



Synchronization in ArcCatalog™

An ESRI® Technical Paper • August 2001

Copyright © 2001 ESRI
All rights reserved.
Printed in the United States of America.

The information contained in this document is the exclusive property of ESRI. This work is protected under United States copyright law and other international copyright treaties and conventions. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or by any information storage or retrieval system, except as expressly permitted in writing by ESRI. All requests should be sent to Attention: Contracts Manager, ESRI, 380 New York Street, Redlands, CA 92373-8100, USA.

The information contained in this document is subject to change without notice.

U.S. GOVERNMENT RESTRICTED/LIMITED RIGHTS

Any software, documentation, and/or data delivered hereunder is subject to the terms of the License Agreement. In no event shall the U.S. Government acquire greater than RESTRICTED/LIMITED RIGHTS. At a minimum, use, duplication, or disclosure by the U.S. Government is subject to restrictions as set forth in FAR §52.227-14 Alternates I, II, and III (JUN 1987); FAR §52.227-19 (JUN 1987) and/or FAR §12.211/12.212 (Commercial Technical Data/Computer Software); and DFARS §252.227-7015 (NOV 1995) (Technical Data) and/or DFARS §227.7202 (Computer Software), as applicable. Contractor/Manufacturer is ESRI, 380 New York Street, Redlands, CA 92373-8100, USA.

ESRI, ArcView, PC ARC/INFO, and the ESRI globe logo are trademarks of ESRI, registered in the United States and certain other countries; registration is pending in the European Community. ArcCatalog, ArcInfo, ArcStorm, ArcSDE, ArcInfo Librarian, and ArcGIS are trademarks and @esri.com and www.esri.com are service marks of ESRI.

The names of other companies and products herein are trademarks or registered trademarks of their respective trademark owners.

Synchronization in ArcCatalog

An ESRI Technical Paper

Contents	Page
About This Document.....	1
Items for Which This Document Doesn't Apply.....	1
Items for Which Metadata Is Not Supported	1
Items for Which Metadata Can't Be Automatically Created and Updated.....	2
Metadata Standards.....	3
The Notation Used in This Document	4
ArcCatalog's Metadata Template.....	5
Creating and Updating Metadata	5
Creating Metadata.....	5
Modifying Metadata.....	6
Synchronizing Metadata	6
Turning Off Synchronization for One Item	7
Managing Synchronization for Individual Metadata Elements.....	7
Documentation Hints	8
Elements That Are Added for All Items.....	9
Metadata Standard Information	10
Information Derived from the Operating System	10
Item Name and Format	10
Horizontal Extent	11
Additional Information Added to Some Items.....	11
Items for Which the Remainder of This Document Applies	11
Type of Data	12
Item Location	12

Contents	Page
Item Size	13
Extent	13
Horizontal Extent	13
Vertical Extent	14
Spatial Reference	14
Coordinate System Name	15
Geodetic Model.....	16
Geographic Data	16
Planar Data.....	16
Planar Data—Map Projections	17
Planar Data—Grid Coordinate Systems	18
Vertical Coordinate System Information	19
Point and Vector Data.....	20
Shapefiles.....	21
Coverages.....	21
Geodatabase Feature Classes, Feature Datasets, and Geometric Networks.....	22
TIN Datasets	22
PC ARC/INFO Coverages	23
CAD Drawings.....	23
VPF Coverages	23
Raster Data.....	24
Geometric Networks	25
Attributes.....	26
Geodatabase Feature Classes and Tables.....	27
Shapefiles and dBASE Tables	29
Coverages and INFO Tables.....	30
Raster Datasets and Raster Catalogs.....	31
PC ARC/INFO Coverages	31
CAD Drawings.....	32
VPF Coverages	32
Subtypes.....	32
Relationship Classes	33
Coverage Relationship Classes.....	34

Contents	Page
Geodatabase Relationship Classes	34
Associated Objects.....	35
Summary of Metadata Support for All Items	36
Items for Which Synchronization Is Supported.....	36
Items for Which Synchronization Is Not Supported.....	37
Appendix A—Changes in Synchronization at 8.1	38

Synchronization in ArcCatalog

About This Document

This section of the document lists the items that you may see in ArcCatalog™ but for which metadata is not supported or whose metadata support is limited. It discusses the standards to which metadata is created by default. It also explains the notation used to refer to individual metadata elements.

Throughout this document, the term *item* refers to any object that may appear in the Catalog tree. The term *data source* may be used to refer to an item that contains data. For example, a folder is an item but not a data source, while a table is both an item and a data source.

Items for Which This Document Doesn't Apply

Metadata is supported for almost all items that you can see in ArcCatalog. Most of those items support automatic metadata creation and update. The following lists detail the items for which metadata is not supported or which support metadata but not automatic metadata updates.

Items for Which Metadata Is Not Supported

Metadata is not supported for the following items, which appear in the Catalog tree:

- Catalog (the root node of the Catalog tree)
- Database Connections folder and Add Database Connection items
- Internet Servers folder, Add Internet Server item, Internet servers, and Internet services (including map and feature services)
- Geocoding Services folder, Add Geocoding Service item, and geocoding services
- Search Results folder and saved searches
- Coordinate Systems folder
- OLE DB Database Connections and objects within databases that are accessed via an OLE DB Database Connection
- Coverage, ArcInfo Librarian™ and ArcStorm™ databases accessed through ArcSDE™ for Coverages and their contents

The "top level" items in the Catalog tree are those that help to organize its contents (Catalog, Database Connections folder, Internet Servers folder, Geocoding Services folder, Search Results folder, and Coordinate Systems folder). For these items ArcCatalog always displays a specific HTML page in the Metadata tab that provides

descriptive information about the item. User-defined metadata is not supported for these items.

Metadata isn't supported at all for the items that you use to create database connections, connections to Internet servers, and new geocoding services. Metadata also isn't supported for individual Internet servers and geocoding services. When a saved search is selected in the Catalog tree the Metadata tab lists the search criteria, but user-defined metadata is not supported. When an Internet service is selected, the Metadata tab will show metadata describing the service if it is available on the Internet server.

Metadata isn't supported for items accessed through an OLE DB database connection; you can neither create metadata nor read it if it exists. OLE DB database providers are primarily used to access nonspatial data stored either in relational databases or in files such as Excel Worksheets. For objects stored in a geodatabase and accessed through a spatial database connection, metadata is stored as a BLOB of XML data in the geodatabase administration table, "GDB_UserMetadata". It isn't possible to store metadata that way for all items accessed through OLE DB providers.

You can create and view metadata for coverages in ArcCatalog. However, when their data is accessed through an ArcSDE for Coverages server, you will be unable to create or view metadata for them. The ArcSDE for Coverages server does not have the capability to access and serve metadata. Because the only way to access ArcInfo Librarian and ArcStorm databases in ArcCatalog is through an ArcSDE for Coverages server, they also suffer from the same limitation.

*Items for Which
Metadata Can't Be
Automatically
Created and Updated*

For the following items you can create and update metadata manually using the metadata editor, the Metadata Properties dialog box, programmatically, or by importing existing metadata. However, automatic metadata creation and update are not supported

- Folders (e.g., folder connections and those that contain shapefiles, not folders associated with coverages, grids, and TIN datasets)
- Geodatabase (the .mdb file or database connection, not the items it contains)
- Standalone XML documents

For folders and geodatabases you may create either XML metadata like other items in ArcCatalog or a more user-friendly HTML metadata page. An HTML page may be useful for helping non-GIS staff members find the information they need on the network or for providing a high-level description of the project for which a personal geodatabase was created.

A metadata HTML page must be well formed; that is, all tags must be properly closed and there may be no syntax errors. For example, all opening tags, such as <P>, must have a corresponding closing tag </P>. In-line elements must also be closed, for example, <HR/> instead of <HR>. All values of all attributes must be enclosed by quotation marks such as . Unfortunately, most

utilities that help you create HTML pages do not generate well-formed HTML; some modification of the result in a text editor will likely be required.

Once a well-formed HTML page has been created, rename the file "metadata.htm" and place it within the appropriate folder. For geodatabases, select the geodatabase, then import the "metadata.htm" file using the "XML" importer. The values of the four ESRI® elements that are added automatically when the geodatabase's XML metadata is created (discussed in 2.1) will appear in text format at the bottom of the HTML page. These can be removed permanently using a Visual Basic for Applications (VBA) script.

Standalone XML documents are somewhat unique. Unlike metadata XML documents that are associated with a specific item, standalone XML documents appear in the Catalog tree. You can't create metadata about them with ArcCatalog, but you can modify their contents using the available metadata tools. If the root element of the XML document is not "metadata" you can still modify its contents, but you will only be able to view the file's contents with the XML stylesheet or a custom stylesheet.

You can create a new standalone XML file in ArcCatalog with a VBA script. The new XML file will have the root element "metadata" and the four ESRI elements that are added automatically when XML metadata is created (discussed in 2.1). A standalone XML document might contain a template of basic information that you add to the metadata of every data source—import the template before adding documentation that describes the specific data source with the metadata editor. A standalone XML document might contain general metadata describing a collection of coverages or detailed metadata describing an Internet service.

Metadata Standards

The metadata created automatically by ArcCatalog complies with version 2 of the Federal Geographic Data Committee's (FGDC) *Content Standard for Digital Geospatial Metadata*, which will be referred to elsewhere in this document as the FGDC standard. This document is located at <http://www.fgdc.gov/metadata/constan.html>. For example, when ArcCatalog automatically records the extent of a shapefile's features within the metadata, it places that information within the appropriate elements as defined by the FGDC standard. Additionally, the default metadata editor supplied with ArcCatalog can be used to create a complete FGDC metadata record.

ESRI has extended the FGDC standard so that metadata can be automatically maintained. It also allows new ESRI data formats, such as geometric networks, to be described in the metadata and to include information using terminology that ESRI users will find familiar. The *ESRI Profile of the Content Standard for Digital Geospatial Metadata*, which describes these extended elements, is located at <http://www.esri.com/metadata/esriprof80.html>. This document will be referred to as the ESRI Profile. When discussing specific metadata elements, the elements defined in the ESRI Profile will be clearly identified.

Despite the fact that ESRI has added additional elements, the metadata created automatically by ArcCatalog remains FGDC compliant. The FGDC standard permits profiles to be used informally by a user community; the ESRI Profile has not been formalized through the FGDC standards process. The ESRI Profile does not modify the

elements defined by the FGDC standard in any way except to extend the domain of a few specific metadata elements where appropriate. The fact that the ESRI Profile was used to create the metadata is documented within the metadata itself, and the online location of the ESRI Profile document is included in the metadata.

ArcCatalog will automatically record in the metadata as much information as possible for each different data format. The process of creating and updating metadata automatically is referred to as *synchronization*. An FGDC metadata synchronizer is used by default in ArcCatalog to create FGDC-compliant metadata. With ArcCatalog 8.1 it is possible for other agencies to customize synchronization, for example, to support other metadata standards. By developing a custom synchronizer you can define exactly what happens when ArcCatalog writes properties of an item to its metadata. Detailed information about building a custom synchronizer can be obtained from ArcOnline.

The Notation Used in This Document

Metadata created by ArcCatalog is stored in XML format. There is one XML element corresponding to each metadata element defined in the FGDC standard and the ESRI Profile. This section of the document discusses the notation used to refer to a specific element in an item's metadata.

Title elements may appear in more than one place in an item's metadata in different contexts. The FGDC standard is composed of seven main sections including Identification Information, which contains general information describing the item. The FGDC standard also has three additional sections that appear in several places throughout the standard including Citation Information. The Title element resides within the Citation Information section. The Citation Information section can occur in several places within the Identification Information section.

In the Identification Information section there is a Citation section that describes the data source itself; it contains the block of elements defined by the floating Citation Information section. Here the title of the coverage might be defined as "The geology of New Mexico". The Identification Information section also has a Cross Reference section that contains the floating Citation Information section. Here the title element would describe a related coverage such as "The geology of the United States". A notation is required to distinguish between many Title elements that are used in different contexts.

Elements in the FGDC standard and the ESRI Profile have both a long name and a short name. The short name is used as the XML tag in the metadata. All tag names and values in an XML file are case sensitive. The root element of all metadata XML documents created by ArcCatalog is "metadata". The short name for the Identification Information section is "idinfo". The short name for the Citation section within the Identification Information section is "citation". The short name for the reusable Citation Information section is "citeinfo". And finally, the short name for the Title element is "title". If the metadata only contained the title of the coverage, the XML file would look like this:

```

<metadata>-
  <idinfo>
    <citation>
      <citeinfo>
        <title>The geology of New Mexico</title>
      </citeinfo>
    </citation>
  </idinfo>
</metadata>

```

A quick way to refer to the title of the coverage is by using a "path". Similar to the path name for a file on disk, it tells how to find a specific element in the XML file when starting from the root element. When creating an XSL stylesheet, you would refer to the title of the coverage as "metadata/idinfo/citation/citeinfo/title"; XSL requires the inclusion of the root element. However, in ESRI software you would refer to this element as "idinfo/citation/citeinfo/title"; the root element is not included—this is how elements will be identified throughout this document. The metadata element's long name will appear to the right of the element's path.

ArcCatalog's Metadata Template

This section of the document describes the elements that are automatically added to metadata for all items that support automatic metadata creation and update. Effectively, this is the template used by ArcCatalog to create metadata.

Creating and Updating Metadata

Metadata is synchronized when it is viewed in the Metadata tab. The current settings determine whether or not metadata is created or existing metadata is updated when synchronization occurs. By default, ArcCatalog is set to always create metadata if it doesn't exist and update metadata if it does.

You can change these settings in the Metadata tab in the Catalog's Options dialog box. You can choose not to have metadata created automatically and not to have metadata updated automatically. For example, you may decide that you want to create metadata only for specific datasets, but once metadata has been created you always want it to be updated automatically. You can trigger synchronization manually, by clicking the Create/Update Metadata button on the Metadata toolbar, or programmatically with the `IMetadata.Synchronize` method.

When ArcCatalog automatically creates metadata, a new `XmlPropertySet` object is created and initialized, and then synchronization occurs immediately afterwards. If automatic metadata creation is turned off in ArcCatalog and metadata doesn't already exist, synchronization will not occur when metadata is created by using a metadata editor or the Metadata Properties dialog box (e.g., adding an enclosure). Metadata is never synchronized when a thumbnail is generated, even if the metadata XML document is created by that process.

Creating Metadata

When metadata is created, the following elements are added to the ESRI section, which is used by ArcCatalog to maintain metadata:

Esri/MetaID—Metadata ID (ESRI Profile)
Esri/CreaDate—Creation Date (ESRI Profile)
Esri/CreaTime—Creation Time (ESRI Profile)
Esri/SyncOnce—Synchronize Once (ESRI Profile)

The Metadata ID element is intended to provide a unique identifier for each metadata record. Its value is a globally unique identifier (GUID) that is generated by the computer.

The Creation Date and Time are the date and time when the metadata document was created by ArcCatalog or initialized programmatically. These values will never change. All dates and times that are written to the metadata by ArcCatalog are recorded in formats that adhere to the FGDC standard. Dates are written in yyyyymmdd format. Times are the local time and are written in HHMMSSSS format.

The value of the Synchronize Once element will initially be "TRUE". The value "TRUE" indicates that while metadata has been created, synchronization hasn't yet taken place.

These four elements can be added to an existing, standalone XML document using the IXmlPropertySet.InitExisting method. When metadata is created automatically by ArcCatalog or when a new XmlPropertySet object is created with Visual Basic, the resulting XML document is automatically initialized using this method (also discussed in "Items for Which Metadata Cannot Be Automatically Created and Updated").

Modifying Metadata

When metadata is modified, the following elements are added to the ESRI section if they don't already exist:

Esri/ModDate—Modification Date (ESRI Profile)
Esri/ModTime—Modification Time (ESRI Profile)

These values will be added or updated by ArcCatalog when you manually update the metadata's content using a metadata editor or the Metadata Properties dialog box, when you create or update a thumbnail, and whenever synchronization occurs. These elements are also updated by ArcCatalog when you programmatically modify metadata using the IXmlPropertySetEdit.SetProperty method.

Synchronizing Metadata

When synchronization occurs, the value of the Synchronize Once element is set to "FALSE", and the following elements are added if they don't already exist:

Esri/SyncDate—Synchronization Date (ESRI Profile)
Esri/SyncTime—Synchronization Time (ESRI Profile)

Synchronization Date and Time are updated each time the metadata is synchronized. When synchronization occurs, the modification date and time elements are also updated, and several additional elements describing the item may be added following the rules outlined in the remainder of this document.

Turning Off Synchronization for One Item

You might turn off synchronization for an individual item in ArcCatalog because the data has been published and its metadata has been finalized. To do this, check Do not automatically update metadata in the Options tab of the Metadata Properties dialog box. When you apply this change, the following element is added to the metadata:

Esri/Sync—Synchronize Automatically (ESRI Profile)

The value of the Synchronize Automatically element is set to "FALSE". If you later uncheck this option in the Metadata Properties dialog box, the value of the Synchronize Automatically element will change to "TRUE".

When the Synchronize Automatically element is present and its value is equal to "FALSE", ArcCatalog won't automatically update the metadata when you view it in the Metadata tab. However, you will not be prevented from editing the metadata in other ways, for example, by updating the thumbnail, changing enclosures, using the metadata editor, programmatically modifying the metadata, or triggering synchronization by clicking the Create/update metadata button.

Managing Synchronization for Individual Metadata Elements

XML elements may have attributes. ArcCatalog uses the "Sync" attribute to control which elements may be automatically updated by the synchronization process. XML attributes look as follows in an XML document: <title Sync="TRUE">The geology of New Mexico</title>. Each item that supports synchronization has a set of rules that govern which elements in the metadata are updated in what manner. When synchronization occurs, if the elements on that list have a Sync attribute whose value is "TRUE", their values will be updated.

Using the Title element as an example, when synchronization occurs for a shapefile, the Title element is added if it doesn't already exist. The Title element's value is set to the shapefile's name as it appears in ArcCatalog, and it will have a Sync attribute whose value is "TRUE". The next time synchronization occurs, if the selected item is a shapefile, the Title element is checked. If the Sync attribute is not present or if its value is not "TRUE", the Title won't be modified. If the Sync attribute is present and its value is equal to "TRUE", the Title element is updated with the shapefile's current name—the item may have been renamed since the last time the metadata was updated.

If you use the metadata editor to manually edit the Title, its Sync attribute is removed. The next time synchronization occurs your descriptive title won't be replaced by the item's name—ArcCatalog won't overwrite values that were typed by a person. Similarly, if you programmatically edit an element's value using either the IPropertySet.SetProperty or IXmlPropertySetEdit.SetProperty methods, the element's value is modified and the Sync attribute is removed. You can programmatically add an attribute or change its value using the IXmlPropertySet.SetAttribute method; if you use this to add the Sync attribute to the Title element and set its value to TRUE, ArcCatalog will once again update its value during synchronization.

The IXmlPropertySet.SetPropertyX method allows more control with respect to the Sync attribute when modifying an element's value. Its last parameter, "syncing", is a Boolean value. If the element's Sync attribute is "TRUE" and syncing is True, the element's value

is modified, but the attribute's value remains the same—the next time synchronization occurs, the value will be replaced. If the element's Sync attribute is not present or is not equal to "TRUE" and syncing is True, the element won't be modified—you can modify its value only if syncing is False. This is how the metadata synchronizers are able to update only specific elements in the metadata. If the element's Sync attribute is "TRUE" and syncing is False, the element's value is modified and the Sync attribute is removed.

In the developer samples provided with ArcCatalog, there are two sample applications that can be used to change which elements are synchronized: Set Synchronized Properties and Advanced Synchronization. You might use these sample tools after importing an existing metadata document if you want to choose the specific metadata elements that should be synchronized.

Documentation Hints

Several elements defined in the FGDC standard are considered mandatory for all metadata records. ArcCatalog can derive values for some of these elements from the data

itself, but others require documentation to be typed in by a person such as a description of the dataset's contents.

If the value of the Synchronize Once element is TRUE when synchronization takes place, the following mandatory documentation elements are added to the metadata if they don't already exist:

idinfo/descript/abstract—Abstract
 idinfo/descript/purpose—Purpose
 idinfo/citation/citeinfo/origin—Origin
 idinfo/citation/citeinfo/pubdate—Publication Date
 idinfo/timeperd/current—Currentness Reference
 idinfo/timeperd/timeinfo/sngdate/caldate—Calendar Date
 idinfo/status/progress—Progress
 idinfo/status/update—Update Frequency
 idinfo/keywords/theme/themekt—Theme Thesaurus
 idinfo/keywords/theme/themekey—Theme Keyword
 idinfo/acconst—Access Constraints
 idinfo/useconst—Use Constraints

metainfo/metc/ctinfo/ctorgp/ctper—Contact Person
 metainfo/metc/ctinfo/ctorgp/ctorg—Contact Organization
 metainfo/metc/ctinfo/ctaddr/addrtype—Address Type
 metainfo/metc/ctinfo/ctaddr/city—City
 metainfo/metc/ctinfo/ctaddr/state—State or Province
 metainfo/metc/ctinfo/ctaddr/postal—Postal or Zip Code
 metainfo/metc/ctinfo/ctvoice—Voice Telephone

The value of these elements is text beginning with "REQUIRED:" and followed by the FGDC standard's description (or a slightly modified version of it) for that element. These hints are intended to assist people in satisfying the minimum requirements of the FGDC

standard; they appear red in the metadata editor and as gray text when metadata is viewed using the ESRI stylesheet.

Unlike other elements that are added automatically, these will not have a Sync attribute. If you remove these elements from the metadata, they won't be added again unless the value of the Synchronize Once element is set to "TRUE" at a later date, for example, if the Synchronize Once element is removed and then the metadata is erroneously initialized again with the `IXmlPropertySet.InitExisting` method.

In the FGDC standard it is mandatory to describe the currentness of the data by completing the Time Period Information section (`timeperd`) within the Identification Information section (`idinfo`). This is accomplished by completing the Currentness Reference element and one of three sections that describe the date and time of the data in different ways. Because it's mandatory to provide one of the date sections, ArcCatalog adds the Calendar Date element within the Single Date/Time section (`sngdate`) with a general hint that the time period of the data must be described. When you provide the date information using the metadata editor you can use a different date section than the one that is added by default.

Similarly, within the Metadata Contact section (`metc`), the floating Contact Information section (`cntinfo`) requires you to provide the person and/or the organization to contact for questions regarding the metadata. Different sections are used to contain the person and organization elements to specify whether the person or the organization is the primary contact. ArcCatalog adds the Contact Organization Primary section (`cntorgp`) by default and places a hint in both the contact person and organization elements that this information must be specified. When you define the actual contact information using the metadata editor, you can switch to the Contact Person Primary section (`cntperp`) instead. You are only required to provide information for the primary contact—either the contact person or organization. Remove the hint for the other element, if appropriate.

Elements That Are Added for All Items

Several elements defined in the FGDC standard will be added to the metadata of all items that support synchronization. All of these elements will have a Sync attribute whose value is "TRUE". If these elements are removed from the metadata, they will be added again the next time synchronization occurs.

`idinfo/descript/langdata`—Language of Dataset (ESRI Profile)
`idinfo/citation/citeinfo/title`—Title
`idinfo/citation/citeinfo/ftname`—File or Table Name (ESRI Profile)
`idinfo/native`—Native Dataset Environment
`idinfo/natvform`—Native Dataset Format (ESRI Profile)
`idinfo/spdom/bounding/westbc`—West Bounding Coordinate
`idinfo/spdom/bounding/eastbc`—East Bounding Coordinate
`idinfo/spdom/bounding/northbc`—North Bounding Coordinate
`idinfo/spdom/bounding/southbc`—South Bounding Coordinate

`metainfo/langmeta`—Language of Metadata (ESRI Profile)
`metainfo/metstdn`—Metadata Standard Name
`metainfo/metstdv`—Metadata Standard Version
`metainfo/mettc`—Metadata Time Convention
`metainfo/metextns/onlink`—Online Linkage
`metainfo/metextns/metprof`—Profile Name
`metainfo/metd`—Metadata Date

Metadata Standard Information

The Metadata Standard Name, Metadata Standard Version, and Time Convention elements are added automatically to the Metadata Information section (metainfo). Their values are the name and version of the FGDC standard and the time convention supported by the metadata synchronizer that was used to update the metadata. ArcCatalog's FGDC synchronizer places the Name "FGDC Content Standards for Digital Geospatial Metadata" and the Version "FGDC-STD-001-1998" in the metadata. The Time Convention is "local time"; that is, when ArcCatalog adds time information into the metadata it will be the local time derived from the computer, not a time that is standardized to Greenwich Mean Time.

In the Metadata Extensions section (metextns), ArcCatalog records that the ESRI Profile is used to define the contents of the metadata document. The value of the Profile Name element is "ESRI Metadata Profile". The value of the Online Linkage element is <http://www.esri.com/metadata/esriprof80.html>, which is the location of the ESRI profile document on the Internet. More than one profile may be used to define the contents of a metadata document.

Information Derived from the Operating System

For the Native Dataset Environment, Language of Dataset, and Language of Metadata elements, their values are derived from the computer that was used to synchronize the metadata. In Native Dataset Environment, information about the computer's operating system and the version of ArcCatalog that is installed is recorded. Presumably this is the same operating system and version of the software with which the data was created. Similarly, the computer's language setting is used to make a guess as to the language of the dataset's attributes and its metadata. These values should be modified as appropriate.

The Metadata Date element is defined by the FGDC standard to indicate when the metadata was last updated. This element will be updated whenever the Modification Date and Time elements are updated in the Esri section as long as value of the Sync attribute for the Metadata Date element is "TRUE". If you modify the value of the Metadata Date element directly with the metadata editor, its value won't be updated automatically in the future.

Item Name and Format

Within the Citation Information section (citeinfo) within the Citation section (citation) within the Identification Information section (idinfo), the Title element will be added if it doesn't exist when synchronization takes place. The item's name as it appears in ArcCatalog such as "My Map.mxd" or "Roads" will be the default title; it should be replaced later with more descriptive information. Until then, the Title element will change when the item is renamed because its Sync attribute has the value "TRUE". The name of the item is also added to the File or Table Name element within the same section; it will continue to reflect the item's name after a descriptive title has been added.

The item's data format is recorded in the Native Dataset Format element. If metadata has been created, this value is used when searching for items in ArcCatalog by type; the value will be one of those in the Type list in the Search dialog box. If this element is not present or if its value is not in the current domain as defined by the ESRI Profile, the item

Horizontal Extent

will not be found by searches that use Type criteria even if it is of the appropriate data format.

Together, the West, East, North, and South Bounding Coordinate elements describe the geographic extent of spatial data. The FGDC standard is by definition a standard for describing geographic data. Therefore, these elements are considered mandatory and are automatically added to the metadata for all items.

The default value for these elements will be documentation hints indicating that their values are required. However, unlike the other documentation hints these elements will have the Sync attribute set to TRUE. If ArcCatalog can calculate the item's geographic extent, the hints will be replaced by the appropriate values when synchronization occurs (discussed in "Extent").

For items such as graphs, some tables, and coordinate systems that don't contain spatial data, the Bounding Coordinate elements are truly inappropriate. The ESRI Profile extends the domain of these elements to include the value "Not applicable"; replace the hints with this value using the metadata editor.

Additional Information Added to Some Items

For many items in ArcCatalog, synchronization places additional elements to those described above in the metadata.

Items for Which the Remainder of This Document Applies

The following items DO NOT have any information added to their metadata in addition to the elements discussed in "ArcCatalog's Metadata Template" in this document:

- Maps (including map templates)
- Layer files (including group layer files)
- Text files
- Coordinate systems
- Graphs
- File types (e.g., Word documents)

For example, metadata describing a layer will not contain information about the symbology used to depict the data, metadata describing a map will not contain information about the size of the map on paper, metadata for text files that contain comma-delimited values will not contain information about columns in the table, and so forth. Any additional information must be added manually.

For the following items, ArcCatalog *does* add elements to their metadata in addition to those described in "ArcCatalog's Metadata Template" in this document:

- Shapefiles and dBASE tables
- Coverages, INFO tables, and coverage relationship classes

- Geodatabase feature datasets, feature classes, geometric networks, relationship classes, and tables (both personal and ArcSDE geodatabases)
- Raster datasets (including ArcSDE rasters)
- TIN datasets
- PC ARC/INFO® coverages
- CAD Drawings
- VPF coverages and tables

The remainder of this section describes elements that are added to many of these items. For example, coordinate system information is recorded in the same way for all items that contain spatial data. The rest of this document describes the elements that are added for individual data formats. All elements described in the rest of this document will have the Sync attribute set to "TRUE".

Type of Data

The Geospatial Data Presentation Form element is added to the Citation Information section (citeinfo) within the Citation section (citation) within the Identification Information section (idinfo).

idinfo/citation/citeinfo/geomform—Geospatial Data Presentation Form

This element identifies the type of spatial data that is being documented. For example, metadata documents might be created to describe not only digital data but also atlases and paper maps. ArcCatalog uses appropriate values from the domain defined in the FGDC standard to describe the item based on its data format: vector digital data, raster digital data, remote-sensing image, or tabular digital data. If a raster dataset is a grid, the value of the Geospatial Data Presentation Form element is "raster digital data"; for all other rasters (including grid stacks), the value is "remote-sensing image".

Item Location

ArcCatalog automatically records where the item is stored using the Online Linkage element within the Citation section (citation) within the Identification Information section (idinfo).

idinfo/citation/citeinfo/onlink—Online Linkage

For items stored in files on disk, a universal resource name (URN) is used to identify the data's location. It uniquely describes the data's location on the network by including the name of the computer on which the data is stored. The URN is created as follows: "\\<computer name>\<disk>\<path>". For example, if a shapefile is stored on my computer's D-drive in a folder named "Data", its location would be "\\MYCOMPUTER\D\Data\myShapefile.shp".

CAD drawings, dBASE tables, VPF tables, and raster datasets that are not grids have their location recorded in the same way as shapefiles. For coverages, raster datasets that are grids, TIN datasets, PC ARC/INFO coverages, and VPF coverages, the path to the

appropriate coverage, grid, or TIN folder is added to the Online Linkage element. For INFO tables, the path to and name of the table's .data file in the appropriate info directory is added.

For objects stored in personal geodatabases, the URN for the Access database (the .mdb file) is added to the Online Linkage element. For items stored within an ArcSDE geodatabase, the value will be the connection information for accessing the database in the following format: "Server=serverName; Service=serviceName; Database=databaseName; User=username; Version=versionName". For an Oracle database you might see a connection string such as "Server=jazz; Service=maps; User=bob; Version=SDE.DEFAULT".

Item Size The size of the data is automatically calculated for most file-based data sources as the sum of all files that together comprise the dataset.

distinfo/stdorder/digform/digtinfo/transize—Transfer Size
distinfo/stdorder/digform/digtinfo/dssize—Dataset Size (ESRI Profile)

The only place in which this information can be recorded in the FGDC standard is in the Distribution Information section (distinfo). The dataset's size is placed in both the Transfer Size and Dataset Size elements. If you compressed a shapefile for distribution by placing it within a ZIP file, for example, you should manually change the Transfer Size element's value to reflect the size of the ZIP file using a metadata editor; its actual size when uncompressed would remain in the Dataset Size element. For items in a geodatabase, these elements will only be added for rasters—their values will be 0.000.

Extent For all items that contain geographic data, ArcCatalog calculates the data's extent and places that information in the Bounding Coordinates section (bounding) automatically (also described in "Elements That Are Added for All Items").

Horizontal Extent The FGDC standard specifies that the Bounding Coordinate elements must describe the extent of the data in decimal degrees. Therefore, the ESRI Profile has defined an additional Local Bounding Coordinates section (lboundng) within the Spatial Domain section (spdom) in which the actual bounding coordinates of the data, either in decimal degrees or projected units, can be recorded.

idinfo/spdom/lboundng/leftbc—Left Bounding Coordinate (ESRI Profile)
idinfo/spdom/lboundng/rightbc—Right Bounding Coordinate (ESRI Profile)
idinfo/spdom/lboundng/topbc—Top Bounding Coordinate (ESRI Profile)
idinfo/spdom/lboundng/bottombc—Bottom Bounding Coordinate (ESRI Profile)

For geographic data whose coordinate system and datum are defined, it's easy to get the data's extent and place that information in both the Bounding Coordinate and Local Bounding Coordinate elements.

If the data is projected and the projection has been defined, the data's actual bounding coordinates are placed in the Local Bounding Coordinates section. ArcCatalog also calculates the data's extent in decimal degrees and places that information in the

Bounding Coordinates section. The calculated extent is an approximation that will be somewhat distorted due to the transformation.

When the data's coordinate system hasn't been defined, this process is more difficult. If the data's bounding coordinates fall between 180 and 180 and between 90 and 90, ArcGIS™ software assumes that the data is geographic and that the datum is NAD27. The extent information will be added to both the Bounding Coordinates and Local Bounding Coordinates sections, and the coordinate system will be recorded in the Spatial Reference section (spref) of the metadata as "GCS_Assumed_Geographic" (discussed in "Spatial Reference").

If the data's bounding coordinates don't fall between 180 and 180 and between 90 and 90, ArcGIS software assumes that the data is projected and describes the projection as Unknown. The data's actual bounding coordinates are placed in the Local Bounding Coordinates section. However, ArcCatalog can't calculate the data's extent in decimal degrees because the transformation to use is unknown. The first time synchronization occurs after the projection has been defined, the data's extent in decimal degrees will be calculated and placed in the metadata. Because the Sync attribute is set to "TRUE" for the Bounding Coordinate elements, the documentation hints will be replaced with the correct values in decimal degrees.

A table or text file may contain geographic data such as address information or the latitude and longitude values describing point features. For these items ArcCatalog will not be able to calculate the data's extent. You should add this information to manually using the metadata editor.

Vertical Extent

For a few items, ArcCatalog can calculate the vertical extent of the data. That information is placed in the Minimum and Maximum Altitude elements within the Spatial

Domain section (spdom).

idinfo/spdom/minalti—Minimum Altitude (ESRI Profile)

idinfo/spdom/maxalti—Maximum Altitude (ESRI Profile)

The vertical extent of the data can only be calculated for shapefiles that contain z values, TIN datasets, and CAD drawings. The Minimum and Maximum Altitude elements aren't added for shapefiles that don't contain z values. However, these elements are added to all TIN datasets and CAD drawings. If a CAD drawing doesn't contain three-dimensional features, both elements will have the value 0.0.

While geodatabase feature classes can store features with z values, there is no way to discover the vertical extent of their features quickly; each individual feature would have to be examined to determine this information. For coverages and other items that have elevation information recorded in an attribute column, the data's vertical extent can be recorded manually in the Minimum and Maximum Altitude elements using the FGDC metadata editor.

Spatial Reference For all items that contain geographic data, ArcCatalog automatically records the coordinate system's parameters in the Horizontal Coordinate System Definition section (horizsys) within the Spatial Reference Information section (spref). For a few items, ArcCatalog will also record some information in the Altitude System Definition section (altsys) within the Vertical Coordinate System Definition (vertdef).

Because all feature classes residing within a geodatabase feature dataset must share the same spatial reference, that spatial reference is defined when the feature dataset is created. And because all feature classes participating in a geometric network must reside within the same feature dataset, they must share the same spatial reference. Coordinate system information is recorded in the metadata for these items even though they don't contain spatial data themselves.

Coordinate System Name

The Coordinate System Name section (cordsysn) contains descriptive names for the item's spatial reference. This section is always added into the Horizontal Coordinate System section.

spref/horizsys/cordsysn/geogcsn—Geographic Coordinate System Name (ESRI Profile)
 spref/horizsys/cordsysn/projcsn—Projected Coordinate System Name (ESRI Profile)

The names of the geographic and projected coordinate systems that are recorded in these elements are descriptive names that can be found in an item's Spatial Reference Properties dialog box. For coverages you can find this information with the Projection tab in its Properties dialog box; check the option to see Spatial Reference details.

If the data is geographic, the name for the geographic coordinate system such as "GCS_WGS_1984" or "GCS_Old_Hawaiian" is placed in the Geographic Coordinate System Name element. This name can be found in the Name text box at the top of the Coordinate System tab in the Spatial Reference Properties dialog box or at the top of the parameters list in the Coverage Properties dialog box. The Projected Coordinate System Name element is not added for geographic data.

If the data is projected, the name for the projected coordinate system such as "Clarke_1866_Albers" or "NAD_1983_StatePlane_Hawaii_4_FIPS_5104" is placed in the Projected Coordinate System Name element. As for geographic coordinate systems, this name can be found in the Name text box at the top of the Coordinate System tab in the Spatial Reference Properties dialog box or at the top of the parameters list in the Coverage Properties dialog box.

For projected coordinate systems, the name for the ellipsoid or spheroid used by the projection such as "GCS_Clarke_1866" or "GCS_North_American_1983" is placed in the Geographic Coordinate System Name element. This name can be found in the list of parameters for the spatial reference. Below the projection's parameters you'll see the heading Geographic Coordinate System; the Name of that coordinate system appears on the following line.

The Spatial Reference tab in the Properties dialog boxes for raster and TIN datasets shows the spatial reference parameters in a different format, and the Spatial Reference Properties dialog box isn't used because their coordinate system is defined in ArcInfo™ Workstation format. These coordinate system names may not be visible in the Properties dialog box for these datasets.

Geodetic Model The Geodetic Model section (geodetic) describes either the geographic coordinate system's datum or the projected coordinate system's ellipsoid or spheroid. This section is always added into the Horizontal Coordinate System section.

spref/horizsys/geodetic/horizdn—Horizontal Datum Name
spref/horizsys/geodetic/ellips—Ellipsoid Name
spref/horizsys/geodetic/semiaxis—Semi-major Axis
spref/horizsys/geodetic/denflat—Denominator of Flattening

In the list of parameters for the spatial reference, you'll see the heading Datum followed by a name such as "D_North_American_1927"; this name is placed in the Horizontal Datum Name element. Below the datum is the heading Spheroid, followed by a name such as "Clarke_1866"; this name is placed in the Ellipsoid Name element. The values for the Semi-major Axis and Denominator of Flattening elements are taken from the list of parameters below the Spheroid heading. For projected coordinate systems, the Datum will appear below the heading Geographic Coordinate System.

Geographic Data The Geographic section (geograph) is added into the Horizontal Coordinate System section if the data is geographic.

spref/horizsys/geograph/geogunit—Geographic Coordinate Units
spref/horizsys/geograph/latres—Latitude Resolution
spref/horizsys/geograph/longres—Longitude Resolution

The FGDC standard defines a specific domain for the Geographic Coordinate Units element. In the list of parameters for the spatial reference you'll see the parameter Angular Unit followed by a value. The appropriate value from the available domain is selected according to the data's angular unit. ArcCatalog will also add the Latitude and Longitude Resolution elements to the metadata, if possible. It isn't possible to derive this information for some data formats.

Planar Data The Planar section (planar) is added into the Horizontal Coordinate System section if the data is projected. Within that section, the Planar Coordinate Information (planci) section and either the Map Projection section (mapproj) or the Grid Coordinate System section (gridsys) will be added, depending on the type of coordinate system.

The following elements may be added to the Planar Coordinate Information section.

spref/horizsys/planar/planci/plance—Planar Coordinate Encoding Method
spref/horizsys/planar/planci/plancdu—Planar Distance Units
spref/horizsys/planar/planci/coordrep/absres—Abscissa Resolution
spref/horizsys/planar/planci/coordrep/ordres—Ordinate Resolution

For vector data, the value of the Planar Coordinate Encoding Method element will be "coordinate pair". For raster data, the value of the Planar Coordinate Encoding Method element will be "row and column". ArcCatalog will also add the Abscissa and Ordinate Resolution elements to the metadata, if possible. It isn't possible to derive this

information for some data formats. For raster data, these values reflect the size of a raster cell.

The Planar Distance Units element is added for vector data. The FGDC standard defines a specific domain for this element. In the list of parameters for the spatial reference you'll see the parameter Linear Unit followed by a value. The appropriate value from the FGDC domain will be used according to the data's linear unit.

Planar Data—Map Projections

The Map Projection section (mapproj) is added into the Planar section to describe map projections such as Albers Equal Area.

```
spref/horizsys/planar/mapproj/mapprojn—Map Projection Name
spref/horizsys/planar/mapproj/<projection section>/<appropriate projection parameters>
```

The FGDC standard explicitly supports several projections. Each one has a specific projection name, which is recorded in the Map Projection Name element. The name of the map projection used by the data, such as "Albers" or "Lambert_Conformal_Conic", can be found in the list of parameters for the spatial reference next to Projection. The FGDC standard name corresponding to the data's map projection, such as "Albers Conical Equal Area" or "Lambert Conformal Conic", is recorded in the Map Projection Name element.

For each map projection supported by the FGDC standard, the section corresponding to the map projection name must be added into the Map Projection section; it will contain the specific list of projection parameter elements used to describe that projection. In the list of parameters for the spatial reference, the heading Parameters is followed by the information that will be recorded in the projection parameter elements.

For example, if the data is projected using the Lambert Conformal Conic projection, the Map Projection Name element's value must be "Lambert Conformal Conic" and the Lambert Conformal Conic section (lambertc) must be added. The Lambert Conformal Conic section must contain two Standard Parallel elements and one each of the Longitude of Central Meridian, Latitude of Projection Origin, False Easting, and False Northing elements. This would appear in the metadata as illustrated below:

```
<planar>
  <mapproj>
    <mapprojn>Lambert Conformal Conic</mapprojn>
    <lambertc>
      <stdparll>value of first Standard Parallel</stdparll>
      <stdparll>value of second Standard Parallel</stdparll>
      <longcm>value of Longitude of Central Meridian</longcm>
      <latprjo>value of Latitude of Projection Origin</latprjo>
      <feast>value of False Easting</feast>
      <fnorth>value of False Northing</fnorth>
    </lambertc>
  </mapproj>
</planar>
```

ArcGIS software supports several projections that aren't defined in the FGDC standard. It accounts for this possibility by including the generic Map Projection Parameters section (mapprojp). It can contain any combination of parameter elements that are required to describe the projection. For projections such as Cassini or Loximuthal that fall into this category, an appropriate name is recorded in the Map Projection Name element; the ESRI Profile extends the domain of this element to include the names of projections supported by ArcGIS software. The appropriate projection parameter elements are added within the Map Projection Parameters section. If the data's projection were Cassini, it would be documented in the metadata as illustrated below:

```
<planar>
  <mapprojp>
    <mapprojn>Cassini</mapprojn>
    <mapprojp>
      <sfctrmer>value of Scale factor at Central Meridian</sfctrmer>
      <longcm>value of Longitude of Central Meridian</longcm>
      <latprjo>value of Latitude of Projection Origin</latprjo>
      <feast>value of False Easting</feast>
      <fnorth>value of False Northing</fnorth>
    </mapprojp>
  </mapprojp>
</planar>
```

The ESRI Profile also defines the rules that are used to describe projections that are supported by ArcGIS software but aren't defined in the FGDC standard.

Planar Data—Grid Coordinate Systems

The Grid Coordinate System section (gridsys) is added into the Planar section to describe grid systems such as Universal Transverse Mercator.

```
spref/horizsys/planar/gridsys/gridsysn—Grid Coordinate System Name
spref/horizsys/planar/gridsys/<grid section>/<grid zone number>
spref/horizsys/planar/gridsys/<grid section>/<projection section>/<appropriate projection parameters>
```

The FGDC standard supports several grid systems. Each one is associated with a specific name, which is recorded in the Grid Coordinate System Name element. If the grid system used is State Plane with the ellipsoid NAD 83, the name "State Plane Coordinate System 1983" is recorded in the Grid Coordinate System Name element.

For each grid system supported by the FGDC standard, the section corresponding to the grid system name must be added into the Grid Coordinate System section, for example, the State Plane Coordinate System section (spcs). That section will contain the appropriate grid zone number element, for example, the SPCS Zone Identifier element, and the appropriate section used to describe the grid system's projection.

Each grid system is associated with one or more map projections. For example, State Plane data may be projected with the Lambert Conformal Conic, Transverse Mercator, Oblique Mercator, or Polyconic projection depending on its geographical location. The

section and the appropriate parameter elements for that map projection will be added into the grid system's section.

If the data's grid system was UTM, the Grid Coordinate System section would appear in the metadata as follows:

```
<planar>
  <gridsys>
    <gridsysn>Universal Transverse Mercator</maprojn>
    <utm>
      <utmzone>value of Zone Number</utmzone>
      <transmer>
        <sfctrmer>value of Scale Factor at Central Meridian</sfctrmer>
        <longcm>value of Longitude of Central Meridian</longcm>
        <latprjo>value of Latitude of Projection Origin</latprjo>
        <feast>value of False Easting</feast>
        <fnorth>value of False Northing</fnorth>
      </transmer>
    </utm>
  </gridsys>
</planar>
```

When examining a dataset's properties, the information describing the grid system can be found in the name of the spatial reference rather than its list of parameters. If the value of the Projected Coordinate System Name element were "NAD_1983_StatePlane_California_IV_FIPS_0404", the grid system would be State Plane with the NAD 83 ellipsoid, and the zone number would be 404.

Vertical Coordinate System Information

For a few items, ArcCatalog adds the Altitude System Definition section (altsys) into the Vertical Coordinate System Definition section (vertdef) if their horizontal coordinate system has been defined.

spref/vertdef/altsys/altenc—Altitude Encoding Method
 spref/vertdef/altsys/altres—Altitude Resolution

This information is added for shapefiles that contain z values, all TIN datasets, and all CAD drawings that are associated with projection files. This information is not added for shapefiles that don't contain z values.

A standalone feature class within a geodatabase may or may not contain z values; if it does, vertical coordinate system information is added even though the vertical extent of its features can't be calculated. A feature dataset's spatial reference always includes a z domain; this defines the maximum and minimum z values that are permitted for all features in all feature classes within the feature dataset. The spatial reference of geometric networks and feature classes that are contained within a feature dataset is the same as the feature dataset's spatial reference. ArcCatalog records vertical coordinate system information for feature datasets and the geometric networks and feature classes they contain including individual feature classes that do not contain z values.

Because the z values are included as part of a feature's coordinates, the value of the Altitude Encoding Method element will be "Explicit elevation coordinate included with horizontal coordinates". The value of the Altitude Resolution element will be derived from the data and added to the metadata, if possible. It isn't possible to derive this information for some data formats.

Point and Vector Data

For items that contain point and vector data, ArcCatalog automatically records information about their features in the Point and Vector Information section (ptvctinf) within the Spatial Data Organization Information section (spdoinfo).

spdoinfo/direct—Direct Spatial Reference Method
 spdoinfo/ptvctinf/sdtsterm/sdtstype—SDTS Point and Vector Object Type
 spdoinfo/ptvctinf/sdtsterm/ptvctcnt—Point and Vector Object Count
 spdoinfo/ptvctinf/vpfterm/vpflevel—VPF Topology Level
 spdoinfo/ptvctinf/vpfterm/vpfinfo/vpfstype—VPF Point and Vector Object Type
 spdoinfo/ptvctinf/vpfterm/vpfinfo/ptvctcnt—Point and Vector Object Count
 spdoinfo/ptvctinf/esriterm/efeatyp—ESRI Feature Type (ESRI Profile)
 spdoinfo/ptvctinf/esriterm/efeageom—ESRI Feature Geometry (ESRI Profile)
 spdoinfo/ptvctinf/esriterm/esritopo—ESRI Topology (ESRI Profile)
 spdoinfo/ptvctinf/esriterm/efeactnt—ESRI Feature Count (ESRI Profile)
 spdoinfo/ptvctinf/esriterm/spindex—Spatial Index (ESRI Profile)
 spdoinfo/ptvctinf/esriterm/linrefer—Linear Referencing (ESRI Profile)
 spdoinfo/ptvctinf/esriterm/netwrole—Network Role (ESRI Profile)

The value of the Direct Spatial Reference Method element will be "Point" or "Vector" as appropriate.

The FGDC standard lets you describe point and vector data using either Spatial Data Transfer Standard (SDTS) or Vector Product Format (VPF) terminology. Either the SDTS Terms Description section (sdtsterm) or the VPF Terms Description section (vpfterm) will be added within the Point and Vector Information section depending on the type of terminology used. In practice, all data formats except VPF are described using SDTS terminology.

Within the SDTS Terms Description section, the SDTS Point and Vector Object Type element describes the type of features that the item contains. The appropriate SDTS feature type term is recorded in this element based on the data format and the type of features the item contains. The number of features contained by the item is placed in the Point and Vector Object Count element. The SDTS Terms Description section will repeat once for each feature class in the coverage, CAD drawing, feature dataset, or geometric network.

Within the VPF Terms Description section, the VPF Topology Level element describes the level of topology that is maintained between a VPF coverage's feature classes. A value of 0 indicates point topology, the values 1 and 2 reflect different levels of linear topology, and 3 indicates polygon topology. One VPF Point and Vector Object Information section (vpfinfo) will be added into the VPF Terms Description section for each feature class in the coverage. Within the VPF Point and Vector Object Information section, the value of the VPF Point and Vector Object Type element reflects the type of

features contained in the feature class. The number of features contained by the feature class is placed in the Point and Vector Object Count element.

Because both the SDTS and VPF descriptions are very general, the ESRI Profile defines the ESRI Terms Description section (esriterm). It provides a detailed description of the data using terminology that will be more familiar to ESRI software users. This section will repeat once for each feature class in the coverage, CAD drawing, feature dataset, or geometric network.

Within the ESRI Terms Description section, the number of features is recorded in the ESRI Feature Count element. The Linear Referencing element's value indicates whether or not the feature coordinates have measures, and the Spatial Index element indicates whether or not a spatial index exists for the data. The ESRI Feature Geometry element describes the type of features that the item contains. In contrast, the ESRI Feature Type element is used to describe a feature's behavior; by definition, features with complex behavior can only exist within a geodatabase. The ESRI Topology element indicates whether or not topology is maintained. The Network Role element is added for feature classes that participate in a geometric network to describe the role that the feature class plays.

Because the ESRI Terms Description, SDTS Terms Description, and VPF Point and Vector Object Information sections are repeating, the element for each of these sections will have the XML attribute Name. Its value will be the name of the shapefile or feature class, for example, <esriterm Name="cities"> or <sdstern Name="route.rivers">. This clearly identifies the feature class with which each section is associated.

Shapefiles

Within the SDTS Terms Description section, a point shapefile would have the SDTS Point and Vector Object Type "Entity point". For multipoint, polyline, and polygon shapefiles the values would be "Composite object", "String", and "G-polygon", respectively.

Within the ESRI Terms Description section, the value of the ESRI Feature Geometry element will be one of Point, Multipoint, Polyline, or Polygon. Because shapefiles contain simple features, the value of the ESRI Feature Type element will be Simple. Because shapefiles do not have topology, the value of the ESRI Topology element will be FALSE. The Spatial Index element's value will be TRUE if a spatial index exists. The Linear Referencing element's value will be TRUE if the feature coordinates have m values.

Coverages

There will be one SDTS Terms Description section and one ESRI Terms Description section for each feature class in the coverage.

Within the SDTS Terms Description section, a point feature class in a coverage would have the SDTS Point and Vector Object Type "Entity point". For point, arc, polygon, label, tic, node, route, region, or annotation feature classes the value would be "Entity point", "Complete chain", "GT-polygon composed of chains", "Label point", "Point", "Node, planar graph", "Composite object", "Composite object", or "Label point", respectively.

Within the ESRI Terms Description section, the value of the Feature Geometry element reflects the type of feature class: Point, Arc, Polygon, Label, Tic, Node, Region, Route, or Annotation. Because coverages contain simple features, the value of the ESRI Feature Type element will be Simple. The value of the ESRI Topology element will be TRUE if topology has been generated for the feature class. The value of the Spatial Index element will be TRUE if a spatial index has been created. The Linear Referencing element's value will be TRUE for route feature classes.

Geodatabase Feature Classes, Feature Datasets, and Geometric Networks

There will be one SDTS Terms Description section and one ESRI Terms Description section for each feature class in the feature dataset or for each feature class that participates in the geometric network.

Within the SDTS Terms Description section, geodatabase feature classes use the same terminology as shapefiles. The SDTS Point and Vector Object Type will have the value "Entity point", "Composite object", "String", or "G-polygon" for point, multipoint, polyline, or polygon feature classes, respectively.

Within the ESRI Terms Description section, feature classes containing simple features will have the value Simple in the ESRI Feature Type element, and one of the values Point, Multipoint, Polyline, or Polygon in the ESRI Feature Geometry element. Annotation and Dimension features are complex; the value of the ESRI Feature Type element will be Annotation or Dimension, and the value of the ESRI Feature Geometry element will be the type of geometry that is associated with the feature class. Feature classes that participate in a geometric network contain complex features; the ESRI Feature Type element will have the value Simple Junction, Complex Junction, Simple Edge, or Complex Edge, and the value of the ESRI Feature Geometry element will be Point or Polyline, as appropriate.

The value of the ESRI Topology element will be TRUE for feature classes that participate in a geometric network. The Spatial Index element's value will be TRUE for all feature classes; a spatial index is always created when the feature class is created. The Linear Referencing element's value will be TRUE if the feature coordinates have m values. Feature classes in a geometric network will also have the Network Role element. Only junction feature classes may have an ancillary role in the network; they will have the value "Source Sink" where appropriate.

TIN Datasets

There will be one SDTS Terms Description section and one ESRI Terms Description section for each of the feature classes that together describe a TIN surface.

Within the SDTS Terms Description section, the SDTS Point and Vector Object Type element will have the value "Ring composed of chains", "Node, planar graph", or "Link" for triangle, node, or edge feature classes, respectively.

Within the ESRI Terms Description section, the value of the ESRI Feature Geometry element reflects the type of features contained in each feature class: Triangle, Node, or Edge. The ESRI Feature Type element will not be added, the value of the ESRI Topology and Spatial Index elements will be TRUE, and the value of the Linear Referencing element will be FALSE.

PC ARC/INFO Coverages

There will be one SDTS Terms Description section and one ESRI Terms Description section for each feature class in the coverage.

Within the SDTS Terms Description section, PC ARC/INFO coverages use the same terminology as shapefiles. For point, arc, polygon, label, tic, or annotation feature classes, the SDTS Point and Vector Object Type element will have the value "Entity point", "String", "G-polygon", "Entity point", "Entity point", or "String", respectively.

Within the ESRI Terms Description section, the value of the ESRI Feature Geometry element will be Point, Polyline, or Polygon according to the type of feature class; Annotation feature classes will have the value Polyline. Because PC ARC/INFO coverages contain simple features, the value of the ESRI Feature Type element will be Simple. The value of the ESRI Topology element will be FALSE. The value of Spatial Index element will be TRUE if a spatial index has been created. The Linear Referencing element's value will be FALSE.

CAD Drawings

A CAD drawing has two representations in the Catalog tree: a CAD dataset and a CAD drawing. Only the CAD dataset is described in the metadata; it has point, polyline, polygon, and annotation feature classes that represent all features in the drawing of that type. Each feature class appears in the Catalog tree and is described in the metadata even if the drawing doesn't contain any of those features—the feature count for an empty feature class is zero.

Within the SDTS Terms Description section, CAD datasets use the same terminology as shapefiles. The SDTS Point and Vector Object Type element will have the value "Entity point", "String", "G-polygon", or "Entity point" for point, polyline, polygon, or annotation feature classes, respectively.

Within the ESRI Terms Description section, the value of the ESRI Feature Geometry element will be Point, Polyline, or Polygon according to the type of feature class; Annotation feature classes will have the value Point. Because CAD drawings contain simple features, the value of the ESRI Feature Type element will be Simple. For all feature classes, the value of the ESRI Topology, Spatial Index, and Linear Referencing elements will be FALSE.

VPF Coverages

A VPF coverage is more like a geodatabase feature dataset than an ArcInfo coverage—it represents a general theme or subject. It can contain many feature classes that represent different aspects of that theme. For example, a transportation coverage might contain feature classes representing airports, helicopter landing pads, bridges, tunnels, harbors, lighthouses, railways, roads, and trails. There will be one ESRI Terms Description section and within the VPF Terms Description section there will be one VPF Point and Vector Object Information section for each feature class in the coverage.

Within the VPF Terms Description section, the VPF Point and Vector Object Type element will have the value Node, Edge, or Face for point, polyline, or polygon feature classes, respectively; annotation feature classes will have the value Node.

Within the ESRI Terms Description section, the value of the ESRI Feature Geometry element will be Point, Polyline, or Polygon as appropriate; annotation feature classes will have the value Point. Because shapefiles contain simple features, the value of the ESRI Feature Type element will be Simple. For all of the feature classes, the value of the ESRI Topology, Spatial Index, and Linear Referencing elements will be FALSE.

Raster Data

For all raster datasets, ArcCatalog automatically records information about the raster data in the Spatial Data Organization Information section (spdoinfo). The Raster Information section (rastinfo) occurs once in the metadata—it describes the entire raster dataset.

spdoinfo/direct—Direct Spatial Reference Method
spdoinfo/rastinfo/rasttype—Raster Object Type
spdoinfo/rastinfo/rastdtyp—Raster Display Type (ESRI Profile)
spdoinfo/rastinfo/rowcount—Row Count
spdoinfo/rastinfo/colcount—Column Count
spdoinfo/rastinfo/vrtcount—Vertical Count
spdoinfo/rastinfo/rastxsz—Cell Size X Direction (ESRI Profile)
spdoinfo/rastinfo/rastysz—Cell Size Y Direction (ESRI Profile)
spdoinfo/rastinfo/rastorig—Raster Origin (ESRI Profile)
spdoinfo/rastinfo/rastband—Number of Bands (ESRI Profile)
spdoinfo/rastinfo/rastbpp—Bits Per Pixel (ESRI Profile)
spdoinfo/rastinfo/rastplyr—Pyramid Layers (ESRI Profile)
spdoinfo/rastinfo/rastifor—Image Format (ESRI Profile)
spdoinfo/rastinfo/rastcmap—Image Colormap (ESRI Profile)
spdoinfo/rastinfo/rastcomp—Compression Type (ESRI Profile)

For all raster datasets the value of the Direct Spatial Reference Method element will be "Raster".

Some elements reflect properties of the individual raster dataset. The Row and Column Count elements describe the number of cells in the Y and X directions, respectively. The Vertical Count element is used to describe the number of cells in the Z direction for volumetric rasters (voxels); its value will always be 1. The X and Y Cell Size elements together represent the area on the earth's surface represented by each cell or pixel.

Other elements reflect properties of the raster's data format. The Image Format element records the data format itself such as "Windows Bitmap" or "ESRI GRID". The Bits Per Pixel element contains the number of bits used to record each value in the raster. The value of the Compression Type element indicates the type of compression used by the data format such as "JPEG" or "None". The value of the Raster Origin element will always be "Upper Left".

The Number of Bands element records how many raster bands are contained in the raster dataset. The value of the Pyramid Layers element will be TRUE if pyramids have been created. The value of the Image Colormap element will be TRUE if the raster has a colormap. Sometimes these values reflect a property of the data format rather than the individual raster dataset.

In two elements, different values are expected for items that contain remotely sensed images rather than general raster data. In practice, this means that rasters that are grids will have different values in these elements than for all other rasters (including grid stacks). The Raster Object Type element will have the value Grid Cell for grids and Pixel for other rasters; lattices may be better described using the value Point. The Raster Display Type element will have the value "matrix values" for grids and "pixel codes" for other rasters. If this information isn't correct, for example, if a grid contains a remotely sensed image, these values should be modified with the metadata editor.

Raster catalogs are represented as ordinary tables in ArcCatalog. When you create metadata for a raster catalog you get the same metadata as you would for other tables of the same format, for example, INFO tables or text files. The metadata will not include any raster information; however, this information may be added using a metadata editor.

Geometric Networks

The rules that define a geometric network are described in the Network Information section (netinfo) within the Spatial Data Organization Information section (spdoinfo).

spdoinfo/netinfo/nettype—Network Type (ESRI Profile)
 spdoinfo/netinfo/connrule/ruletype—Rule Type (ESRI Profile)
 spdoinfo/netinfo/connrule/rulecat—Rule Category (ESRI Profile)
 spdoinfo/netinfo/connrule/rulehelp—Rule Help (ESRI Profile)
 spdoinfo/netinfo/connrule/rulefeid—From Edge Feature Class (ESRI Profile)
 spdoinfo/netinfo/connrule/rulefest—From Edge Subtype (ESRI Profile)
 spdoinfo/netinfo/connrule/ruleteid—To Edge Feature Class (ESRI Profile)
 spdoinfo/netinfo/connrule/ruletest—To Edge Subtype (ESRI Profile)
 spdoinfo/netinfo/connrule/ruledjid—Default Junction Feature Class (ESRI Profile)
 spdoinfo/netinfo/connrule/ruledjst—Default Junction Subtype (ESRI Profile)
 spdoinfo/netinfo/connrule/rulejunc/junctid—Available Junction Feature Class (ESRI Profile)
 spdoinfo/netinfo/connrule/rulejunc/junctst—Available Junction Subtype (ESRI Profile)
 spdoinfo/netinfo/connrule/ruleeid—Edge Feature Class (ESRI Profile)
 spdoinfo/netinfo/connrule/ruleest—Edge Subtype (ESRI Profile)
 spdoinfo/netinfo/connrule/ruleemnc—Edge Minimum Cardinality (ESRI Profile)
 spdoinfo/netinfo/connrule/ruleemxc—Edge Maximum Cardinality (ESRI Profile)
 spdoinfo/netinfo/connrule/rulejid—Junction Feature Class (ESRI Profile)
 spdoinfo/netinfo/connrule/rulejst—Junction Subtype (ESRI Profile)
 spdoinfo/netinfo/connrule/rulejmnc—Junction Minimum Cardinality (ESRI Profile)
 spdoinfo/netinfo/connrule/rulejmx—Junction Maximum Cardinality (ESRI Profile)
 spdoinfo/netinfo/elemcls/roletype—Ancillary Role (ESRI Profile)
 spdoinfo/netinfo/elemcls/rolefld—Ancillary Role Attribute (ESRI Profile)
 spdoinfo/netinfo/elemcls/enabfld—Enabled Attribute (ESRI Profile)

The Network Type element indicates the type of real-world network that the geometric network represents, for example, "Utility network".

Within the Network Information section there will be one Connectivity Rule section (connrule) for each connectivity rule in the network. These rules let the geodatabase maintain topological integrity between all features in the network. The Network

Information section will also contain one Element Class section (elemcls) for each feature class that participates in the geometric network.

Within the Connectivity Rule section, three elements are always added. The Rule Type element will have the value "Junction connectivity" or "Edge connectivity". Junction connectivity rules define which edges may connect to which junction. Edge connectivity rules define which junctions may be used to connect two edges. The Rule Category element will have the value 1 or -1. The Rule Help element will always be empty.

Edge connectivity rules are described using the From-edge, To-edge, Default Junction, and Available Junction elements. The From-Edge and To-Edge elements describe the two edges that can be connected. The Default Junction elements describe which junction will be used by default to connect those edges. The Available Junction elements describe the alternate junctions that can be used. Each Feature Class and Subtype element combination identifies the specific group of features within a feature class to which the connectivity rule applies.

Junction connectivity rules are described using the Edge and Junction elements. A junction connectivity rule describes a junction subtype and an edge subtype combination that can be connected. The Edge Cardinality elements describe how many edges may connect to each junction. The Junction Cardinality elements describe how many junctions may connect to each edge.

Within the Element Class section, the Ancillary Role element indicates whether or not a feature class has an ancillary role in the network; its value may be None or Source Sink. If the role is Source Sink, the Ancillary Role Attribute element will also be added to the metadata; it indicates which attribute contains the values that define each feature's ancillary role in the network. The Enabled Attribute element indicates which attribute contains the values that determine which features are part of the network. There is no way to tell which Element Class section is associated with which feature class.

Attributes An item's entities and their attributes are described in the Entity and Attribute Information section (eainfo).

eainfo/detailed/enttyp/enttyp1—Entity Type Label
 eainfo/detailed/enttyp/enttyp2—Entity Type Type (ESRI Profile)
 eainfo/detailed/enttyp/enttypc—Entity Type Count (ESRI Profile)
 eainfo/detailed/attr/attrlabl—Attribute Label
 eainfo/detailed/attr/attalias—Attribute Alias (ESRI Profile)
 eainfo/detailed/attr/attrtype—Attribute Type (ESRI Profile)
 eainfo/detailed/attr/attwidth—Attribute Width (ESRI Profile)
 eainfo/detailed/attr/atprecis—Attribute Precision (ESRI Profile)
 eainfo/detailed/attr/attscale—Attribute Scale (ESRI Profile)
 eainfo/detailed/attr/atoutwid—Attribute Output Width (ESRI Profile)
 eainfo/detailed/attr/atnumdec—Attribute Number of Decimal Places (ESRI Profile)
 eainfo/detailed/attr/attrdef—Attribute Definition
 eainfo/detailed/attr/attrdefs—Attribute Definition Source
 eainfo/detailed/attr/attrdomv/udom—Unrepresentable Domain

One Detailed Description section (detailed) will be added to the Entity and Attribute Information section for each of the item's entities. For example, a table will only have one Detailed Description section, but a coverage will have one Detailed Description section for each feature class.

Within the Detailed Description section, an Entity Type section (enttyp) will be added to describe the entity itself. Also, one Attribute section (attr) will be added for each of the entity's columns including object identifier, geometry, and other columns that are created and maintained by ESRI software.

Within the Entity Type section, the value of the Entity Type Label element will be the entity's name. The Entity Type Type element describes what the entity is, for example, a Table or Feature Class. The Entity Type Count element records the number of objects that the entity contains, for example, rows or features. For tables, this information is essential as the number of rows it contains isn't recorded anywhere else.

Within each Attribute section, the Attribute Label and Alias elements contain the column's name and alias, respectively. The Attribute Type, Width, Precision, Scale, Output Width, and Number of Decimal Places elements are added to describe the column's data type in the manner that is appropriate for the data format. For columns that are defined and maintained by ESRI software, such as identifier and geometry columns, a description of the column will be added where possible. The Attribute Definition element describes the column, and the Attribute Definition Source element's value will be "ESRI". The Unrepresentable Domain element describes why the column's values can't be defined by a concise domain.

Because the Detailed Description section element is repeating, it will have the XML attribute Name. Its value will be the name of the entity, for example, <detailed Name="Owners"> or <detailed Name="roadscov.ratrout">. This clearly identifies the entity with which each Detailed Description section is associated.

Geodatabase Feature Classes and Tables

The value of the Entity Type Label element and the Name attribute for the Detailed Description section will be the name of the feature class or table. The Entity Type Type element's value will be Feature Class or Table, as appropriate.

For items in a geodatabase, the value of the Attribute Alias element will be the same as the column's name if an alias hasn't been defined. Columns in these items are described using the Attribute Width, Attribute Precision, and Attribute Scale elements. Width is the size of the column in bytes, Precision is the total number of digits permitted in the value, and Scale is the total number of decimal places permitted. The Attribute Type element records the column's data type using geodatabase terminology: String, SmallInteger, Integer, Single, Double, Date, or Blob. For example, an integer column might be described as follows:

```
<attr>
  <attrlabl>LAND_CODE</attrlabl>
  <attalias>Landuse code</attalias>
  <attrtype>SmallInteger</attrtype>
  <attwidth>2</attwidth>
  <atprecis>3</atprecis>
  <attscale>0</attscale>
</attr>
```

All three of the Width, Precision, and Scale elements will be added for all columns regardless of their data type; that is, for text columns the Precision and Scale elements will be added with the value zero. The Attribute Precision element's value may legitimately be zero in some cases, for example, when the column's values are stored as binary data in the database. Personal geodatabases only support binary columns; their Precision and Scale will always be zero.

Object Identifier and Geometry columns appear in the list of columns for all entities as appropriate. For example, in a geodatabase table you would see the object identifier column described as follows:

```
<attr>
  <attrlabl>OBJECTID</attrlabl>
  <attalias>OBJECTID</attalias>
  <attrtype>OID</attrtype>
  <attwidth>4</attwidth>
  <atprecis>10</atprecis>
  <attscale>0</attscale>
</attr>
```

These columns are described the same way for all data formats. Therefore, the object identifier and geometry columns for shapefiles, dBASE tables, coverages, and INFO tables will be described in the same way as they are for items stored in a geodatabase. The only differences are that the Attribute Label and Alias elements may have different names than those used within a geodatabase, and the Attribute Width and Precision elements may be zero depending on the data format. Because these columns are created and maintained by ESRI software, ArcCatalog automatically adds a description of the columns and their values where possible. For example, the object identifier and geometry columns in a shapefile will appear as follows:

```

<attr>
  <attrlabl>FID</attrlabl>
  <attalias>FID</attalias>
  <attrtype>OID</attrtype>
  <attwidth>4</attwidth>
  <attprecis>0</attprecis>
  <attscale>0</attscale>
  <attrdef>Internal feature number.</attrdef>
  <attrdefs>ESRI</attrdefs>
  <attrdomv>
    <udom>Sequential unique whole numbers that are automatically
      generated.</udom>
  </attrdomv>
</attr>
<attr>
  <attrlabl>Shape</attrlabl>
  <attalias>Shape</attalias>
  <attrtype>Geometry</attrtype>
  <attwidth>0</attwidth>
  <attprecis>0</attprecis>
  <attscale>0</attscale>
  <attrdef>Feature geometry.</attrdef>
  <attrdefs>ESRI</attrdefs>
  <attrdomv>
    <udom>Coordinates defining the features.</udom>
  </attrdomv>
</attr>

```

Feature classes in a geodatabase may have additional required columns. Polyline feature classes will have a Shape_Length column, and Polygon feature classes will have Shape_Length and Shape_Area columns that are created and maintained by ESRI software. Descriptions will be provided for these columns and their column's values.

Shapefiles and dBASE Tables

The value of the Entity Type Label element and the Name attribute for the Detailed Description section will be the name of the shapefile or table. The Entity Type element's value will be Feature Class or Table, as appropriate.

Because column aliases aren't supported for shapefiles and dBASE tables, the value of the Attribute Alias element will always be the same as the Attribute Label element. Columns in these items are described using the Attribute Width and Attribute Number of Decimal Places elements. Their values more closely resemble the terminology used in ArcView® GIS 3. In this context, Width is the total number of digits permitted in the values. The Number of Decimals element is only added to the metadata when it is appropriate to do so. The Attribute Type element records the column's data type in language that will be familiar to ArcView GIS 3 users: "Number", "String", "Boolean", or "Date", where appropriate. For example, two attribute columns might be described as follows:

```

<attr>
  <attrlabl>POP1996</attrlabl>
  <attalias>POP1996</attalias>
  <attrtype>Number</attrtype>
  <attwidth>11</attwidth>
</attr>
<attr>
  <attrlabl>POP96_SQMI</attrlabl>
  <attalias>POP96_SQMI</attalias>
  <attrtype>Number</attrtype>
  <attwidth>13</attwidth>
  <atnumdec>6</atnumdec>
</attr>

```

The object identifier and geometry columns for shapefiles and dBASE tables are described using the rules described for geodatabase feature classes and tables. The name of the object identifier column will be FID for shapefiles and OID for dBASE tables.

Coverages and INFO Tables

For INFO tables, only one Detailed Description section will be added to describe the table itself. For coverages there will be one Detailed Description section for each primary feature class. For a route coverage, only columns in the Node, Arc, and Route feature classes would be described. For a region coverage, only columns in the Polygon and Region feature classes would be described. Detailed Description sections will not be added to describe the columns of Annotation, Label, and Tic feature classes.

The value of the Entity Type Label element and the Name attribute for the Detailed Description section will be the name of the INFO table such as "Owners", or the name of the feature class's attribute table. For an Arc feature class in a coverage named "roads", the value would be "roads.aat". For a Region feature class named "states" in a coverage named "country", the value would be "country.patstates". The Entity Type element's value will be Feature Class or Table, as appropriate.

For coverages and INFO tables, the Attribute Alias element will be added to the metadata only if an alternate name has been defined for the column. Columns in these items are described using the Attribute Width, Attribute Output Width, and Attribute Number of Decimal Places elements. Their values more closely resemble the terminology used in ArcInfo Workstation. In this context, Width is the total number of digits permitted in the values. The Number of Decimals element is only added to the metadata when it is appropriate to do so. The Output Width element contains the display width for the column. The Attribute Type element records the column's data type in language that will be familiar to ArcInfo Workstation users: "Float", "Number", "Integer", "Binary", "Character", or "Date", where appropriate.

The object identifier and geometry columns for coverages and INFO tables are described using the rules described for geodatabase feature classes and tables. The name of the object identifier column will be FID for coverages and OID for INFO tables. Coverages have a few columns in addition to the object identifier and geometry columns that are defined and maintained by ArcInfo such as AREA, FNODE#, and LENGTH. A description of these columns will be provided. The values will also be described for all

columns except the coverage-ID column, which by definition is a column of user-defined values. For example, the coverage# column would be described as follows:

```
<attr>
  <attrlabl>MYCOVERAGE#</attrlabl>
  <attrtype>Binary</attrtype>
  <attwidth>4</attwidth>
  <atoutwid>5</atprecis>
  <attrdef>Internal feature number.</attrdef>
  <attrdefs>ESRI</attrdefs>
  <attrdomv>
    <udom>Sequential unique whole numbers that are automatically
      generated.</udom>
  </attrdomv>
</attr>
```

Additional pseudo-columns such as \$ANGLE for point coverages are not described in the metadata.

Raster Datasets and Raster Catalogs

If a raster dataset contains integer data, a Detailed Description section may be added for each raster band. The raster band's table may contain attribute data such as a description of land cover types for a classified satellite image. Alternatively, the table may contain information about how the values in the raster band are displayed. The value of the Entity Type Label element and the Name attribute for the Detailed Description section will be the name of the raster band, for example, "Band_1". The Entity Type Type element's value will be Table.

All of a raster band's columns are described using the same rules as for geodatabase feature classes and tables. The name of the object identifier column will be ObjectID. The value of the Attribute Type element represents the geodatabase equivalent of the column's data type.

Raster catalogs are represented as ordinary tables in ArcCatalog. A table is considered to be an image catalog if it has five columns: Image, XMin, YMin, XMax, and YMax. Raster catalogs can be created in any table format such as INFO tables. A raster catalog will be documented in the metadata in the same way as for other tables of the same format.

PC ARC/INFO Coverages

For PC ARC/INFO coverages there will be one Detailed Description section for each feature class. Unlike ArcInfo coverages, Detailed Description sections will be added to describe Annotation, Label, and Tic feature classes. The value of the Entity Type Label element and the Name attribute for the Detailed Description section will be the name of the feature class, for example, "Point", "Arc", or "Label"; this is also different than for ArcInfo coverages, which record the name of the feature attribute table. The Entity Type Type element's value will be Feature Class.

All of a PC ARC/INFO coverage's columns, including the coverage columns such as LPOLY_, AREA, and COVERAGE_ID, and pseudo columns such as ANGLE for point coverages are described using the same rules as for geodatabase feature classes and

tables. The name of the object identifier column will be FID. Label and Annotation feature classes will only have the columns FID and Shape recorded in the metadata. For the Tic feature class, the columns FID, Shape, IDTIC, XTIC, and YTIC will be documented. The value of the Attribute Type element represents the geodatabase equivalent of the column's data type.

CAD Drawings

For CAD drawings there will be one Detailed Description section for each feature class in the CAD dataset. The CAD dataset has Point, Polyline, Polygon, and Annotation feature classes that represent all features of that type in the drawing. Each feature class appears in the Catalog tree and is described in the metadata even if the drawing doesn't contain any of those features—the value of the Entity Type Count element for an empty feature class is zero. The value of the Entity Type Label element and the Name attribute for the Detailed Description section will be the name of the feature class: "Point", "Polyline", "Polygon", or "Annotation". The Entity Type Type element's value will be Feature Class.

All columns in the drawing are described using the same rules as for geodatabase feature classes and tables. The name of the object identifier column will be FID. The value of the Attribute Type element represents the geodatabase equivalent of the column's data type.

VPF Coverages

For VPF coverages there will be one Detailed Description section for each feature class. The value of the Entity Type Label element and the Name attribute for the Detailed Description section will be the name of the feature class, for example, "bridge". The Entity Type Type element's value will be Feature Class.

All columns in the feature class are described using the same rules as for geodatabase feature classes and tables. The name of the object identifier column will be "id"; it appears second in the list of columns, after the geometry column, rather than first. The value of the Attribute Type element represents the geodatabase equivalent of the column's data type.

The columns in a VPF table are not documented.

Subtypes

Subtypes can be defined for objects stored in geodatabase feature classes and tables (both feature classes and tables are object classes). Each feature or record will belong to one of the subtypes. For example, subtypes of utility pole features might be metal, fiberglass, or wood.

One Subtype Information section (subtype) for each subtype will be added into the Detailed Description section (detailed) within the Entity and Attribute Information section (eainfo) that describes the object class.

eainfo/detailed/subtype/stname—Subtype Name (ESRI Profile)

eainfo/detailed/subtype/stcode—Subtype Code (ESRI Profile)

eainfo/detailed/subtype/stfield/stfldnm—Subtype Attribute Name (ESRI Profile)

eainfo/detailed/subtype/stfield/stflddv—Subtype Default Value (ESRI Profile)

eainfo/detailed/subtype/stfield/stflddd/domname—Domain Name (ESRI Profile)

eainfo/detailed/subtype/stfield/stflddd/domdesc—Domain Description (ESRI Profile)

eainfo/detailed/subtype/stfield/stflddd/domowner—Domain Owner (ESRI Profile)
 eainfo/detailed/subtype/stfield/stflddd/domfldtp—Attribute Type (ESRI Profile)
 eainfo/detailed/subtype/stfield/stflddd/domtype—Domain Type (ESRI Profile)
 eainfo/detailed/subtype/stfield/stflddd/mrgtype—Merge Rule (ESRI Profile)
 eainfo/detailed/subtype/stfield/stflddd/spltype—Split Rule (ESRI Profile)

Within each Subtype Information section, the Subtype Name and Subtype Code elements record the appropriate values. For example, in the Detailed Description section for the Poles feature class, one Subtype Information section would describe the "metal" subclass, whose code is "0". Another Subtype Information section would describe the "wood" subtype, whose code is "2".

You can specify default attribute values for objects in a subtype. For example, when you add a new wood pole feature it might have a default height value. Metal poles might have different default height values. You can also specify attribute domains that apply to objects in that subtype. For example, the height of a wood pole must be within a specific height range; metal poles would have a different height range. When a new wood pole is added, the values that can be stored in the height column will be restricted to values that fall within the domain that is appropriate for wood poles.

The Subtype Information section will contain one Subtype Attribute section (stfield) for each attribute column in which a default value or a domain was defined for that subtype. Within the Subtype Attribute section, the column's name is recorded in the Subtype Attribute Name element. If a default value has been defined for the subtype, that value is recorded in the Subtype Default Value element.

If the attribute column has a domain, an Attribute Defined Domain section (stflddd) will be added into the Subtype Attribute section. The name of the domain is recorded in the Domain Name element, a description of it is recorded in the Domain Description element, the type of column with which this domain can be associated is recorded in the Domain Type element such as "Float", and the Domain Type would be a value such as "Range".

The split and merge policies for domains specify the value that is assigned to new features that are created by splitting or merging existing features. For example, with a range, domain features that are split may have been assigned either the default values for features in that subtype, or they may get the same values as the original feature. The appropriate values are recorded in the Split Rule and Merge Rule elements. The Domain Owner element will always be present but empty.

Relationship Classes

Relationship classes explicitly define the relationship between coverages and INFO tables or between objects in a geodatabase. For example, the features in two feature classes or coverages might be linked together so that when a feature is moved in one item, the corresponding feature in the other item is also moved. Similarly, a relationship might be defined between features in an item and records in a table where the record in the table is automatically deleted when the feature is deleted.

A Detailed Description section (detailed) is added into the Entity and Attribute Information section (eainfo) to describe the relationship class. An Entity Type section (enttyp) is added into the Detailed Description section to describe the relationship class entity. A Relationship Information section (relinfo) is also added into the Detailed Description section to describe the details of the relationship.

eainfo/detailed/enttyp/enttyp1—Entity Type Label
 eainfo/detailed/enttyp/enttyp2—Entity Type Type (ESRI Profile)
 eainfo/detailed/relinfo/otfcname—Origin Name (ESRI Profile)
 eainfo/detailed/relinfo/otfcprimarykey—Origin Primary Key (ESRI Profile)
 eainfo/detailed/relinfo/otfcforeignkey—Origin Foreign Key (ESRI Profile)
 eainfo/detailed/relinfo/dtfcname—Destination Name (ESRI Profile)
 eainfo/detailed/relinfo/dtfcprimarykey—Destination Primary Key (ESRI Profile)
 eainfo/detailed/relinfo/dtfcforeignkey—Destination Foreign Key (ESRI Profile)
 eainfo/detailed/relinfo/relnccardinality—Relationship Cardinality (ESRI Profile)
 eainfo/detailed/relinfo/relnattributes—Attributed Relationship (ESRI Profile)
 eainfo/detailed/relinfo/relncomposite—Composite Relationship (ESRI Profile)
 eainfo/detailed/relinfo/relnnotificationdirection—Notification Direction (ESRI Profile)
 eainfo/detailed/relinfo/relnforwardlabel—Relationship Forward Label (ESRI Profile)
 eainfo/detailed/relinfo/relnbackwardlabel—Relationship Backward Label (ESRI Profile)

Within the Entity Type section, the value of the Entity Type Label element and the Name attribute for the Detailed Description section will be the name of the relationship class, for example, "ParcelOwners". The value of the Entity Type Type element will be "Relationship". An Entity Type Count element will not be added.

Within the Relationship Information section, the name of the origin and destination objects are recorded in the Origin Name and Destination Name elements. The Primary Key and Foreign Key elements record the columns in the origin and destination that contain the same values; these columns allow the two objects to be joined together.

Coverage Relationship Classes

The value for the Relationship Cardinality element may be "One to One" or "One to Many"; coverage relationship classes can't have many-to-many cardinality. The value for the Notification Direction will always be "None", and the values for the Attributed Relationship and Composite Relationship elements will always be FALSE; these options aren't supported for coverage relationship classes.

The Origin Primary Key element identifies the column in the origin, and the Origin Foreign Key element identifies the column in the destination that contains the same values. The Destination Primary Key element identifies the object identifier column of the destination object, and the Destination Foreign Key element will be empty.

Geodatabase Relationship Classes

The value for the Relationship Cardinality element may be "One to One", "One to Many", or "Many to Many". The value for the Notification Direction element may be "None", "Forward", "Backward", or "Both". The value for the Attributed Relationship element will be TRUE if the relationship class has attributes, and the value for the Composite Relationship element will be TRUE if it is a composite relationship.

For one-to-one and one-to-many relationships that are not attributed, the origin and destination Primary Key and Foreign Key elements are recorded in the same way as for coverage relationship classes. For many-to-many and attributed relationships, a table is created in the geodatabase. The Origin Primary Key element identifies the column in the origin, and the Destination Primary Key element identifies the column in the destination that contains the same values. The origin and destination Foreign Key elements identify the two columns in the new table that contain the same values as the primary key columns in the origin and destination.

Associated Objects

While the item itself is described in detail in the Entity and Attribute Information section (eainfo), it is sometimes necessary to list the additional objects with which the item is associated. For each associated object, an additional Detailed Description section (detailed) will be added into the Entity and Attribute Information section (eainfo); it will only contain an Entity Type section (enttyp).

eainfo/detailed/enttyp/enttyp_l—Entity Type Label
 eainfo/detailed/enttyp/enttyp_t—Entity Type Type (ESRI Profile)
 eainfo/detailed/enttyp/enttyp_c—Entity Type Count (ESRI Profile)

Within the Entity Type section, the value of the Entity Type Label element and the Detailed Description element's Name attribute will be the name of the associated item. The Entity Type Type element describes what the associated item is, and the Entity Type Count element records the number of objects that the item contains.

Metadata describing a coverage, INFO table, geodatabase feature class, or geodatabase table will include one Detailed Description section for each relationship class in which that item participates. The Entity Type Type element's value will be "Relationship". See the metadata describing the relationship class itself for details about the relationship.

Metadata describing coverage and geodatabase relationship classes includes one Detailed Description section for each of the two items that participate in the relationship. When a coverage participates in a relationship class, the Entity Type Label element and the Detailed Description section's Name attribute will be the simple name of the coverage feature class such as "polygon" rather than "mycountry.pat". The value of the Entity Type Type element will always be either "Feature Class" or "Table", and the number of features or records in the item is recorded in the Entity Type Count element. See the metadata describing the item itself for information about its attributes and subtypes.

Metadata describing geodatabase feature datasets will include one Detailed Description section for each feature class and relationship class that it contains; geometric networks that are created within a feature dataset aren't described. The value of the Entity Type Type element will either be "Feature Class" or "Relationship". For feature classes only, the number of features in the item is recorded in the Entity Type Count element.

Metadata describing geodatabase geometric networks datasets will include one Detailed Description section for each feature class that participates in the geometric network. The value of the Entity Type Type element will be "Feature Class". The number of features it contains is recorded in the Entity Type Count element.

Summary of Metadata Support for All Items

Items for Which
Synchronization Is
Supported

	Template	Type of data	Item location	Item size	Extent	Spatial reference	Point and vector data	Raster data	Geometric networks	Attributes	Subtypes	Relationship classes	Associated objects
Shapefile	x	x	x	x	x	x	x			x			
dBASE table	x	x	x	x						x			
ArcInfo coverage	x	x	x	x	x	x	x			x			x
INFO table	x	x	x	x						x			x
ArcInfo coverage relationship class	x	x										x	x
Geodatabase feature class	x	x	x		x	x	x			x	x		x
Geodatabase table	x	x	x							x	x		x
Geodatabase relationship class	x	x	x									x	x
Geodatabase feature dataset	x	x	x		x	x	x						x
Geodatabase geometric network	x	x	x		x	x	x		x				x
Raster dataset	x	x	x	x	x	x		x		x			
TIN dataset	x	x	x	x	x	x	x						
PC ARC/INFO coverage	x	x	x	x	x	x	x			x			
CAD drawing	x	x	x	x	x	x	x			x			
VPF coverage	x	x	x	x	x	x	x			x			
VPF table	x	x	x	x									
Map	x												
Layer file	x												
Text file	x												
Coordinate system	x												
Graph	x												
File type	x												

Items for Which
Synchronization Is
Not Supported

	No metadata support	Static HTML page shown	Metadata viewing only	Manual XML metadata support	HTML metadata support
Catalog		x			
Folders and folder connections				x	x
Standalone XML documents				x ¹	
Personal geodatabases				x	x
Database Connections folder		x			
Add Database Connection items	x				
OLE DB database connections and their contents	x				
ArcSDE for Coverages database connections and their contents	x				
Other spatial database connections				x	x
Internet Servers folder		x			
Add Internet Server item	x				
Internet servers	x				
Internet services			x		
Geocoding Services folder		x			
Add Geocoding Service item	x				
Geocoding services	x				
Search Results folder		x			
Saved searches			x ²		
Coordinate Systems folder		x			

Footnotes:

¹ Standalone XML documents: Metadata tools modify the XML document itself, not metadata about the XML document.

² Saved searches: Criteria for the saved search are shown in the Metadata tab, not metadata about the saved search.

Appendix A—Changes in Synchronization at 8.1

The following list describes the changes in synchronization that occurred between the releases of ArcCatalog 8 and 8.1.

1. **Synchronize Once (Esri/SyncOnce):** At 8.1, when synchronization occurs, the value of the Synchronize Once element is changed from TRUE to FALSE. At version 8, if the Synchronize Once element was present when synchronization occurred, it was removed. When synchronization occurs at 8.1, this element will not be added. This does not affect synchronization. However, it means that if the metadata is initialized using the `IXmlPropertySet.InitExisting` method and then saved, the SyncOnce element will be added and its value will be TRUE; the next time synchronization occurs after that the documentation hints will be added again.
2. **Documentation hints:** At 8.1, when documentation hints are added, their elements will not have the Sync attribute with the exception of the Bounding Coordinate elements. At version 8, the Sync attribute was always added to the documentation hint elements with the value TRUE even though these elements would never be automatically updated; this caused some confusion. For example, because there are no rules for updating the abstract element its value would never be modified automatically by ArcCatalog even if its Sync attribute was set to TRUE. Also, at 8.1 the text "REQUIRED:" appears before the element's description; this makes the mandatory elements more visible in the metadata editor. At version 8, the text "REQUIRED." was added after the description.

When synchronization occurs at 8.1, neither the Sync attribute nor the value of existing documentation hint elements will be modified.

3. **Native Dataset Environment (idinfo/native):** The text that is automatically added to this element is slightly different with 8.1. The value of this element will be updated automatically when synchronization occurs at 8.1.
4. **Native Dataset Format (idinfo/natvform):** At 8.1, the Native Dataset Format element is automatically added to the metadata for more items. Also, the values that are added are different than they were at version 8. The values for this element now match the terminology used by ArcCatalog's search tool; if this element doesn't contain the appropriate value, you won't be able to find the item when searching for items by type. The value of this element will be updated automatically when synchronization occurs at 8.1.
5. **Item location:** At 8.1, the item's storage location is recorded in the Online Linkage element (idinfo/citation/citeinfo/onlink). At version 8, the item's storage location

was recorded in the Distribution Information section (distinfo). File-based items were described with the following elements:

distinfo/stdorder/digform/digtopt/onlinopt/computer/networka/networkr—Network Resource

distinfo/stdorder/digform/digtopt/onlinopt/accinstr—Access Instructions

distinfo/stdorder/digform/diginfo/formname—Format Name

distinfo/stdorder/digform/diginfo/filedec—File Decompression Technique

The file's URN was constructed the same way as described in "Item Location" and recorded in the Network Resource element. The Access Instructions element was added with the value "Local area network". To complete the mandatory elements within the Distribution Information section, the Format Name element and the File Decompression Technique element were also added with a value describing the data's format and the value "No compression applied", respectively.

The location of items stored within a personal geodatabase is recorded in the same way as for file-based items except that the Format Name and File Decompression Technique elements would not be added. For items stored within an ArcSDE geodatabase, the value of the Access Instructions element would be "SDE connection". Instead of creating one text string containing the connection information for that geodatabase, that information was recorded in the following elements, which were added into the SDE Connection section (sdeconn):

distinfo/stdorder/digform/digtopt/onlinopt/computer/sdeconn/server—Server Name (ESRI Profile)

distinfo/stdorder/digform/digtopt/onlinopt/computer/sdeconn/instance—Instance Name (ESRI Profile)

distinfo/stdorder/digform/digtopt/onlinopt/computer/sdeconn/database—Database Name (ESRI Profile)

distinfo/stdorder/digform/digtopt/onlinopt/computer/sdeconn/user—User Name (ESRI Profile)

distinfo/stdorder/digform/digtopt/onlinopt/computer/sdeconn/version—Version Name (ESRI Profile)

This change was made so that the automatically generated metadata describes the item itself. It was determined that the Distribution Information section should be used to record how published datasets are distributed. When an item is published, the metadata for that item should be modified as appropriate to remove information about the internal storage location and add information about how the public may acquire the item.

When synchronization occurs at 8.1, the Online Linkage element will be added with the appropriate value. However, the information that was previously added to the Distribution Information section will not be removed; it can be removed manually, if appropriate, using the metadata editor.

6. Spatial reference: At 8.1, the Latitude and Longitude Resolution elements are added to the metadata where possible to describe items that have a geographic coordinate system. These elements were not added at version 8.

Also, projections that are supported by ESRI software but not explicitly supported by the FGDC standard were described differently at version 8. Instead of placing the projection's parameter elements with the Map Projection Parameters element as defined in "Point and Vector Data", those elements were added to specific section elements for each projection as defined in the ESRI Profile. For example, a Cassini section (cassini) would have been used to describe the Cassini projection.

Whenever synchronization occurs, the existing spatial reference information is removed from the metadata and the current information is added. At 8.1, the Latitude and Longitude Resolution elements will be added, if appropriate, and all projections will be described according to the rules defined in the ESRI Profile.

7. Attributes: At 8.1, the Attribute Definition, Attribute Definition Source, and Unrepresentable Domain elements are added to describe ESRI-defined columns where possible. These elements were not added at version 8.

For coverages, at 8.1 the object identifier and geometry columns are described the same way as for all other data formats, and pseudo columns, such as \$ANGLE, are not described in the metadata. However, at version 8, the object identifier and geometry columns were described using the same elements as for other columns in the feature class, and pseudo columns were included for some feature classes.

When synchronization occurs at 8.1, the Attribute Output Width element will remain in the Attribute section (attr) for the object identifier and geometry columns even though it is no longer appropriate. Also, the Attribute sections describing pseudo columns should be manually removed using the metadata editor.

8. Associated objects: At 8.1, when an INFO table participates in a relationship class, only a brief description of the relationship class is included in its metadata as described in "Associated Objects". At version 8, the detailed properties of the relationship class were added to the INFO table's metadata.
9. When synchronization occurs at 8.1, the details of the relationship class will remain in the metadata, but they will not be updated in the future. Manually remove the entity and attribute section describing the relationship class using the metadata editor, then synchronize the metadata again.