Appendix F – Part 3

Defendants' Supplemental Prior Art Statement
'228 Patent
(TC1298-TC1325)

to

TimeBase's Memorandum in Support of Its Motion for Summary Judgment of No Invalidity

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- **Sacks-Davis 1995:**

  Sacks-Davis 1995 discloses "providing a plurality of attributes, wherein the attributes define a manner in which the plurality of portions of text-based data and the amended portion of text-based data can be organized, displayed and linked in a multidimensional space." Specifically, Sacks-Davis 1995 discloses encoding stored documents with multiple attributes, and using those attributes to organize and link to the stored documents. For example:

  - *See, e.g.*, "Text created in a word processor generally contains embedded markup that describes the structure of the text and how it should be presented," at 455.
  - *See, e.g.*, "The attributes of records can be atomic values, tuples (structured values), nested tables, or references (pointers)," at 455.
  - *See, e.g.*, "The Document table contains entries consisting of a document identifier, a title, a nested table of authors, and a nested table of references to hypertext nodes contained in that document," at 455.
  - *See, e.g.*, "Information about author names is stored as a structured attribute, name, which is a tuple consisting of two components: surname and firstname," at 455.
  - *See, e.g.*, "In addition to atomic attributes and structured attributes, Atlas supports reference attributes. A reference is a tuple comprising the global key of a record or nested record. In the hypertext example, bidirectional links between documents and their associated nodes are maintained using reference attributes, so that in table Hypertext, attribute doc has values from the domain of the key of the Document table, namely, attribute doc_id," at 456.
  - *See, e.g.*, "As in a conventional database, each record contains attribute data such as name, age place of birth, and gender," at 465.

- **Sciore 1991:**

  Sciore 1991 discloses "providing a plurality of attributes, wherein the attributes define a manner in which the plurality of portions of text-based data and the amended portion of text-based data can be organized, displayed and linked in a multidimensional space." Specifically, Sciore 1991 discloses encoding stored documents with multiple attributes which are expressly described as organizing the stored documents into a multidimensional space. Sciore 1991 also discloses pointers between the stored documents. For example:

  - *See, e.g.*, "We develop a version specification language at the conceptual level, and a multidimensional specification language at the logical level," at 355.
  - *See, e.g.*, "At the conceptual level, we show how versions can be chosen from a

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version set based on the values of their attributes," at 356-57.

- *See, e.g.*, "At the logical level, we show how the logical semantics of versioning can be encoded explicitly in a dimension type. Arbitrary combinations of dimension types can be associated with a set of versions, according to the desired semantics of an application. Because each dimension types is independent of the others, each combination determines a multi-dimensional space of versions," at 357.

- *See, e.g.*, "Typically, refinement is implemented by including the scheme of T1 in each T2-object, and extension is implemented by storing a pointer to a T1-object in each T2-object," at 357.

- *See, e.g.*, "The versions of a design object all have the same scheme, so they differ only in the values for their attributes. These different attributes reflect the different design choices that caused the version to be created," at 358.

- *See, e.g.*, "In this section we show how this semantics can be specified as a set of orthogonal dimensions, with each version being a point in the k-dimensional space defined by these dimensions," at 363.

- *See, e.g.*, "The attribute occuredAT records the time at which the change took place. This attribute can be thought of as defining a one-dimensional time line, and allows the version set to be viewed as a function from times to versions," at 364.

- *See, e.g.*, "In particular: there can be an arbitrary number of dimensions, not just two; dimensions can be defined by any attribute, not just the ones corresponding to time; dimensions are not hard-coded into the system. New dimensions can be declared by an application, and different combinations of dimensions can be declared for each generic type," at 365.

- *See, e.g.*, "In general, the attributes chosen as dimensions should form a key of the version set, so that at most one version is associated with any coordinate in the version space," at 366.

- *See, e.g.*, "Our framework provides the means by which a database designer can specify a multi-dimensional logical structure to the version set. This logical structure can then be used to choose versions easily and conveniently," at 367.

- **Stonebraker 1990:**

Stonebraker 1990 discloses "providing a plurality of attributes, wherein the attributes define a manner in which the plurality of portions of text-based data and the amended portion of text-based data can be organized, displayed and linked in a multidimensional space." Specifically, Stonebraker 1990 discloses a multi-dimensional database where the attributes are points on axes of a multidimensional space where it is possible to

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navigate from one record to the next. For example:

- *See generally* Introduction, page 125 (saying that POSTGRES is a "three-dimensional solution" to "real-world data management problems").
- *See generally* section II.B, beginning on page 126 (discussing attribute types and inheritance)
- *See* page 126, for example. "It is also possible to interact with at POSTGRES database by utilizing a navigational interface. . . . Because POSTGRES gives each record a unique identifier (OID), it is possible to use the identifier for one record as a data item in a second record. Using optionally definable indexes on OID's it is then possible to navigate from one record to the next by running one query per navigation step."

- **Stonebraker 1994:**

Stonebraker 1994 discloses "providing a plurality of attributes, wherein the attributes define a manner in which the plurality of portions of text-based data and the amended portion of text-based data can be organized, displayed and linked in a multidimensional space." Specifically, Stonebraker 1994 discloses a multidimensional space stored in a POSTGRES database. Stonebraker 1994 further discloses navigation along the dimensional axes. For example:

- "Although Tioga uses POSTGRES, our proposal can readily be adapted to any system that supports an extendible type system, user defined functions, and a multi-dimensional access method" at 2.
- "Although it is possible to support an interface b/w the browser and the DBMS which allows browsing of an arbitrary collection of DBMS types, we chose a different approach. Each object may be of an arbitrary type, but it must have associated with it a **geometry**. The geometry of an object describes its location in an **application coordinate space**. All objects in an application are located in this common N-dimensional coordinate system, whose dimensions are appropriate to the specific application. The geometry of an object may be either a polygon [footnote text: "In this document, 'polygon' refers to a general N-dimensional polyhedron, not merely a two-dimensional polygon."] or a point. It is the job of the human recipe designer to ensure that the recipe produces the geometry representation (polygon or point) expected by some browser. Failure to provide this will result in a type mismatch. To achieve a common polygon representation, we have defined a standard N-dimensional polygon, **N-D-polygon**. The generic tuple passed from the browser from a recipe will have the form: {value, type, location}. The value can be an instance of a base type or a composite type, and its location is represented by the N-D-polygon as indicated. For example, the value might be a satellite image; its type might be AVHRR, and the location associated with it might be a rectangle

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representing one of the quadrants of a U.S. Geological Survey map," at 4.

- "The browser has three ways to relocate its position in N-space: it can move to a previously designated identifier, it can move to a specific N-D-point which it calculates in some fashion, or it can move in some direction, denoted by (Δ_1, …, Δ_N) until some condition F(value) <operator> <constant> is true. This third relocation command is useful, for example, if a user is browsing Hurricane Hugo, and wishes to **fast-forward** the hurricane, i.e. skip or skim through images sorted by time, until Hugo hits land. If landfall of the hurricane can be expressed as a predicate, then the appropriate MOVE command would look like MOVE along (0,0,…,+1) until hits_land(Hurricane.hugo) = TRUE. The +1 means a movement along the positive time axis, assuming time is the last dimension in this coordinate system. Note that recipes may be fast-forwarded in this fashion in any dimension," at 5.

- **Taylor 1994:**

Taylor 1994 discloses "providing a plurality of attributes, wherein the attributes define a manner in which the plurality of portions of text-based data and the amended portion of text-based data can be organized, displayed and linked in a multidimensional space." Specifically, Taylor 1994 discloses attributes and multiple dimensions. For example:

- "SHIC provides for multiple classifications of an item which is crucial for classifying media items such as photographs where one scene could be classified in several different ways," at 240.

- "The temporal classification schema . . . stores information relating artefacts to some existence in time. The schema consists of year time point identifiers that constitute the relevant temporal span," at 240.

- *See* figure 1.

- "The combination of the conceptual, temporal and geographical classification spaces and their respective operators means that information requests do not need to be limited to one particular dimension. They can be multi-dimensional. An example of such a query would be: Show me Costume from Pontypridd during the Victorian era. The temporal dimension provides a method by which a temporal walk through a concept can be obtained. A temporal walk consists of showing the development of an historical concept or geographic area over time. In practical terms this requires the ordering of a set of media items according to the information stored in the temporal schema," at 242.

- **Travis & Waldt:**

Travis & Waldt discloses "providing a plurality of attributes, wherein the attributes define a manner in which the plurality of portions of text-based data and the amended portion of text-based data can be organized, displayed and linked in a multidimensional space."

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Specifically, Travis & Waldt discloses storing multiple attributes that provide additional information about the text-based data being stored, and then using those attributes to organize and link to the stored documents. For example:

- *See, e.g.*, "When a document is loaded into the database, the database manager creates a record containing this identifier, along with other parameters like the authors name, load date, chapter title, and so on. The document is stored separately, with a pointer in the relational data table pointing to where the text ended up," at 193.
- *See, e.g.*, "The loader also makes available to the database parameterized information that can be used later to search and retrieve the appropriate objects. Such parameter information is object identifiers, author names, creation and modification dates, and perhaps some keywords. Most of this information can be obtained by querying the attributes on the element tags in the content of the document object," at 204.
- *See, e.g.*, "In addition to the name of an element, the start-tag can contain information about the element. This additional information is called an 'attribute'. Attributes can be used to indicate additional information for processing. For example, although the creation date and author may never be printed in any form from this document, this information might be needed in order to load a database or decide which elements are to be included in a particular rendering," at 221
- *See, e.g.*, "Attributes are used to convey extra information about an element," at 239.
- *See, e.g.*, "Our general rule is that an element contains information that is to be published or appear in the rendered output forms, which attributes are used to further describe that information (information about information)," at 239.
- *See generally* 304–07.

- **Wilkinson 1998:**

Wilkinson 1998 discloses "providing a plurality of attributes, wherein the attributes define a manner in which the plurality of portions of text-based data and the amended portion of text-based data can be organized, displayed and linked in a multidimensional space." Specifically, Wilkinson 1998 discloses retrieving, linking, and displaying of text-based data using attributes. For example:

- *See, e.g.,* section 5.8, beginning on page 95 (describing navigation by linking).
- *See, e.g.,* 98–99 (discussing the issues with versioning of links in a versioned

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document management system).

- *See, e.g.*, "The simplest form of navigation is direct access, which, roughly speaking, is the kind of access provided by traditional paper filing mechanisms. In such accesses, the document is known to exist and to have a particular, unique identifier, and that identifier is used to fetch the document. Building relationships between documents allows more powerful forms of navigation. Several important relationships that can be exploited by navigation are: A document's location in an information space. A document's relationship to an information space. A document's membership of a set of related documents." at 95.

- *See, e.g.*, "Another method for supporting access to individual versions is to use a multi-dimensional index structure. With version information (or time) as one dimension and the content as another, search access to all versions can be provided at the cost of a small penalty for all queries . . . . An alternative requiring no penalty for searching all versions is to index each as a separate document using standard indexing mechanisms and to create a separate index for the version metadata (or time)," at 98.

- *See, e.g.*, "Most metadata is organized as a set of (attribute, value) pairs. Thus we need a structure that can support queries of the form 'which documents have value A for attribute B?'" at 100.

- **Wilson 1990:**

Wilson 1990 discloses "providing a plurality of attributes, wherein the attributes define a manner in which the plurality of portions of text-based data and the amended portion of text-based data can be organized, displayed and linked in a multidimensional space." Specifically, Wilson 1990 discloses storing an index of catchwords associated with each stored document that can be used to manage and access the stored documents. For example:

- *See, e.g.*, "it is easy to provide a structured index composed of the terms appearing in the catchword section," at 125.

- *See, e.g.*, "When the user enters the Justus running under Guide he is given a choice of three methods of access…index of pre-defined terms," at 125.

- **Wilson 1992:**

Wilson 1992 discloses "providing a plurality of attributes, wherein the attributes define a manner in which the plurality of portions of text-based data and the amended portion of text-based data can be organized, displayed and linked in a multidimensional space." Specifically, Wilson 1992 discloses that attributes such as name of the amending author and date of the amendment can be stored. Wilson discloses that these attributes can be used as part of a multidimensional space in that these attributes describe nodes which are

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linked together into a network "where, in principle, any node in the system can be accessed from any other node." For example:

- *See, e.g.*, "The defining characteristic of hypertext is not its ability to accommodate hierarchical structures, but its capacity to support directed graphs; that is, networks were, in principle, any node in the system can be accessed from any other node," at 170.
- *See, e.g.*, "Explicit location references in the text to other nodes, either within the same document or in other documents, can be automatically converted to hypertext links. The effect of this conversion is to integrate many disparate documents into a seamless textual universe," at 170.
- *See, e.g.*, "An electronic system makes it easier to store the name of the amending author and the date of the amendment where these are required," at 180.
- *See, e.g.*, "Figure 14 shows the lowest level of catchword index: Fig. 15 shows four expanded entries for the headword criminal law. The full text of any of these law reports can be obtained by selecting the appropriate numerical button," at 181.

- **The Pre-1997 Westlaw/Westmate System**:

The Westlaw/Westmate system has many attributes that organize, display, and link the portions and amended portions of legislation, and so using the system would entail performing this method. *See, e.g.*:

- DataBasics 1993, ("United States Code Annotated"): Disclosing multiple attributes at doc no. 79858-69.
- Westlaw DB 1991, (disclosing the TNDX file containing attributes associated with statutory sections) at 14-15.
- Wren 1994, "the CALR vendors have divided documents in their databases into units corresponding to elements that recur in cases and other legal authorities. These units are called "fields" in WESTLAW . . . . The term "field," though, is broadly used in computer terminology to refer to divisions within documents in any database . . . ," at 75.
- The Essential Guide 1996, at 47: "You can use restrictions to limit your WIN search. For example, in a case law database, you can restrict your search by court, date, judge, attorney or added date."
- The Essential Guide 1996, at 136, showing a statutory section, including some of the fields within a statute, as well as a link to a related case.

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- **The Pre-1997 Premise System**:

  The Premise system has many attributes that organize, display, and link the portions and amended portions of legislation, and so using the system would entail performing this method. *See, e.g.*:

  - Premise Software & Statutes: Select "Search/Search Book…" and then change the "Search Using" field to "Fields Template," which will then list several of the attributes of the portions and amended portions.

  - Premise Publisher: 11 (defining "Detail" to be "A set of descriptive information fields about a single object in PREMISE Publisher, e.g., document . . . .); 75–94 (showing the "PARMS" or parameters, which are attributes to be added to the markup tags); 151–154 (showing how to add, change, and delete attributes associated with documents); 181–89 (showing how to add attributes to a Premise database)

- **The Astoria System (pre-1997):**

  The Astoria System contained attributes associated with portions and amended portions and the use of attributes to organize and access the stored documents. Use of this system therefore constitutes a method for providing a plurality of attributes wherein the attributes define a manner in which the plurality of portions of text-based data and the amended portion of text-based data can be organized, displayed and linked in a multidimensional space. For example:

  - *See, e.g.,* Astoria 1997-1: "Astoria provides a mechanism for associating arbitrary, user-definable attributes with Astoria objects. Custom Attributes provide a means for Astoria users to store relevant information directly with any object, providing a robust foundation for object status tracking, and the search and assembly of individual document components." "Astoria users specify a value for the custom attribute and then can search, retrieve, and assemble new documents based on custom attribute values," at THOM00211911.

- **The EnAct System** (previously known as Themis)**:**

  The EnAct system has many attributes that organize, display, and link the portions and amended portions of legislation, and so using the system would entail performing this method. *See, e.g.*:

  - TSS 1994-2, at SAIC002754, and explanatory material at SAIC002753–2781 (showing the attributes within the EnAct databases).

  - Arnold-Moore 1997-2, at 178, figure 1 (showing ability to search the information with various attributes)

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- **The Documentum/Interleaf System:**

  The Documentum/Interleaf system has many attributes that organize, display, and link the portions and amended portions of text-based information, and so using the system would entail performing this method. *See, e.g.*:

  - Ovum Interleaf 1996, at 254–55 (and figure H2.3) ("RDM has several mandatory attribute types.")
  - Ovum Documentum 1996, at 208–09 ("Documentum offers good scope for organizing documents via the attributes which come built-in with the system.")

- **The Core Materials on Legal Ethics System:**

  The Core Materials on Legal Ethics system involves a method of using a system having many attributes that organize, display and link portions of text-based data.

- **The Federal Rules of Civil Procedure System:**

  The Federal Rules of Civil Procedure system a method of using a system having many attributes that organize, display and link portions of text-based data.

- **The Law Desk NY System:**

  The Law Desk NY system a method of using a system having many attributes that organize, display and link portions of text-based data.

- **The Law Desk USCS System:**

  The Law Desk USCS system a method of using a system having many attributes that organize, display and link portions of text-based data.

- **The New Mexico Law System:**

  The New Mexico Law on Legal Ethics system a method of using a system having many attributes that organize, display and link portions of text-based data.

- **The NY Official Reports System:**

  The NY Official Reports system a method of using a system having many attributes that organize, display and link portions of text-based data.

- **The NY CLS Beta System:**

  The NY CLS Beta system a method of using a system having many attributes that organize, display and link portions of text-based data.

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• **The OnPoint System:** The OnPoint system a method of using a system having many attributes that organize, display and link portions of text-based data. • **The Social Security Plus System:** The Social Security Plus system a method of using a system having many attributes that organize, display and link portions of text-based data. • **The UCC System:** • The UCC system a method of using a system having many attributes that organize, display and link portions of text-based data.
(g) encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes; • **Agosti 1991:** Agosti 1991 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Agosti 1991 discloses links between stored text-based documents, including links defined by the auxiliary data stored at the hyperconcept level. For example: • *See, e.g.*, "The representation of an object at this level is made by means of: connections to documents which are related to it…connections to the auxiliary data items," at 318. • *See, e.g.*, "The collection of document objects is organised at the first level of the architecture as a 'hyperdocument', that is in the form of a lattice structure," at 318. • *See, e.g.*, "The hyperdocument is made up of a network of structural links combined with the network of reference links…This means that the user may choose to follow along one path or another even in consideration of the direction of the references present within the semantic units," at 318. • *See, e.g.*, "The model supports navigability through the document collection. Due to the fact that specific cross-references are often present between the documents of the collection, the system must explicitly be able to support navigability through these connections," at 318. • *See, e.g.*, "Each of the two levels of the system's architecture represents a distinct

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network of nodes and links," at 319.

- *See, e.g.*, "The model supports navigation between the two levels by means of the navigability function. In this way it is at all times possible to pass from the hyperdocument to the hyperconcept and back again," at 320.
- *See, e.g.*, "By clicking the mouse button the object pointed is activated, i.e. the system receives the order to move in the direction indicated and to present the pertaining information or to execute the requisite function," at 322.
- *See, e.g.*, "It is possible to shift directly from any point in the hypertext network to other hyperdocuments by making use of the links existing between them," at 322.
- *See, e.g.*, "The nodes included within the single documents contains a function which allows all the links which bind that single document to the others to be displayed," at 323.

- **Arnold-Moore 1994:**

Arnold-Moore 1994 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Arnold-Moore 1994 discloses both static links and dynamic links which can be inserted into the stored text-based data. These links are defined, at least in part, by attributes such as time. For example:

- *See, e.g.*, "In this context hypertext would allow the note to be visible to the user only after they have selected (usually by pointing and clicking a mouse) a 'button' which is displayed with the text on the screen. Each separate unit of text which is presented on the screen is termed a *node*. The interrelated nodes and the links between them together form *hypertext*," at 3.
- *See, e.*g., "Hypertext allows the user to do exactly that. It's applicability to the legal domain and particularly statutes is widely recognized," at 4.
- *See, e.g.*, "The functionality of a hypertext database should also be supported. These include tracing links and queries based on the existence of links," at 5.
- *See generally, e.g.*, 6.
- *See generally, e.g.*, 12.
- *See, e.g.*, "Within a versioned hypertext, two kinds of links are possible: 1. static links – which refer to a specific version or part of a version; 2. dynamic links – which refer to the latest version or part or, more generally, to the version at a

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corresponding time," at 14

- *See, e.g.*, "Whether links should be in-line (appearing explicitly in the text) or stored in a separate link table seems dependent on the intended application," at 14.

- **Arnold-Moore 1994-2:**

Arnold-Moore 1994-2 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Arnold-Moore 1994-2 discloses links between stored text-based documents, which are defined, at least in part, by attributes such as an absolute identifier. For example:

- *See, e.g.*, "This information is explored by browsing, rather than querying, however we may view the traversal of a link as another kind of query," at THOM00196608.

- *See, e.g.*, "Finally, we will certainly wish to follow any hypertext links that are provided," at THOM00196608.

- *See, e.g.*, "When versioning hypertext, links can either be static or dynamic. In order to support static links to element we require an absolute identifier for each ELF. The EID is also useful for supporting dynamic inclusion of sub-elements," at THOM00196611.

- **Arnold-Moore 1997-2:**

Arnold-Moore 1997-2 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Arnold-Moore 1997-2 discloses use of SGML to create links between stored pieces of legislation. The disclosed links are defined, at least in part, by attributes such as section number. For example:

- *See, e.g.*, "Themis uses SGML to store legislation," at 175.

- *See, e.g.*, "Legislation has been described as providing a cross-reference network," at 179.

- *See, e.g.*, "Hypertext allows the user to do exactly that. It's applicability to the legal domain and particularly statutes is widely recognized," at 179.

- *See, e.g.*, "This text needs to be associated with the intended target element. For example the reference to 'section 135' (See Figure 3) will need to be associated with the element which has a section number of '135' (See Figure 5) in the target document," at 181.

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- *See, e.g.*, "Thus all links in Themis are dynamic rather than static," at 181.

- **Bachman 1973:**

  Bachman 1973 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Bachman 1973 discloses links that permit movement to the next or previous stored document, or from an attribute to a document described by that attribute. For example:

  - *See, e.g.*, "He can start at the beginning of the database, or at any known record, and sequentially access the 'next' record in the database until he reaches a record of interest or reaches the end," at 656.

  - *See, e.g.*, "He can enter the database with a database key that provides direct access to the physical location of a record," at 656.

- **Campbell 1988:**

  Campbell 1988 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Campbell 1988 discloses links between each node, which are defined by attributes. For example:

  - *See, e.g.*, "Nodes are related by links. A link defines a relationship between a source node and a destination node and can be followed in either direction. A cross-context link relates two nodes in different contexts and is useful for sharing data between two contexts. The generality provided by link attributes allows application writers to define their own notions of link types or link end-point attachment schemes," at 857.

  - *See, e.g.*, "Guide uses buttons – special areas on a screen – to represent links in a document between the information the screen and related information. When a button is selected, by clicking the mouse, Guide follows the link to display the related information. Replacement buttons replace the button icon displayed on the screen with the information associated with that button," at 858.

  - *See, e.g.*, "The various button relationships are modeled as links," at 858.

  - *See, e.g.*, "Figure 2 shows an example of a note button. The Document Browser contains the text being examined; the icon within the browser represents the note button. The Note Browser contains the note associated with the note button," at 858.

  - *See, e.g.*, "Therefore, the other end of the link representing the button can point to the entire node that contains the button's information," at 858.

  - *See, e.g.*, "FileBoxes can be represented in the HAM using nodes, links, and

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attributes. Both FileBoxes and notecards are equivalent to nodes. The model uses a node attribute to determine whether a node is a FileBox or a notecard. Links show which notecards (or FileBoxes) are in a particular FileBox. Link attributes determine which links refer to other FileBoxes and notecards," at 860.

- **Fay 1996:**

  Fay 1996 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Fay 1996 discloses that versions of documents contain markup and will be linked. For example:

  - *See, e.g.,* "The locking unit also contains the links that connect the tree elements within the locking unit, so that if the locking unit contains a section and three paragraphs, the links joining these elements will be within the locking unit, but links of these same paragraphs to other documents will not be within the locking unit," at 2:29–34.

  - "[T]he imported document instance would contain document, chapter, section, etc., objection having their own attributes and connected according to the structure implied by the descriptive markup." 3:35–40.

  - "Each element of a document is associated with a data field. For example, one node of a tree may be a chapter, and contain textual data in the form of a chapter heading, a chapter introductory paragraph, a chapter abstract, etc., as we as 'structural' data such as the identity of a parent (document), identify of children (sections), and connections to other places in other documents where the same language may also be used. The person who has the document checked out is the only person who can change any of this textual or structural data," at 1:25–34.

- **Horne 1997:**

  Horne 1997 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Horne 1997 discloses links, defined by the attribute of time, between versions of stored statutes. For example:

  - *See, e.g.*, "But markup could go further. It could give the dates on which the amendments were made, the dates on which they took effect, and the names of the Acts or SI which had made them, and the user's program could use this markup to display a statute as it was on a particular date chosen by the user and could offer hypertext cross-references to the amending legislation," at 3.

  - *See, e.g.*, "HMSO have a program called 'the Statute Law Database'. This is an electronic version of Statutes in Force. It contains in SGML form the law as it was on a particular date in the 1980s together with all acts and statutory instruments

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which have come into force since that time. All of these are linked together," at 3.

- **Kim 1996:**

  Kim 1996 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Kim 1996 discloses encoding links, including links defined by the attribute of a unique identifier, between stored multimedia. For example:

  - *See, e.g.*, "Meanwhile, hypermedia data relate multimedia data by linking them together, and permit users to browse related parts through links," at 496.
  - *See, e.g.*, "Besides, HOML defines virtual objects and dynamic link objects, which can decide a link destination with a query result in run time," at 497.
  - *See, e.g.*, "The anchor element specifies the source or the destination of a link. Since there can be many anchor elements in a text element, each anchor element should have a unique identifier," at 497.
  - *See, e.g.*, "The link element specifies a relation between a source object and a destination object through navigation. According to the number of destination objects, there are single links, multi-destination links and dynamic links," at 498.

- **Larson 1988:**

  Larson 1988 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Larson 1988 discloses links between stored text-based documents. For example:

  - *See, e.g.*, "A hypertext system is made up of a set of 'nodes' and 'links'. . . . Links are associative connections between nodes. They may represent a variety of associative connections, including citations, quotations, or similarity of content. They may also represent a hierarchic structuring of the nodes," at 195.

- **Lo 1995:**

  Lo 1995 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Lo 1995 discloses encoding the stored documents with links defined by SGML tags. For example:

  - *See, e.g.*, "Links and versioning are two important aspects of document management," at 339.

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- *See, e.g.*, "This paper thus attempts to describe a specific set of link versioning behaviors to provide a platform to explore the various issues of link versioning," at 339.
- *See, e.g.*, "Links represent inherent associations of content and structure of texts. Efficient management of links allows convenient cross referencing in information browsing," at 339.
- *See, e.g.*, "Link sources and destinations can be defined by SGML tags," at 339.
- *See, e.g.*, "intra-version link: both the source and the destination of the link are located in the same version, eg the ink ab; intra-version link: both the source and the destination of the link are located in the same document, but different versions, eg the link ef; inter-document link: both the source and the destination of the link are located in different documents, eg the link ed," at 340.
- *See, e.g.*, "An intra-version link is static in nature," at 340.
- *See, e.g.*, "In contrast to intra-version links, inter-document links are dynamic in nature, tending towards switching or augmenting destination references whenever new versions are created in which their destinations are duplicated," at 341.
- *See, e.g.*, "The first method is the traditional method (also employed by SGML) of referencing locations with unique identification. The second method attempts to manage links as objects, each with an identification itself," at 342.
- *See, e.g.*, "Conceptually this method specifies unique identifiers (Ids) for referent elements (destinations); and directional links can be established by making references (Ref) from the reference elements (sources) to the referent elements' identifiers," at 342.

- **Lo 1996:**

Lo 1996 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Lo 1996 discloses links and markups language, with the text including links encoded with markup language. For example:

- *See, e.g.*, page 9, section 1.2.2 (Managing Functions). For example: "Link support is a facility provided by the basic service layer. Managing links is a direct support of non-linearity of documents as mentioned in Section 1.1. Link support is a prerequisite to information retrieval by browsing. It is also particularly important in depicting the dependence relationships between various documents, if such relationships need to be maintained and utilized . . . ."

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- *See, e.g.,* page 11, section 1.3. For example: "Links and versioning are two important aspects of document management. Efficient management of links allows convenient cross referencing in information browsing."
- *See, e.g.,* page 12, section 1.4. For example: "In particular, SGML structures can be utilized to implement links."
- *See generally, e.g.*, section 2.1, starting on page 15, entitled "Linking."
- *See generally, e.g.*, section 2.3.2, starting on page 39, entitled "SGML Support for Linking."
- *See, e.g.,* figure 2.5, page 41.

- **Osterbye 1992:**

  Osterbye 1992 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Osterbye 1992 discloses using links between stored nodes, which are defined, at least in part, by the element of date. For example:

  - *See, e.g.*, "Links are one-to-one, and can be anchored to nodes in both ends," at 34.
  - *See, e.g.*, "A link can point to a specific element, in which case the link always points to the same element. Or the link can point to the current element, meaning the newest element in the version group," at 38.
  - *See, e.g.*, "The link is an entity that relates a source node to a destination node (or subtypes of nodes)," at 38.

- **Sacks-Davis 1994:**

  Sacks-Davis 1994 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Sacks-Davis 1994 discloses encoding links between stored documents defined by SGML attributes. For example:

  - *See, e.g.*, "SGML can be used to support advanced presentation modes such as hypertext," at THOM00198835.
  - *See, e.g.*, "Access by SGML attributes is a commonly used method for supporting hypertext links," at THOM00198839.

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- **Sacks-Davis 1995:**

  Sacks-Davis 1995 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Sacks-Davis 1995 discloses encoding links, defined by attributes, between stored documents using hypertext. For example:

  - *See, e.g.*, "In addition to atomic attributes and structured attributes, Atlas supports reference attributes. A reference is a tuple comprising the global key of a record or nested record. In the hypertext example, bidirectional links between documents and their associated nodes are maintained using reference attributes, so that in table Hypertext, attribute doc has values from the domain of the key of the Document table, namely, attribute doc_id," at 456.

  - *See, e.g.*, "Rather than store documents as monolithic objects in a database it is more efficient to represent documents as a set of smaller fragments, which can be connected by links. Links allow users to browse documents by following the original document structure, and to discover knowledge by browsing fragments in the other documents. This is the basic paradigm underlying hypertext systems," at 465.

- **Sciore 1991:**

  Sciore 1991 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Sciore 1991 discloses encoding stored documents with "pointers" to other stored documents. For example:

  - *See, e.g.*, "Typically, refinement is implemented by including the scheme of T1 in each T2-object, and extension is implemented by storing a pointer to a T1-ojbect in each T2-object," at 357.

- **Stonebraker 1990:**

  Stonebraker 1990 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Stonebraker 1990 discloses that every record in the POSTGRES database contains a linking means defined by the attribute of a unique identifer. For example:

  - *See e.g.*, "Because POSTGRES gives each record a unique identifier (OID), it is possible to use the identifier for one record as a data item in a second record. Using optionally definable indexes on OID's it is then possible to navigate from one record to the next by running one query per navigation step," at 126.

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- **Travis & Waldt:**

  Travis & Waldt discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Travis & Waldt discloses hypertext links, defined by attributes such as ID, to other parts of a document or to other documents. For example:

  - *See, e.g.*, "HTML provides a simple means to place hypertext links in your document. These links can point to locations in your own document, to other documents at your side, or even to documents at other sites around the world," at 56.
  - *See generally, e.g.*, 241–42 (defining ID, IDREF, IDREFS).
  - *See generally, e.g.*, 293–95 ("In modern terms these [cross-references] are called hyperlinks."; "In SGML, we usually use an empty element to indicate a link to some other part of the document. The ID and IDREF declared values for attribute definition lists are used to assure uniqueness (in the case of ID) and valid reference (in the case of IDREF) within the document.").

- **Wilkinson 1998:**

  Wilkinson 1998 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Wilkinson 1998 discloses navigation by links. For example:

  - *See generally, e.g.*, section 5.8, beginning on page 95 (describing navigation by linking).
  - *See, e.g.*, pages 98–99 (discussing the issues with versioning of links in a versioned document management system).
  - *See generally* section 2.4.6, beginning on page 28 (entitled "SGML").

- **Wilson 1988:**

  Wilson 1988 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Wilson 1988 discloses encoding links between stored documents using hypertext, including links defined by attributes such as date. For example:

  - *See, e.g.*, "Justus automatically highlights inter-statute references and intra-statute references. When a user selects a reference, the text corresponding with that

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reference is displayed," at 27.

- *See, e.g.*, "Terms that are defined within the interpretation section of the statute are also highlighted through the statute; the definition can be displayed on request," at 27.

- *See, e.g.*, "By selecting the button [BEFORE 5 JULY 1973], we can see the text of Section 167(2)(a) before it was amended: figure 9," at 35.

- **Wilson 1990:**

Wilson 1990 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Wilson 1990 discloses encoding links between stored documents using hypertext. For example:

- *See, e.g.*, "In directed graph systems, the text is divided into segments called nodes: in principle any node in the system should be accessible from any other node," at 123.

- *See, e.g.*, "Each node in a hypertext system has a label or name or, in Guide, a definition button. This label can be used as a link icon or, in Guide, a usage button or a glossary button, any number of times throughout the text. When a link icon or button (definition, usage or glossary) appears on the display it is highlighted in some way: in Guide, by using bold type face or by underlining. It can be selected using a pointed device such as a mouse. When this happens the hypertext system finds and displays the text associated with that icon or button," at 123.

- **Wilson 1992:**

Wilson 1992 discloses "encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes." Specifically, Wilson 1992 discloses both hypertext links or "buttons" that link between versions of legislative material. Wilson 1992 also discloses automatic recognition of citations within text-based data which can then be replaced with hypertext links. For example:

- *See, e.g.*, "Local buttons are an ideal mechanism for multiple versions. An electronic system makes it easier to store the name of the amending author and the date of the amendment where these are required. Figure 12 shows a section of the Industrial Relations Act 1971 with local buttons for an earlier version. Figure 13 shows the button expanded," at 179-180.

- *See, e.*g., "Explicit location references in the text to other nodes, either within the same document or in other documents, can be automatically converted to hypertext

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links," at 170.

- *See, e.g.*, "Another example is a cross-reference. Consider the requirement to create a link to an on-line database containing legal citations. The name of the citation must be rendered on the screen in a different color and underlined, which informs the user that the item is associated with an external link. Either of the following approaches will work…," at 306.

- **The Pre-1997 Westlaw/Westmate System**:

  The Westlaw/Westmate system included portions of text-based data and amended portions of text-based data wherein the portions were encoded with a markup language that included links that used attributes. For example:

  - *See, e.g.,* DataBasics 1993, ("United States Code Annotated": Disclosing "Update" and "Docs in Sequence" navigation features), at doc no. 79858-59.

  - *See, e.g.,* www.westlaw.com, California Statutes Annotated Database from 1996 (CA-STAN96), CA BUS & PROF § 28 (two versions: one active and one as amended).

  - *See, e.g.,* www.westlaw.com, California Statutes Annotated Database from 1996 (CA-STAN96), CA BUS & PROF § 2 (showing linking means within statutory portion).

  - *See, e.g.,* AMPEX § 2.

  - The Essential Guide 1996, at 15: "Jump is the feature on WESTLAW that lets you move instantly from one location to another. To use Jump, simply press **Tab** until your cursor reaches the Jump marker (> or ▶), then press **Enter**. If you use a mouse, you can position the cursor on the Jump marker and click or double-click."

  - *See generally* The Essential Guide 1996, at Chapter "5.4 Jump"

  - The Essential Guide 1996, at 136, showing a statutory section, including some of the fields within a statute, as well as a link to a related case.

  - The Essential Guide 1996, at 154, showing a link from a law review article to a case.

- **The Pre-1997 Premise System**:

  The Premise system included linking means of a markup language that used attributes. For example:

  - *See, e.g.,* Premise Software & Statutes: "Browse" the "Document List" in the CA-STAT-AN1 database within the Premise software, including Bus. & Prof. Code §§ 2

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& 26, which contain links to other sections and cases.

- *See, e.g.,* Premise Publisher, at 3 ("By marking your original source documents, you can add embedded references to create links, which allow you to jump directly to other documents, images, PREMISE electronic books, applications or WESTLAW . . . ."); 11 (defining "Hypertext Link" as "A section of text that refers to a related piece of text . . . or an object. The related information is the target of the reference."); 30 (explaining "References and Target Points"); 49 (showing means for linking in PREMISE); 156–61 (describing how to add links to documents).

- Premise Publisher: 30 (stating that the chapter is instructing the user how to insert markup code into documents for purposes of publishing them via PREMISE); 74–96 (explaining how to add the correct markup tags and attributes to an ASCII file); 359 (defining "Data markup"); 360 (defining "Data markup codes")

- **The Astoria System (pre-1997):**

The Astoria System allowed users to use a markup language and to add links to documents. Use of this system therefore constitutes a method for encoding each of the plurality of portions of text-based data and the amended portion of text-based data with a markup language to include at least one link defined by one of the plurality of attributes. For example:

- *See, e.g.,* Astoria 1997-1: "Astoria Link Clusters allow users to link components in hypertext fashion within and between documents. Through Link Clusters, users can identify associations—for instance, topical relationships—between related components without changing the location of the component. This allows Astoria users to organize related information so they can reference and update it more quickly," at THOM00211908.

- *See, e.g.,* XSoft: "LINKS: Users can connect elements to other elements in hypertext fashion within and between documents using links. The links let workers create non-linear paths of relationship through the database," at THOM00198648-49.

- *See, e.g.,* XSoft Astoria: "Astoria has complete version control capabilities. . . . The result is a version control module that is consistent with an SGML environment," at THOM00198652.

- *See, e.g.,* XSoft Premiers Astoria: "Astoria is fully integrated with the XSoft InContext SGML Editor," at THOM00211913. "Astoria is particularly well-suited to working with structured documents based on the Standardized Generalized Markup Language (SGML), making the management of those documents significantly easier and more productive," at THOM00211914. "[I]t builds on the value of SGML with document management capabilities such as

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version control, revision tracking and component re-use," at THOM00211914. • *See,e.g.,* XSoft: "Astoria is an object-oriented document production component management system that enable users to easily find, use, share and manage SGML documents and their components, as well as unstructured documents. . . .Because Astoria works directly with SGML elements using an object-oriented database, it can provide unprecedented control over SGML documents as well as unstructured information by allowing fine-grained access and version control," THOM00198647. • **The EnAct System** (previously known as Themis)**:** The EnAct system uses a markup language, including links that used attributes. For example: • *See, e.g.,* Arnold-Moore 1997-2, at 179 (text following the heading: "Cross References"), and in particular: "The *Themis* system uses SGML tags to identify both internal and external cross references (typically identified in the user interface by a shaded background). Each target element has an identifier (unique within that document) in the tag which can then be included in the tag of the source of the reference. . . . These tags—in combination with an SGML display which supports hypertext—allow users to navigate from the text of the reference (See Figure 3) to the fragment which contains the element to which the reference refers (See Figure 5). The identifier from the source tag is used to construct a query which retrieves the appropriate fragment from the database." • *See, e.g.,* http://web.archive.org/web/19990430002036/www.thelaw.tas.gov.au/background.html: "advanced searching and browsing capabilities with all cross-references and amendment history information stored as electronic hyperlinks." • **The Documentum/Interleaf System:** The Documentum/Interleaf system allows users to use a markup language and to add links to documents using attributes. For example: • Interleaf allows users to utilize the SGML markup language. *See* Consleg 1996, at 301 ("SGML is used as the representation format for the storage of acts." • Interleaf allows links. *See* Ovum Interleaf 1996, at 254 ("Creation of document objects is done via design templates, which define where document objects are stored and the relationship between these objects and other objects.") • RightSite provides the ability to include links in documents. *See* RightSite 1996, at 218–219.

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• **The Core Materials on Legal Ethics System:** The Core Materials on Legal Ethics system involves a method of using a system having a markup language, including links. • **The Federal Rules of Civil Procedure System:** The Federal Rules of Civil Procedure system a method of using a system having a markup language, including links. • **The Law Desk NY System:** The Law Desk NY system a method of using a system having a markup language, including links. • **The Law Desk USCS System:** The Law Desk USCS system a method of using a system having a markup language, including links. • **The New Mexico Law System:** The New Mexico Law on Legal Ethics system a method of using a system having a markup language, including links. • **The NY Official Reports System:** The NY Official Reports system a method of using a system having a markup language, including links. • **The NY CLS Beta System:** The NY CLS Beta system a method of using a system having a markup language, including links. • **The OnPoint System:** The OnPoint system a method of using a system having a markup language, including links. • **The Social Security Plus System:** The Social Security Plus system a method of using a system having a markup language, including links. • **The UCC System:**

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• The UCC system a method of using a system having a markup language, including links.
(h) allowing a user to search the text-based data using at least one of the plurality of attributes; and • **Agosti 1991:** Agosti 1991 discloses "allowing a user to search the text-based data using at least one of the plurality of attributes." Specifically, Agosti 1991 discloses using attributes in query formation and indicates that a variety of searching functions could be used with the disclosed model. For example: • *See, e.g.*, "EXPLICIT is based on a two-level architecture which holds the two main parts of the informative resource managed by an information retrieval tool: the collection of documents and the indexing term structure. The term structure is managed as a schema of concepts which can be used by the final user as a frame of reference in the query formulation process," at 316. • *See, e.g.*, "The EXPLICIT hypertext retrieval model is based on a two-level architecture, which holds the two main parts of a database managed by an information retrieval system: the collection of documents, and the auxiliary data. By the term auxiliary data we mean the data describing the document information contents," at 317. • *See, e.g.*, "a set of structured data which represents the different deterministic properties of the object (e.g., date of publication, title, list of authors, etc.)," at 318. • *See, e.g.*, "When the object is inserted in the network it becomes a node of the structure. The data which the object contains are modeled as property values of the object and become, when inserted, actual node attributes. Some node attributes can be, for example, name, node type (e.g. legal authority documents, law documents, auxiliary data items), or the link type," at 320. • *See, e.g.*, "Following the results of the user's requirements analysis which has been initially conducted, it has been decided to include in the model only a simple string search function, because the results of the analysis have indicated that it was not considered really important to include particularly sophisticated search functions," at 318. • **Arnold-Moore 1994:** Arnold-Moore 1994 discloses "allowing a user to search the text-based data using at least one of the plurality of attributes." Specifically, Arnold-Moore 1994 discloses a means of filtering through legislative material based on effective dates. For example: • *See, e.g.*, "Queries can use these indicies to return a subset of the database which can

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then be filtered on time constraints," at 11.

- *See, e.g.*, "A time index on the version skeleton can be maintained independently of the content index to filter versions on time," at 12-14.

- **Anwar 1996:**

Anwar 1996 discloses "allowing a user to search the text-based data using at least one of the plurality of attributes." Specifically, Anwar 1996 discloses a method for querying, retrieving, and displaying data, including text-based data, on a computer. For example:

- *See, e.g.*, "The multi-dimensional display and manipulation system includes an [sic] user interface and a multi-dimensional data object subsystem where the subsystem includes means for . . . retrieving. . . multi-dimensional data objects and the user interface includes means for displaying and graphically manipulating the multi-dimensional data objects in a window defined on a display device," at Summary of the Invention.

- *See, e.*g., Analysis Scenario 1, starting at 14:64–16:39, describing ways in which a user can formulate multi-dimensional queries using the attributes of the stored data.

- **Arnold-Moore 1994-2:**

Arnold-Moore 1994-2 discloses "allowing a user to search the text-based data using at least one of the plurality of attributes." Specifically, Arnold-Moore 1994-2 discloses searching either by keyword, by attribute, or by a combination. For example:

- *See, e.g.*, "The language, Structured Generalized Query Language (SGQL), allows efficient access to the content, structure and attributes of documents at any level within their structure," at THOM00196608.

- *See, e.g.*, "Queries might specify that certain attributes have particular values, but have concentrated on matching against the content of the document," at THOM00196608.

- *See, e.g.*, "These databases will need to be searched by attribute," at THOM00196608.

- *See, e.g.*, "We thus see that a database system to support databases of large structured documents need a query language that allows retrieval: by exact matching Boolean combinations of words and phrases; by ranking by similarity to a given text; using hypertext links; by attribute," at THOM00106609.

- *See generally* THOM00196609-10 (Representative Queries).

- *See, e.g.*, "The relational model extended to support content queries can support a

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whole range of queries including mixed content and structure, pure structure, and attribute queries," at THOM00196610. • **Arnold-Moore 1997:** Arnold-Moore 1997 discloses "allowing a user to search the text-based data using at least one of the plurality of attributes." Specifically, Arnold-Moore 1997 discloses searching by keywords and by attributes such as effective date. For example: • *See, e.g.*, "The drafter can view any Act or search the whole database using Boolean or ranking queries at any time point for which a valid version is stored on the system," at 59. • **Arnold-Moore 1997-2:** Arnold-Moore 1997-2 discloses "allowing a user to search the text-based data using at least one of the plurality of attributes." Specifically, Arnold-Moore 1997-2 discloses a means of filtering through legislative material based on effective dates. For example: • *See, e.g.*, "Despite improved performance of ranking (or natural language) queries, lawyers who have used digital legal libraries will be most familiary with the Boolean query approach," at 177. • *See, e.g.*, "The SIM system supports both Boolean (with proximity operators) and ranking queries," at 177. • *See, e.g.*, "A standard inverted-file word index can be used to extract a list of matching documents on content (or an enhanced index to allow queries on structure also), and then this list can be filtered by a time constraint using a time-index," at 179. • *See, e.g.*, "Each fragment or table of contents has a valid start and end time associated with it. We then use an inverted-file index to give access to the fragments by content. As described for whole documents, we then filter results using the time information to collect just the fragments which are valid at the specified time defaulting to the current date (See Figure 1)," at 179. • **Bachman 1973:** Bachman 1973 discloses "allowing a user to search the text-based data using at least one of the plurality of attributes." Specifically, Bachman 1973 discloses searching by attributes, which he describes as "data keys." For example: • *See, e.g.*, "In sequential file technology, search techniques are well established. Start with the value of the primary data key, of the record of interest, and pass each record in the file through core memory until the desired record, or one with a higher key, is

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found. (A primary data key is a field within a record which makes that a record unique within the file.) Social security numbers, purchase order numbers, insurance policy numbers, bank account numbers are all primary data keys. Almost without exception, they are synthetic attributes specifically designed and created for the purpose of uniqueness. Natural attributes, e.g. names of people and places, dates, time, and quantities, are not assuredly unique and thus cannot be used," at 654.

- *See, e.g.*, "Database management has two main functions. First is the inquiry or retrieval activity that reaccesses previously stored data in order to determine the recorded status of some real world entity or relationship," at 654.

- *See, e.g.*, "In addition to a record's primary key, it is frequently desirable to be able to retrieve records on the basis of the value of some other fields. For example, it may be desirable, in planning ten-year awards, to select all the employee records with the 'year-of-hire' field value equal to 1964. Such access is retrieval by secondary data key. The actual number of records to be retrieved by a secondary key is unpredictable and may vary from zero to possibly include the entire file. By contract, a primary data key will retrieve a maximum of one record," at 655.

- *See, e.g.*, "With the advent of retrieval on secondary data keys, the previously one-dimensional data space received additional dimensions equal to the number of fields in the record," at 655.

- **Bentley 1979:**

  Bentley 1997 discloses "allowing a user to search the text-based data using at least one of the plurality of attributes." Specifically, Bentley 1979 discloses six alternative methods for searching in the disclosed k-dimensional space using attributes. For example:

  - *See, e.g.*, "In this section we investigate a number of search methods for range searching," at 398.

  - *See generally* 398-405.

- **Campbell 1988:**

  Campbell 1988 discloses "allowing a user to search the text-based data using at least one of the plurality of attributes." Specifically, Campbell 1988 discloses searching the stored data by attribute. For example:

  - *See, e.g.*, "The HAM maintains history for these objects, allows selective access through a filtering mechanism…," at 856.

  - *See, e.g.*, "Attributes are also used in the predicates that are part of the HAM filters,"