | NM | 23 | 0020S | 0030W | 31 | MS378,MS | | | |
| 26403532 | ST | NM | 23 | 0080S | 0050E | 28 | OKLAHOM | | | |
| 26572778 | ST | NM | 23 | 0100S | 0190W | 28 | UNSURVE | | | |
| 26572948 | ST | NM | 23 | 0190S | 0150W | 11 | AND SWN | | | |
| 26642397 | ST | NM | 23 | 0190S | 0150W | 23 | 1357,AND | | | |
| 50463309 | ST | CO | 6 | 0050N | 0670W | 2 | X | | | |



For example, there are currently 4.8 million rows of data in the Land Description Table and 25.8 million rows in the Case Land Table



2.4 Project Initiation

On January 7, 1998, Michael Dombeck, Chief, Forest Service and Pat Shea, Director, Bureau of Land Management signed a Memorandum entitled "Bureau of Land Management-Forest Service Partnership for Land Management and Customer Services." This became known as the "Service First" initiative. Subsequently, a Partnership Agreement for an ALP/ALMRS Joint Development Project was signed on June 11, 1998 by four sponsors: Jack Arthur (Director, IRM) and Jack Craven (Director, Lands) for the Forest Service, and Gayle Gordon (Assistant Director, IRM) and Pete Culp (Assistant Director, Minerals, Realty & Resource Protection) for the Bureau of Land Management. Additionally, a Project Charter was signed in March, 1999 by the four project sponsors. With approval of this charter, the project was renamed the National Integrated Land System.

2.5 NILS Scope

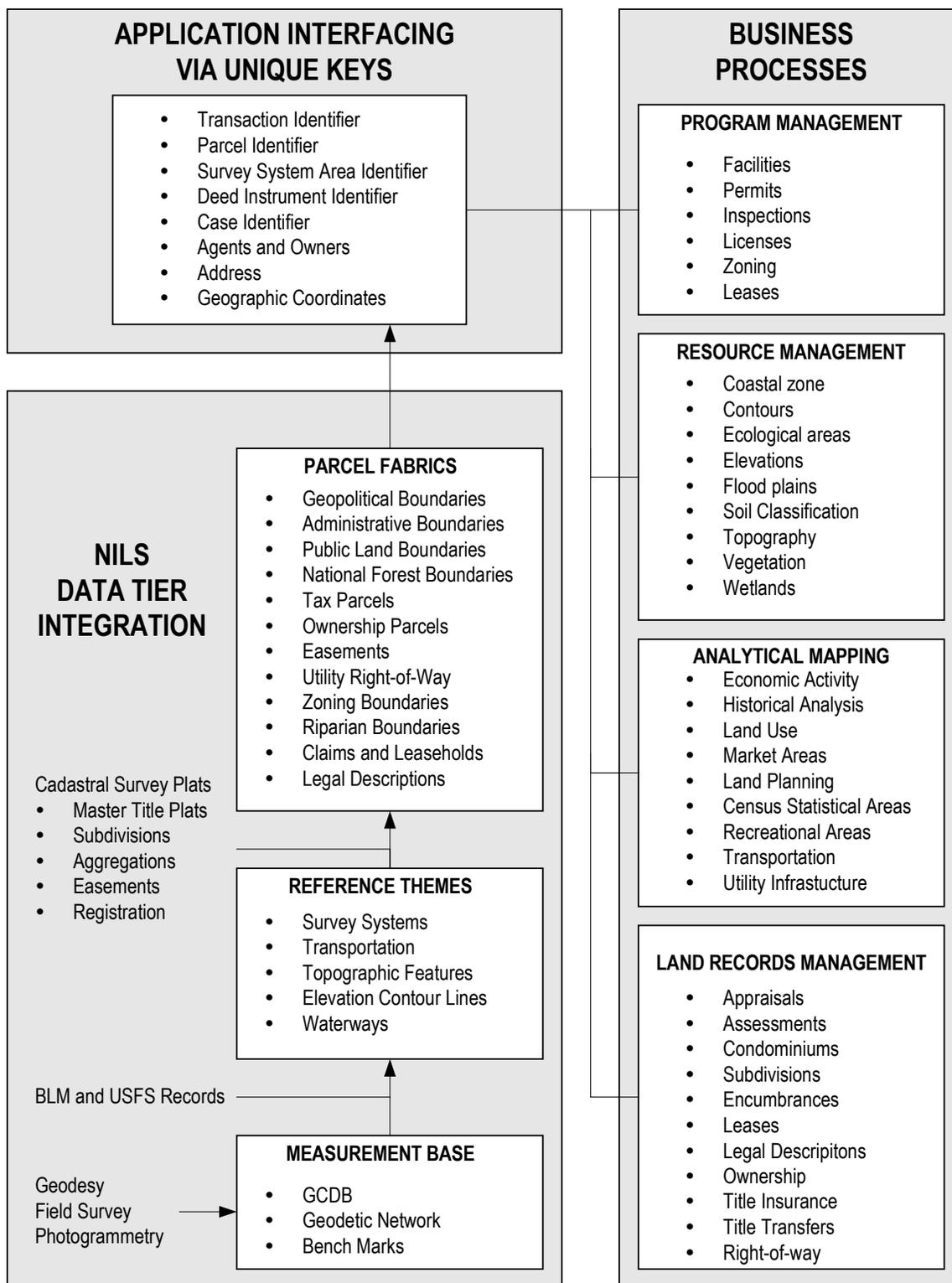
The NILS project is an initiative to develop a common solution for BLM and the Forest Service and their partners for the business processes involved with the management of cadastral land records (see the business process summary in Figure 2.3). Because these business processes have much in common with those of the larger survey and land management community and the BLM and Forest Service are committed to working in partnerships, the NILS project is a cooperative venture. NILS will implement the Federal Geographic Committee's Cadastral (FGDC) Data Content Standard, while contributing to the National Spatial Data Infrastructure (NSDI). The BLM is managing the NILS Project using the Managed Evolutionary Development (MED) methodology, which is a phased development process. An overview of this process is included in Section 6.0.

The BLM is in the process of developing a bureau-wide architecture to provide the framework for all information technology investments. This framework includes conducting business process analysis for BLM's core business functions. The NILS Project is conducting the business process analysis for the core business functions for providing land and resource title information. These functions fit into the larger scheme of BLM's other business processes (as depicted in Figure 2.4). Other land management agencies and organizations have similar business processes, and the NILS business processes fit into these in a similar fashion.

Figure 2.3. Summary of NILS Business Process Use Cases

| | |
|---|-------------------------------|
| <p style="text-align: center;">General Requirements</p> <ul style="list-style-type: none"> • Manage Data Transformation • Make Formatted Output • Compare/Contrast Data • Reconstruct Historical Version of Data • Administer Data Access Rights • Audit Workflow Process | SYSTEM |
| <p style="text-align: center;">Research</p> <ul style="list-style-type: none"> • SM-01 Survey Research <hr/> <p style="text-align: center;">Capture Survey Readings and Observations</p> <ul style="list-style-type: none"> • SM-02 Pre-Field Survey Setup • SM-03 In-Field Survey Setup • SM-04 Collect Field Data Observations • SM-05 Perform COGO and Layout | SURVEY MANAGEMENT |
| <p style="text-align: center;">Analyze Survey Data and Construct Measurements</p> <ul style="list-style-type: none"> • MM-01 Construct Measured Feature • MM-02 Adjust Analyze Measurement Network • MM-03 Edit Measurement Data | MEASUREMENT MANAGEMENT |
| <p style="text-align: center;">Identify and Verify Legal Descriptions</p> <ul style="list-style-type: none"> • PM-01 Verify Parcel <hr/> <p style="text-align: center;">Add, Create, Construct Legal Descriptions</p> <ul style="list-style-type: none"> • PM-02 Construct Legal Description <hr/> <p style="text-align: center;">Manage Legal Description Fabric (resolve gaps and overlaps)</p> <ul style="list-style-type: none"> • PM-03 Edit Legal Description Fabric • PM-04 Re-Adjust Fabric <hr/> <p style="text-align: center;">Construct Parcels from Legal Description Components</p> <ul style="list-style-type: none"> • PM-05 Edit Parcel Fabric • PM-06 Edit Parcel Annotation | PARCEL MANAGEMENT |
| <p style="text-align: center;">GeoCommunicate</p> <ul style="list-style-type: none"> • GC-01 Conduct Search • GC-02 Browse Search Results • GC-03 Submit Event • GC-06 Submit Data • GC-10 Post Comment <hr/> <p style="text-align: center;">Manage Communications</p> <ul style="list-style-type: none"> • GC-04 Manage Event Notification Process • GC-05 Manage Provider Account • GC-07 Manage Subscriber Account • GC-08 Manage Data Process • GC-09 Manage Accounts • GC-11 Manage Forums | GEOCOMMUNICATOR |

Figure 2.4. The Context of the NILS Business Processes
 The NILS business processes fit into a larger context of land and resource management business processes



2.6 The Field-to-Fabric Concept

A central goal of NILS is that users would have the tools to manage land records and cadastral data in a Field-to-Fabric manner. This concept implies the fundamental goal of developing a common data model that unifies the worlds of Surveying and GIS. This unification concept is fundamental for land records managers and maintainers of cadastral mapping databases as they strive to improve the accuracy and quality of their data.

One prevailing pattern in the management of land records and cadastral data is that the accuracy of maps can be enhanced using new data acquired by more accurate techniques. As new surveys translate into legal descriptions and subdivision plats, map maintainers can use these new measurements as a source of control for their maps. The professional community of land surveyors and land records managers require better tools to find and extract data from a GIS, to use that data to prepare for and to complete a field survey, and to incorporate the new survey data as improved control to enhance the GIS.

The geographic representation of cadastral data is often managed as a series of maps (e.g., assessor map books, master title plats). Using GIS tools, these maps may be automated (digitally converted) and managed in a digital drawing environment. (See Figure 2.5) One of the desired characteristics of such maps is that all the map sheets may be combined into a single geographic representation, often called a map layer. A **fabric** refers to a map layer of features that share geometry at common nodes (corners) and along common edges (boundaries) in a topological structure. (See Figure 2.6) When features in a fabric are edited, a change to a geometric element (i.e., a point, line or area feature) affects the shape of all features that are topologically tied to the edited feature. Fabrics may be constrained to manage a seamless coverage of the land area (i.e. no gaps or overlaps).

There are many possible types of fabrics. A fundamental data model for NILS would include a common **fabric object** (super-class) that can be extended to handle various tiers of infrastructure depicting the cadastral (land) data. These tiers would include specific fabrics that contain control features, measurement features, surveyed coordinates, land boundaries, terrain features, land descriptions and constructed land units (parcels) as necessary to manage and display land use, land rights and land ownership. Common tools, properties, rules, and behaviors are needed to manage land from the fieldwork to the building and managing of the parcel fabrics.

Figure 2.5. Managing Cadastral Land Data

SPATIAL DATA:**CONTROL NETWORK**

(geodetic reference; section corners; reference points)

OWNERSHIP BOUNDARIES

(from measured points; traverses; legal descriptions)

PARCELS

(ownership/legal; fiscal/tax)

EASEMENTS AND RIGHTS-OF-WAY

(public/utility; private rights of access [2D] and/or exploitation [3D air/mineral/water/etc.])

COMPLEX FEATURES

(condominiums; mobilehomes; leasehold; administrative districts)

GRAPHICS

(leader arrows; tie-bars)

ANNOTATION

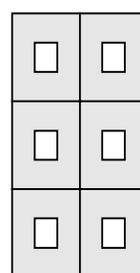
(bearing; distance; parcel identifier; notes)

PLANIMETRIC/TOPOGRAPHIC BASE**IMAGE DATA:**

ORTHOPHOTOGRAPHY
 SATELLITE IMAGES
 SCANNED/DIGITAL DOCUMENTS/
 PHOTOGRAPHS

TABULAR DATA:

LAND TRANSACTION INFORMATION
 OWNERSHIP/ADDRESS DATA
 VALUATION DATA & TAX ROLLS

**FILES**

TAX BOOKS
 PLATS
 PARCEL MAPS
 RECORD OF SURVEYS
 TAX RATE AREA CHANGES
 SUBDIVISION INDEX
 MICROFILM RECORDS
 PARCEL IDENTIFIER
 CONTROL
 TRANSMITTALS

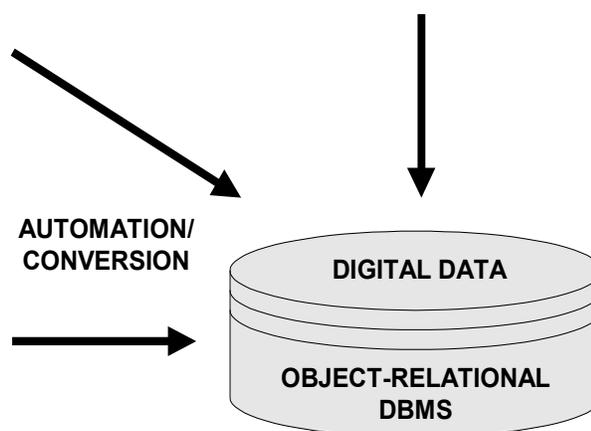
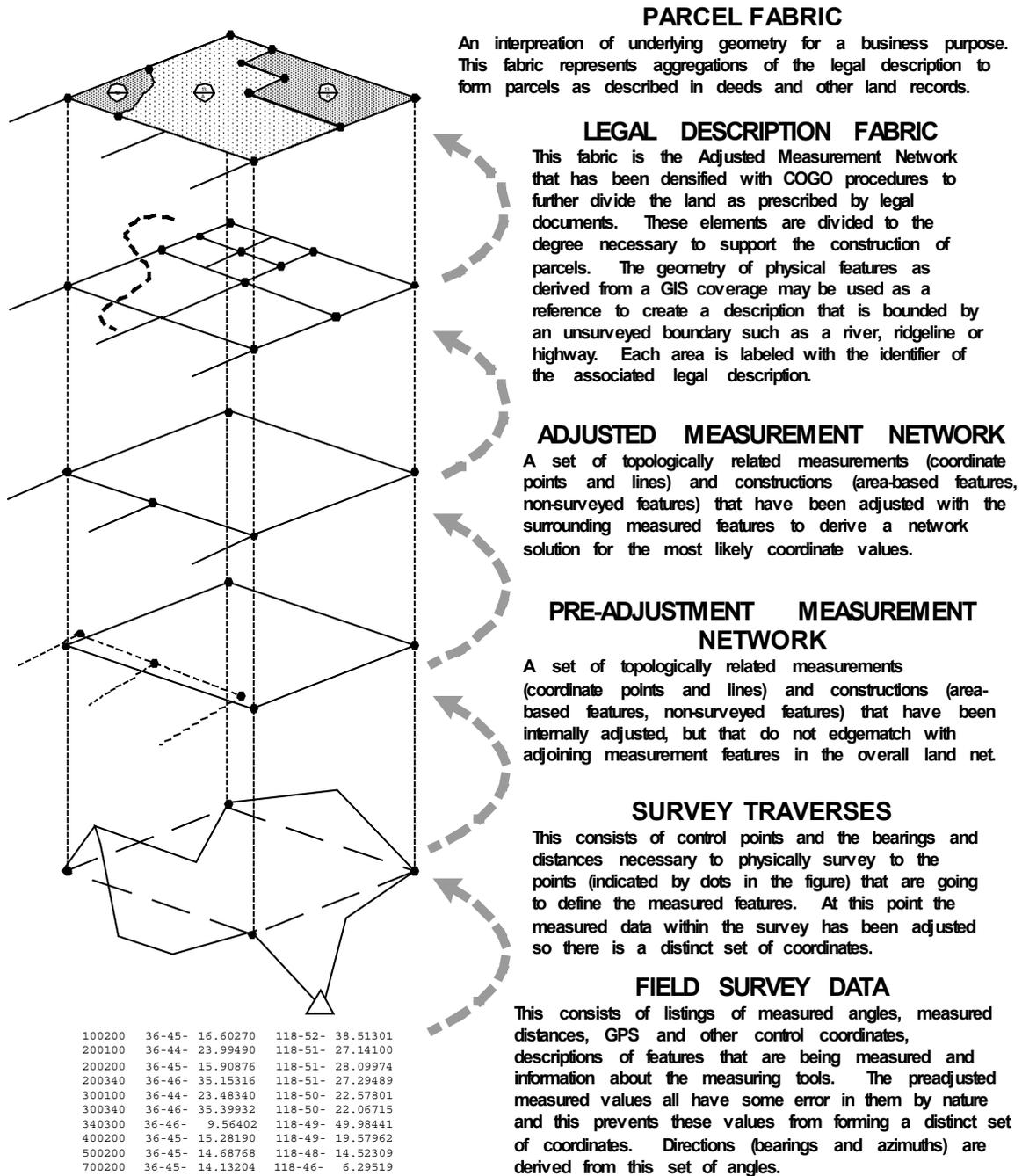


Figure 2.6 Multi-Tiered Fabric



2.7 Summary of NILS Business Process Components

The National Integrated Land System (NILS) is a joint project between the BLM and the USDA Forest Service in partnership with the states, counties, and private industry to provide business solutions for the management of cadastral records and land parcel information in a Geographic Information System (GIS) environment. The goal of NILS is to provide a process to collect, maintain, and store parcel-based land and survey information that meets the common, shared business needs of land title and land resource management. The Forest Service and BLM's vision is to make parcel-based land information available for managers, specialists and the public in an organized automated system. A fast, easy, user-friendly automated national integrated land system will provide both agencies, our partners and the public with better tools for efficient multiple-use management of the national forest and public lands.

The NILS concept would provide the user with tools to manage land records and cadastral data in a Field-to-Fabric manner. The user would be able to use field survey measurement data directly from the survey measuring equipment, manipulate this data into lines and points, and create legal land and parcel descriptions to be used in mapping and land record maintenance. Data and information would be accessible via the Internet for research and analysis.

This concept implies the development of a common data model that unifies the worlds of surveying and GIS. This unification concept is fundamental for land records managers and maintainers of cadastral mapping databases to improve the accuracy and quality of the data to create standard land descriptions and cadastral data that can be used by anyone.

NILS is intended to provide a common data model and tools to manage land records as described in the following system component overviews:

- **Common Cadastral (land) Data Model**—Data model built upon the FGDC Cadastral Content Standard, enhanced to meet the core functional requirements of the NILS partnerships. The model would contain feature object classes representing the properties, rules, and behaviors of cadastral entities, and designed as an open and extensible format to facilitate both generalization and customization.
- **Survey Management Process**—An integrated set of automation objects that are embedded into compatible survey data collection software packages to support the capture of measurement features and metadata into a database format. The goal of the Survey Management Process is to minimize the need for data conversion and reconstruction as measured features are incorporated into the land records management system.
- **Measurement Management Process**—Produce a new feature coordinate solution by performing a weighted planimetric-geodetic adjustment according to the qualitative characteristics of individual feature elements in the working set. The Measurement Management Process enables users to create a higher-quality, control network database for the Public Land Survey System (PLSS) and the non-Rectangular Survey System (metes and bounds), relying upon much of the feature and functionality inherent in the GCDB Measurement Management system (GMM).

- **Parcel Management Process**—A process for managing land records and cadastral feature data stored in the database model, providing custom feature classes, tools, and procedures for editing land records in a transactional, history tracking environment. Users would be able to customize the Parcel Management process to accommodate their established workflow and business processes.
- **GeoCommunicator**—A proactive Internet subscription process for sharing access to data stores and to planned and existing program project activities in cadastral and realty to facilitate collaborative capabilities and data sharing.