

Electronic transfer of geographic information (NTF)

Part 1. Specification for NTF structures

Committees responsible for this British Standard

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Electronic transfer of geographic information (NTF)
Part 1. Specification for NTF structures

Revised text

Clause 2.1.3.2 Partial topology

In line 1 delete 'Figure 7' and substitute 'Figure 6'.

AMD 8917/December 1995

Clause 4.2.2.1 Record specification

Delete the sentence beginning 'Comment records'.

AMD 8917/December 1995

Clause 4.2.4.3 Notes on fields

In item b), line 2, delete 'levels 0 to 3' and substitute 'levels 1 to 4'.

AMD 8917/December 1995

Clause 4.2.5.2 Description

(In line 1 delete 'a').

Delete item b) and its text.

AMD 8917/December 1995

Clause 4.2.6.3 Notes on fields

In item a), line 1, after 'field' insert 'or attribute'.

After existing text insert the following new items.

d) {CODE_VAL}. The value of the field or attribute being described.

e) CODE_DES}. Descriptive text of the code.

AMD 8917/December 1995

Clause 4.2.10.3 Notes on fields

In item o), line 1, delete '[SECHREC]' and substitute '[SECQUAL]'.

In item t) delete 'major' and substitute 'semi-major'.

AMD 8917/December 1995

Clause 4.4.15.1 Record specification

In the row beginning 'DIR', insert '0' in column 4.

In the row beginning 'GEOM_ID', insert '0' in column 4.

AMD 8917/December 1995

Clause 4.4.18.3 Field specification

In item b) delete existing text and substitute the following.

{SELECT}. A user-defined cross reference to a text string in the associated attribute record(s).

AMD 8917/December 1995

Clause 4.5.4.1 Record specification

Delete the row beginning 'I SIGN'.

AMD 8917/December 1995

Clause 4.5.4.3 Field specification

Delete item c) and its text and renumber the existing item d) as item c).

AMD 8917/December 1995

Clause 4.5.11.1 Description

Insert the following as the final row below the row beginning 'I CHAIN ID'.

ISIGN	A1	t		+ or -
-------	----	---	--	--------

AMD 8917/December 1995

Clause 4.5.11.3 Field specification

After item c) insert the following.

d) {SIGN}. Indicates whether the chain defines the outer (+) or an inner (-) boundary of a face.

AMD 8917/December 1995

Clause 4.5.15.2 Description

Delete existing text and substitute the following.

To transfer the position of a node lying at the junction of two or more edges, the position of a point feature, or a cross-reference of a representative point to a face.

AMD 8917/December 1995

Clause C.3 Codelists for attributes

In row 5, column 1, delete '0' and substitute '000000' (against 'Unspecified' in column 2).

AMD 8917/December 1995

Clause D.2.2.6 {XMAX}, {YMAX}, {XMIN} and {YMIN}

After paragraph 1 insert the following new paragraph.

Zero is a valid value for each of these optional fields if one or more fields has a non-zero field. Zero in all four fields indicates no data in any of them.

AMD 8917/December 1995

Clause D.3.2

Delete the existing text and substitute the following.

Each string has a {SELECT} value which appears in both the text record and in the {VAL_ATT} field of the attribute record. Alternative text strings are identified by the different {SELECT} value values and each may have a different text position record.

The {SELECT} field in the text record is also a user-defined label with values defined either in a codelist record or externally. (This facility may be used to transfer display control criteria for example for display at different scales or for different themes.)

AMD 8917/December 1995

Contents

	Page
Committees responsible	Inside front cover
Foreword	iii
Specification	
Section 1. General	1
1.1 Scope	1
1.2 Normative references	1
1.3 Definitions	1
1.4 Editorial conventions particular to this standard	3
1.5 Convention in record and field formats	3
Section 2. NTF levels and the vector data models	4
2.1 The family of models	4
2.2 NTF levels	4
2.3 Rules of Association	6
2.4 Semantic Relationships	6
2.5 Elements of the NTF Models	6
Section 3. Transfer file structure	15
3.1 General transfer structure	15
3.2 Volume header records	15
3.3 Database description records	15
3.4 Section records	16
Section 4. Record syntax	26
4.1 General	26
4.2 Syntax of common records	27
4.3 Syntax of records for levels 1 and 2	37
4.4 Syntax of records for level 3	44
4.5 Syntax of records for level 4	53
4.6 Records for level 5	58
Annexes	59
A (informative) Objectives of Working Group on national standards	59
B (informative) External feature files	60
C (informative) Codelist record (examples)	63
D (informative) Interpreting associated records and fields	66
Figures	
1 Simple spaghetti model (level 1)	9
2 Simple spaghetti data model (level 2)	9
3 Complex spaghetti data model (level 3)	10
4 Generic topological model	11
5 Link and node data model (level 3)	12
6 Partial topological data model (level 3)	13
7 Full topological data model (level 4)	14
8 The logical structure	18
9 Physical file structure	19

	Page
10 Record structure for levels 1 and 2	20
11 Structure of level 3 feature records	21
12 Structure of level 3 feature records (continued)	22
13 Structure of level 3 geometry and topology records	23
14 Structure of level 4 records	24
15 Structure of levels 3 and 4 text records	25
16 Character position record	39
17 Digitized position indicators	42
18 Digitized position indicators	52
19 Relationship between image and grid coordinates	62
List of references	Inside back cover

Foreword

This Part of BS 7567 has been prepared under the direction of the Information Systems Technology Standards Policy Committee.

This British Standard provides a specification for the transfer of spatial and related aspatial data. Five levels of transfer are provided. These range through 1 to 4 for data in increasing degrees of complexity and comprehensiveness, to level 5 which is user definable. These levels support a range of data models from simple 'spaghetti' data to rigorous topological and network models.

References to raster, grid or other classes of data may be included in levels 3 and above. These data are passed in separate external files and, pending the development of formal international standards, *de facto* standards may be used.

All levels require the association of one record with another. At levels 1 and 2, this is achieved by adjacency, so that a record containing coordinates follows immediately after the feature record (line, point) to which it belongs. At level 3 and above, association is achieved by the matching of key fields containing unique identity numbers and data records have no particular order.

The standard itself is divided into Parts. This Part is used in conjunction with either Part 2 or Part 3. (In practice it is necessary to agree between the donor and recipient which of these Parts is to be used. However reference to the documents may only be necessary for software authors.) These associated Parts cover alternative methods of encoding the data: Part 2 covers a dedicated encoding system known as 'plain NTF' and Part 3 relies on BS 6690 (ISO 8211) to provide the encoding system.

This specification refers to 'NTF' both in its title and within the text. This acronym has historical significance and provides continuity with the *de facto* standard which was in widespread use in the United Kingdom prior to the publication of Parts 1, 2 and 3 of BS 7567. The background to NTF is related at annex A.

This specification is intended to form the core of a 'Product Specification' which defines the product to be supplied by the donor to the recipient in its entirety. The Product Specification may be prepared by either party to the transfer of data.

In section 4, various subclauses are introduced but not used: this device is for the convenience of cross-referral between the implementation specifications for NTF levels 3 and 4. For example, a record for level 3 implemented in 4.4.6 is implemented for level 4 at 4.5.6.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Section 1 General

1.1 Scope

This Part of BS 7567 specifies a neutral transfer format, NTF, that comprises:

- a) media-independent file and data record descriptions for information exchange;
- b) the description of data elements, vectors and arrays containing character strings and numeric forms, and relationships between data elements;
- c) volume and header information that enable data interchange to occur with minimal specific external description;
- d) five levels of interchange, related to the complexity of the data to be transferred.

Part 2 specifies the implementation of plain NTF and Part 3, the implementation using BS 6690.

NTF facilitates the transfer of spatial and related aspatial information between computer systems. This may include digital topographic maps, digital terrain models and a full range of geographic database contents. It is not designed for the permanent storage of data on any specific system. It provides the means for describing the contents of data records, but does not define their contents.

1.2 Normative references

This Part of BS 7567 incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on the inside of the back cover. Subsequent amendments to, or revisions of, any of these publications apply to this Part of BS 7567 only when incorporated in it by updating or revision.

1.3 Definitions

For the purposes of this Part of BS 7567, the following definitions apply.

1.3.1 area

A spatial extent defined by circumscribing lines that form a closed perimeter that does not intersect with itself.

1.3.2 block

A logically dependent set of records.

1.3.3 database

A group of one or more Sections with common characteristics defined in a data dictionary.

Information and data being transferred in a transfer set is deemed to belong to one or more databases. These may be databases in the literal sense, or may be collections of data from a common source, such as a national coverage of large scale mapping.

1.3.4 edge

An edge is a curve joining two possibly identical nodes without intersecting any edge including itself. Any sequence of edges either bounds a face and/or represents a line feature.

1.3.5 entity

The general term for a real world or digital phenomenon.

1.3.6 face

An extent bounded by edges. Faces do not overlap.

1.3.7 feature

The formal representation of an object. A simple feature (or primitive) exists in NTF when a point, line, complex line, polygon, text string or external record is created with or without associated attribute records. A complex feature exists in NTF when a group of simple and/or complex feature records are combined in a complex polygon or collection of features record, with or without associated attribute records.

1.3.8 field

A unit of data. Each field has a name associated with it. A default interpretation is defined in either this document or in a data dictionary. Fields are grouped to form records.

NOTE. This definition of **field** is specific to Parts 1 and 2 of BS 7567 : 1992.

1.3.9 line

A series of connected coordinated points forming a simple feature with homogeneous attribution.

1.3.10 link

A line without logical intermediate intersections. A link record contains references to nodes at each end.

1.3.11 node

Either the termination of one or more links, or an isolated point within a face.

1.3.12 object

A 'real world' phenomenon.

1.3.13 packing

SPCs (spaces) used as fillers to complete a record or field.

1.3.14 polygon

A surface or region bounded by a closed link or series of links.

1.3.15 record

A logical group of fields. Each record has a name associated with it. A default interpretation is defined in either this document or in a data dictionary. Logical records are transferred by means of physical records.

NOTE. This definition of a **record** is specific to Parts 1 and 2 of BS 7567 : 1992.

1.3.16 section

A free-standing group of inter-related records.

NOTE. A section may be a map sheet and/ or a theme (eg., water features); it may also arise from a need to separate data belonging to logically independent data models.

1.3.17 segment

A chord defined by two consecutive coordinates in a line string.

1.3.18 spaghetti

Spatial data comprising unrelated features.

1.3.19 transfer set

A transaction of one or more databases in one or more volumes. It may be associated with external documentation.

1.3.20 volume

A group of one or more databases.

1.4 Editorial conventions particular to this standard

1.4.1 Use of []

All records have full and abbreviated names. Full names are used in the main text. Abbreviated names are used in the record descriptions and are enclosed thus: **[RECORD NAME]**.

1.4.2 Use of { }

All fields in records are named. They are presented thus: **{FIELD NAME}**.

1.4.3 Use of **SPC**

SPC is the space character.

1.4.4 Use of X, Y, Z and Q

In the text:

X refers to the X coordinate or Easting, Y to the Y coordinate or Northing, and Z to a height above a user-defined datum. In the data records, the fields containing such values have names, for example., **{X_COORD}**.

XY is used to refer to a coordinate pair (planimetric values only) and XYZ to a triplet.

Q refers to a quality which may be applied to coordinates, such as XYQ or XYQZQ.

1.4.5 Use of fonts

Proper names and data which are the expression of NTF in this standard are distinguished from the general text through the use of a distinctive font, for example **[RECORD]**

1.4.6 Conventions used in figures

The following conventions apply in figures 1 - 7 and 10 - 15.

	One - one	One - many	Many - many
Compulsory	————	————<	>————<
Optional	-----	-----<	>-----<

1.5 Conventions in record and field formats

1.5.1 Record and field names

Each record and field shall have a name.

1.5.2 Dates

Dates shall have one of two formats:

a) year, month, day, or **yyymmdd**; for example, **860501** is 1st May 1986. The start of the calendar is 1950, so that **50ymmdd** means 1950 and **49ymmdd** is 2049.

b) **yyyymmdd** to allow the century to be included.

1.5.3 Completion of fields

Compulsory fields shall contain valid data. Optional fields shall contain either valid data or the appropriate characters to indicate 'no data'. If no data is indicated by **SPC** or **0** (zero), there shall be sufficient such characters to completely occupy the allowable field width.

NOTE. In some cases, a field which is not required may be left out of the record.

Section 2 NTF levels and the vector data models

2.1 The family of models

2.1.1 General

NTF supports many user-defined vector data models but most are represented by one of a family of five data models specified in 2.1.2 and 2.1.3. There is no formal correlation between the vector models and the NTF levels, but the preferred levels for each model are summarized at 2.2.7.

Each of the family of five models includes feature and attribute classification, attribution of features and text placement. The non-spaghetti models support semantic relationships between features, and alternative representations of names.

Figures 1 to 3 are diagrams of the spaghetti models, figure 4 is the general topological model and figures 5 to 7 are examples of particular topological models specified in 2.1.3.

2.1.2 Spaghetti models

2.1.2.1 *Simple spaghetti*

This model contains only line, point and text features that are related to each other by geometric position only. Figures 1 and 2 represent the simple spaghetti model with minimum and multiple attribution (levels 1 and 2) respectively.

2.1.2.2 *Complex spaghetti*

This is similar to simple spaghetti but area information may be defined by closed lines. The user may either define an area by a closed line in levels 1 or 2 or use the polygon and chain records in level 3 to make the area definitions explicit (figure 3).

2.1.3 Topological models

2.1.3.1 *Network*

A structured network of links and nodes with explicit topological and semantic relationships. Figure 5 is one example of a level 3 data model for link and node data. Alternatively, the relevant elements of level 4 may be used for this model. See figure 7.

2.1.3.2 *Partial topology*

This is the same as a link and node model, but includes the definition of areas. Figure 7 is one example of a level 3 partial topology model.

2.1.3.3 *Full topology*

All features are defined by topological elements (faces, edges and nodes) in which the faces are contiguous and fill the spatial extent of the data set without overlap (figure 7).

2.2 NTF levels

2.2.1 General

NTF is a general transfer format that may be used for a wide variety of applications and for transfers of data of various degrees of complexity. Simple data sets require fewer record types than the more complex data sets. To accommodate this, NTF defines five levels of complexity so that the data may be matched to the correct transfer level for efficiency and ease of use. The main characteristics of the levels are specified in 2.2.2 to 2.2.6.

2.2.2 Level 1

This is used for simple vector data. Lines, points, and text are separate entities, and each may be given one feature code and one attribute value, for example, a contour height. Text may be given a plotting position and the drawing style defined, but it is not possible to relate it to a line or point feature. Figure 1 is a diagram of a data model for level 1 and 4.3 specifies the syntax.

2.2.3 Level 2

Also for simple vector data, but with several additional facilities. The main purpose of this level is to permit the addition of many attributes to the lines, points and text. These attributes may be defined by the donor. Text may be linked to a feature as an attribute. The features may have quality data, such as method of capture, date of capture, and any change they have undergone may be specified. At this level it is possible to transfer 'change-only' or revision data without transferring the whole data set again. The size of the coordinate fields may also be varied so that space is not wasted.

Figure 2 is a diagram of a data model for level 2, and 4.3 specifies the syntax.

2.2.4 Level 3

This level supports a variety of data models that may include network data, polygons, semantic relationships and complex features (for example, a school consisting of its buildings, boundaries, playing fields).

This level is designed for:

- a) transferring basic geometry and simple features through the use of geometry and feature records;
- b) relating basic geometrical and topological elements to one or more features through the use of chain, polygon and complex line records;
- c) combining features to form complex features through the use of collection and complex polygon records;
- d) using text records both to relate text strings to features and for cartographic output; and
- e) referencing and positioning external features, for example raster data.

The record structure at this level may also be defined to be compatible with the spaghetti models of NTF levels 1 and 2.

See 2.5 for the relationships between the elements that are supported by level 3. 4.4 specifies the syntax.

2.2.5 Level 4

This level contains records that allow the transfer of data in either a rigorous full topological model or a link and node model (see figure 7). It uses several of the records defined for level 3, but includes additional records to support the topological model.

See 2.5 for the relationships between the elements that are supported by level 4. 4.5 specifies the syntax.

2.2.6 Level 5

This is a user definable format, and is intended mainly for highly specialized data sets that do not fit easily into levels 3 or 4, such as data sets that contain complex semantic relationships. The data description and data format records are specified in 4.6.

Level 5 shall be used only where other levels are inappropriate and with explicit agreement between donor and recipient.

2.2.7 Relationship between the data models and the NTF levels

In summary, data for the vector models specified in 2.2.2 to 2.2.6 may be transferred at the following levels:

Simple Spaghetti	Levels 1 and 2
Complex Spaghetti	Levels 1, 2 and 3
Link and Node	Levels 3 and 4
Partial Topology	Level 3
Full Topology	Level 4

Level 5 may be used for derivations of all these models.

2.3 Rules of Association

2.3.1 Records in levels 1 and 2 shall be related by their adjacency in the file. In levels 3, 4 and 5, association shall be by cross-references in defined fields.

2.3.2 Thus in level 2 point and line records shall be immediately followed by their geometry records and these may be followed by one or more attribute records. If an attribute record is common to many features, then a copy of the record shall follow each feature.

2.3.3 In levels 3 and 4, there is no requirement to order records within a section. Geometry and attribute records shall be related to feature records via their respective identifiers and may appear anywhere in a transfer file. Attribute records common to more than one feature may appear once only.

2.4 Semantic Relationships

2.4.1 Relationships between features that are not explicit in the geometry or the topology may be expressed through the collection record and associated attribute records. The collection record shall be used to identify the features that are related. The attribute record of the collection shall be used to define the relationship.

2.4.2 If the relationship is too complex for the collection and attribute records in levels 3 and 4, then the transfer shall be made in level 5.

2.5 Elements of the NTF Models

2.5.1 General

There are five groups of elements in NTF: features, topology, geometry, attributes and text. At level 3, 4 and 5, text may be treated as either a feature in its own right or an attribute of a feature. Also these levels may include features represented by external data. The main characteristics and relationships of the elements within these groups shall be as defined in 2.5.2 to 2.5.5.

Figure 4 shows the general relationship of the elements and figures 3 and 5 to 7 show how features, topology and geometry elements combine to support the various models that may be defined in levels 3 and 4.

The elements that support the spaghetti models in levels 1 and 2 and their relationships are shown in figures 1 and 2. Their record structure is specified at 4.3.

2.5.2 Features

2.5.2.1 General

Features are defined through combinations of topological and geometric elements and they may be specified by one or more attributes. They may be contained in one or more collections.

2.5.2.2 Collection

A collection shall contain one or more features of any type within the same section. Any specific collection shall not refer to itself.

2.5.2.3 Complex polygon (level 3 only)

This feature shall contain one or more polygons that do not necessarily form a contiguous extent. The constituent polygons may overlap. Component polygons may be flagged to show whether they are to be added or subtracted to create the final area. For example, an area surrounding a hole may be transferred as a positive polygon completely enclosing a negative one. The complex polygon may refer to a representative coordinated point as a centroid or seed. This point need not be within the boundary of the feature.

2.5.2.4 Complex Line (level 3 only)

This is a continuous linear entity composed of one or more separate lines. The lines shall be recorded in a chain.

2.5.2.5 Area (level 4 only)

An area defines a single contiguous extent and shall be represented by one or more contiguous faces. Areas may overlap each other.

2.5.2.6 Polygon (level 3 only)

A polygon represents a single contiguous extent. It shall be represented by a chain containing a sequence of lines that together form the closed perimeter of the extent.

2.5.2.7 Line

A line defines a linear entity. In level 3 it shall be specified by a single string of coordinates. In level 4 it shall be represented by one or more edges.

2.5.2.8 Point

A point is an entity that is defined by a single location. In level 3 it shall be specified by a single coordinated point. In level 4 it shall be represented by a single node.

2.5.2.9 Text

Text is an entity defined by a string of characters and these text strings may be displayed at several locations with different text styles. See 3.7.

2.5.3 Topology

2.5.3.1 General

At levels 3 and 4, the topological elements represent features. They are specified by geometry. Topological elements do not have attributes.

2.5.3.2 Face (level 4 only)

A face is a component of one or more areas. It shall be bounded by a sequence of edges and may contain one or more isolated nodes. Faces shall not overlap, and the total area of the faces shall equal the extent of the data set. A face may also be represented by a chain containing a sequence of edges that define its perimeter.

2.5.3.3 Chain

A chain is a collection of one or more linear elements. In level 3, a chain shall be a collection of directed coordinate strings (geometry) for a complex line or a polygon. In level 4, a chain shall be a sequence of directed edges for a line or a face.

NOTE. The elements of a chain for a polygon describe the perimeter of the entity as a single closed loop.

2.5.3.4 Edge (level 4 only)

An edge is a curve joining two possibly identical nodes without intersecting any edge including itself. Any sequence of edges shall either bound a face and/or represent a line feature. The geometry of an edge shall be represented by a string of coordinated points and associated attributes. See 2.5.4.3.

An edge shall have a start node and an end node. Their positions shall be the first and last points in the string of coordinates that define the edge. An edge may also have a left face and a right face, where left and right are relative to the direction of the coordinate string.

When the direction of an edge is reversed in a line or chain, the coordinate string shall be interpreted as starting at the end node and ending at the start node, and the left and right faces are reversed.

2.5.3.5 Node

A node is either the termination of one or more links or the representation of an isolated position. Its position shall be defined by a single coordinated point. In level 3 it may also list the starting orientation and height of each of the coordinate strings that terminate at the node.

2.5.4 Geometry

2.5.4.1 General

Geometries contain an ordered list of coordinates that define the position and shape of features, topology and text. These geometry elements shall contain either two- or three-dimensional coordinates and may carry attributes. Each coordinate within the string may have quality codes related to their planimetric and height accuracies.

2.5.4.2 Single coordinate geometry

A single coordinate may define the position of:

- a) a representative point for one or more complex polygons and/or polygons;
- b) a seed or reference point for a face;
- c) a point (level 3 only);
- d) a node;
- e) a text string in a cartographic display.

2.5.4.3 Coordinate string

This element is a sequence of coordinated points. A code indicates the type of geometry, that is., line string, arc, circle. It may define the form and position of:

- a) a feature;
- b) an edge;
- c) successive characters in a curved text string.

2.5.5 Attributes

Attributes shall relate to one or more features. Geometry may also have attributes, although it is recommended that these are restricted to geometric accuracy attributes. The topological elements shall not carry attributes.

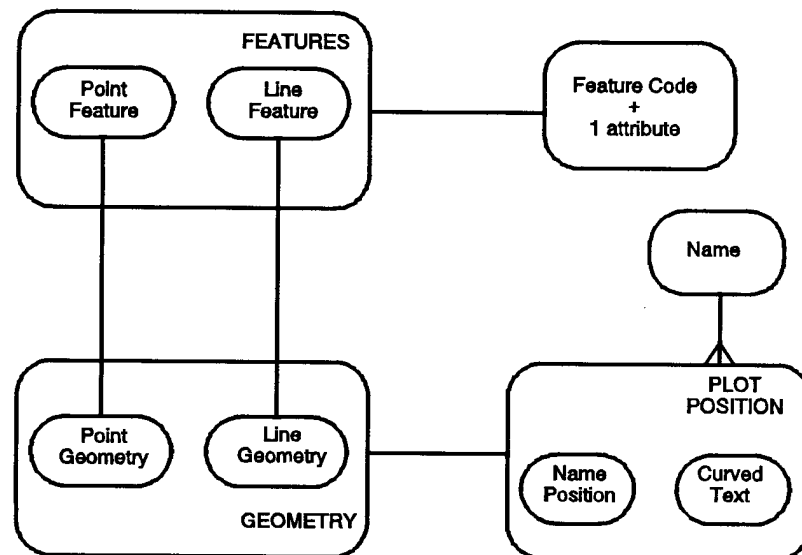


Figure 1. Simple Spaghetti Model (level 1)

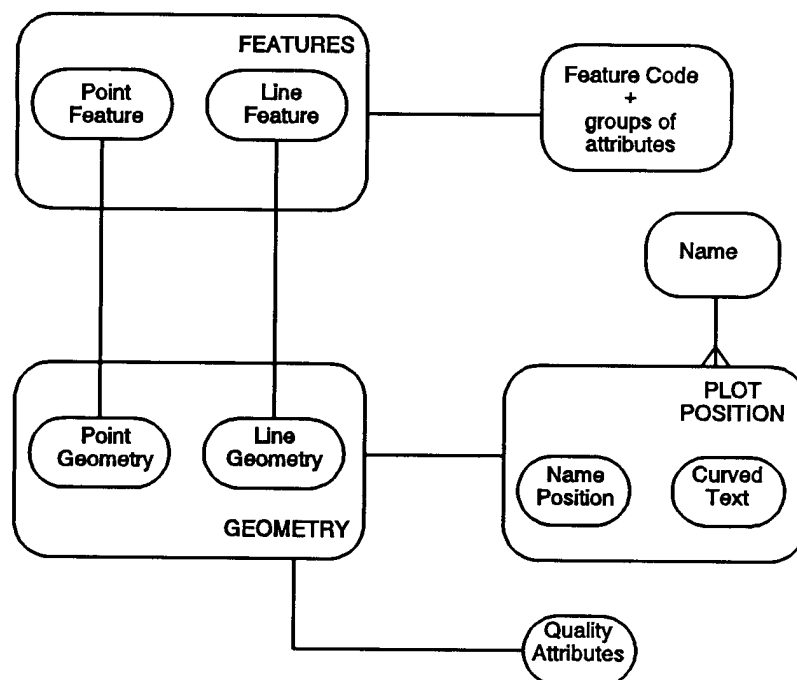


Figure 2. Simple Spaghetti Data Model (level 2)

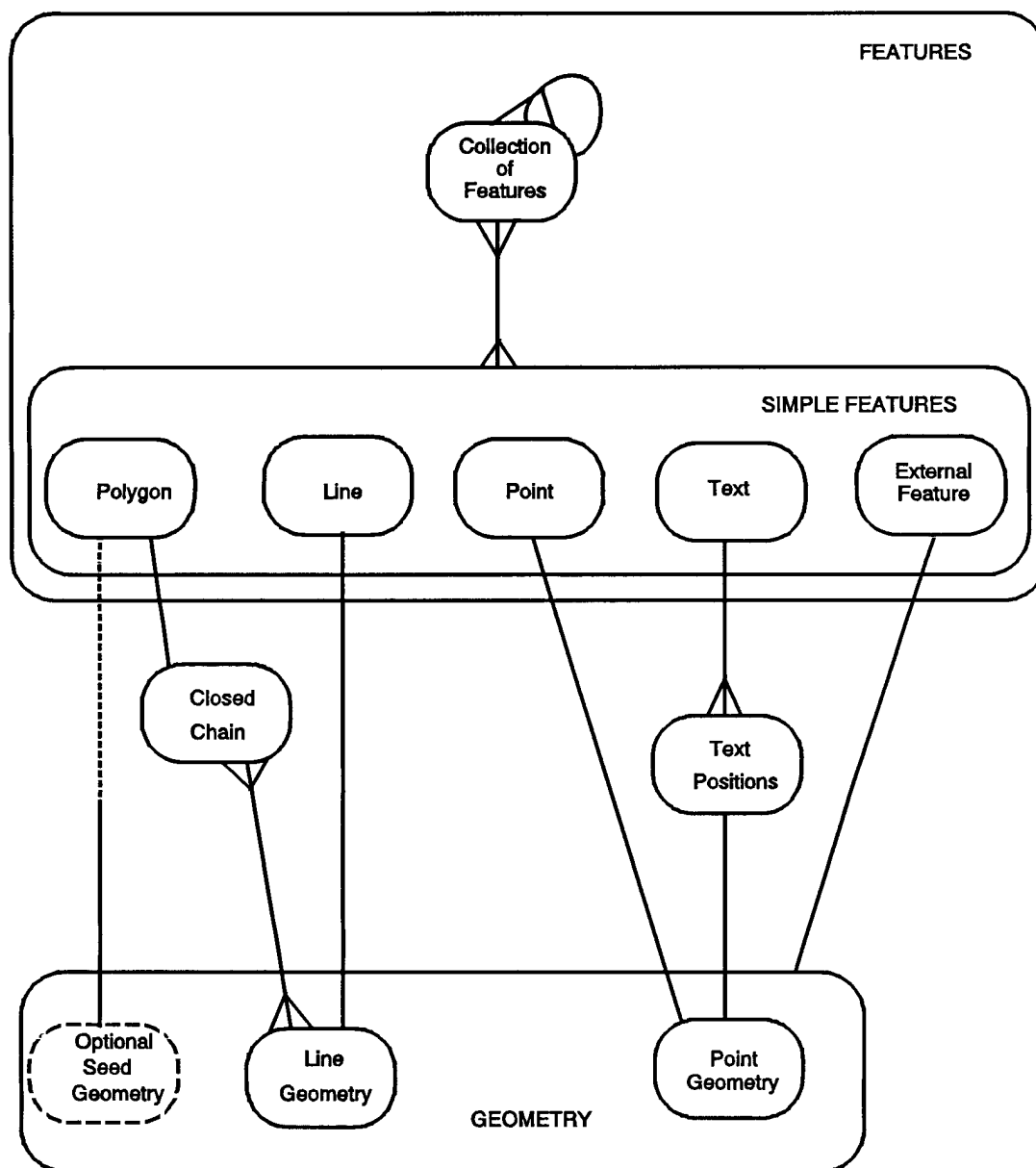


Figure 3. Complex Spaghetti Data Model (level 3)

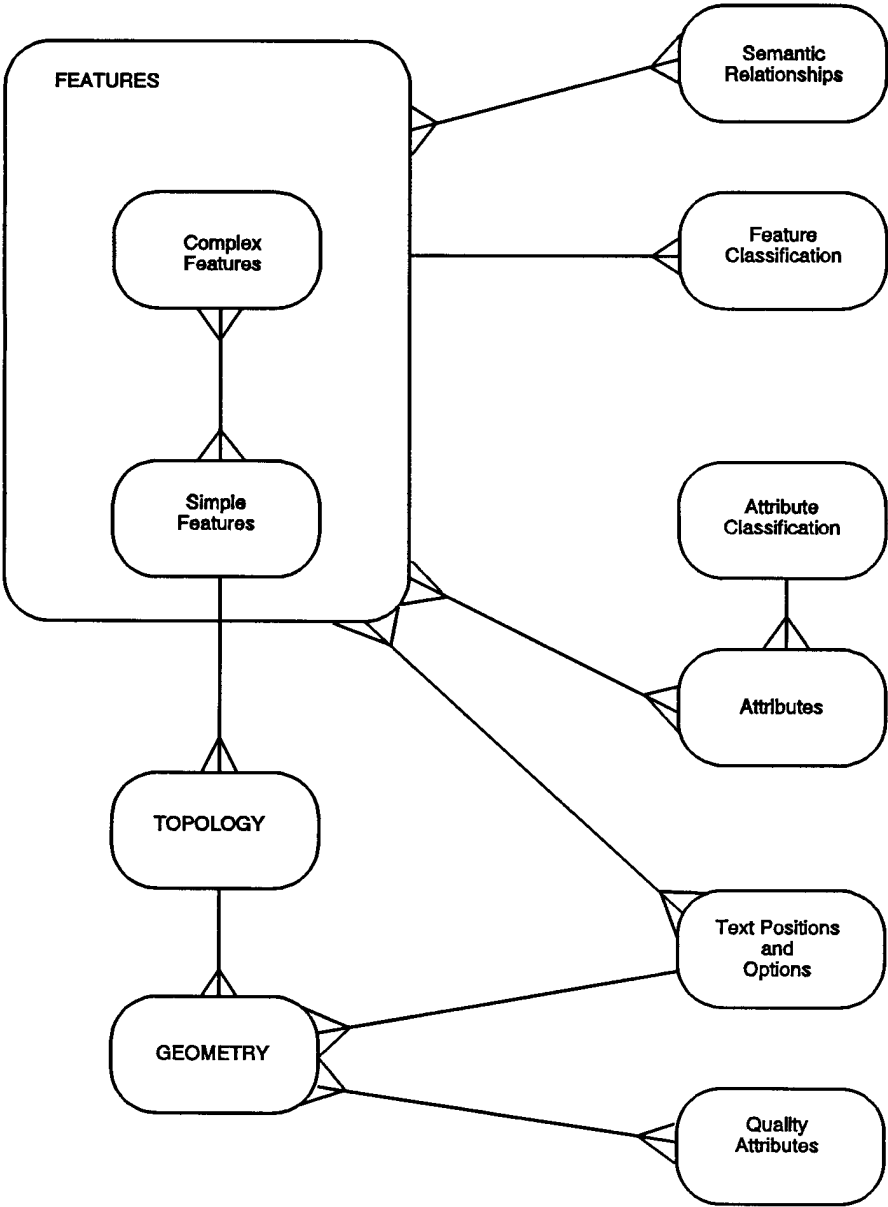


Figure 4. Generic Topological Model

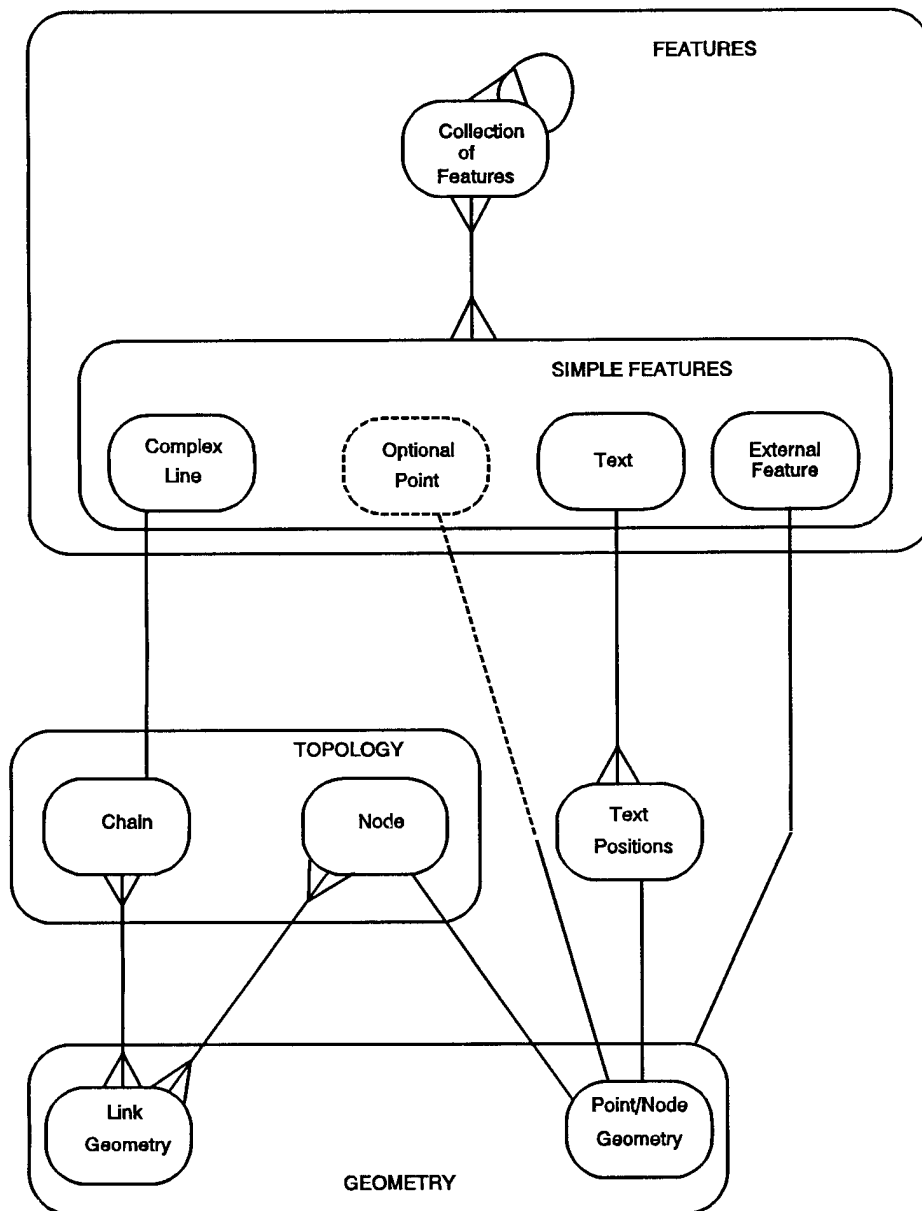


Figure 5. Link and Node Data Model (level 3)

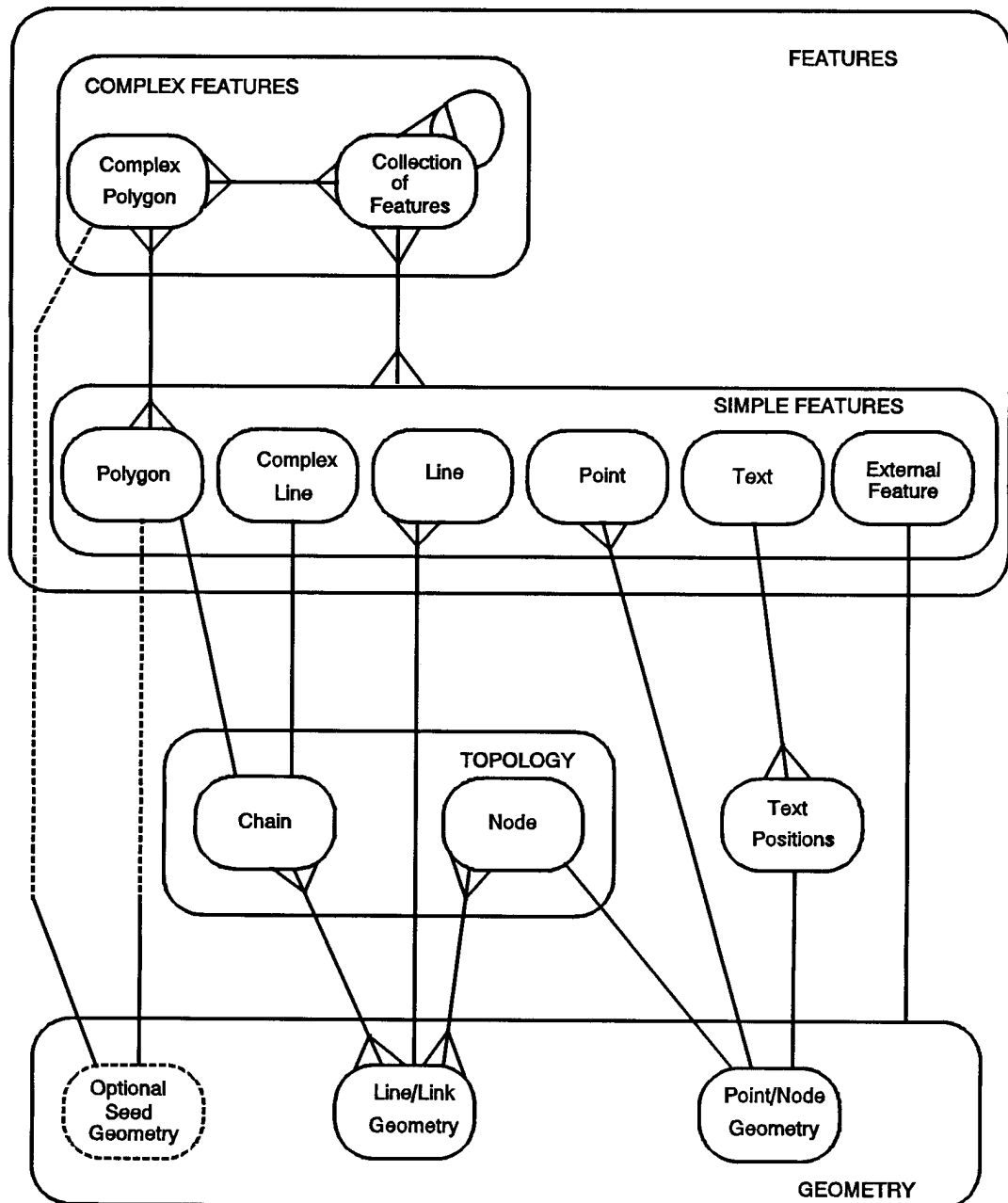


Figure 6. Partial Topological Data Model (level 3)

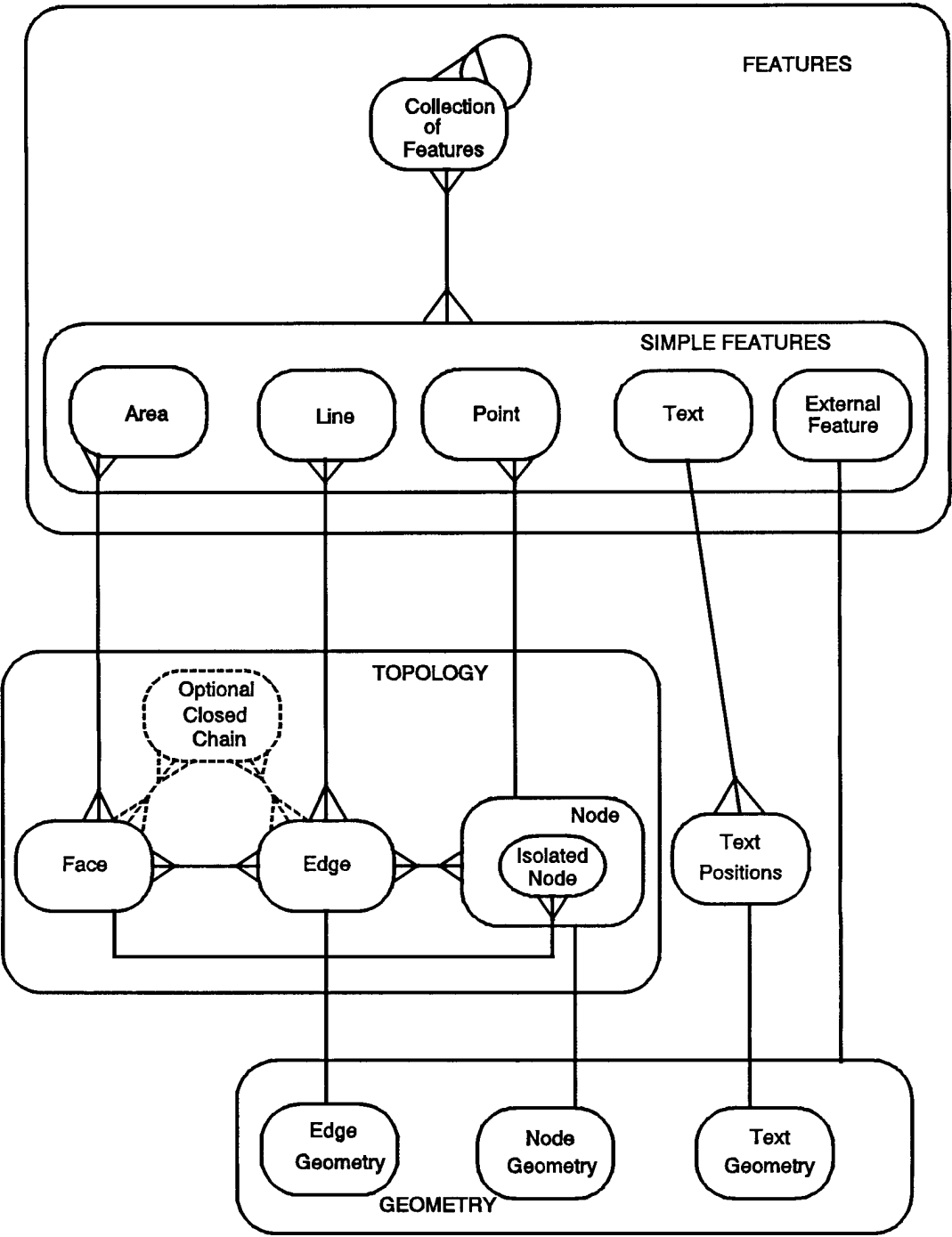


Figure 7. Full Topological Data Model (level 4)