Office de la Propriété Intellectuelle du Canada
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CA 2720897 C 2015/06/30

(11)(21) 2 720 897

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 2009/04/28
(87) Date publication PCT/PCT Publication Date: 2009/11/05
(45) Date de délivrance/Issue Date: 2015/06/30
(85) Entrée phase nationale/National Entry: 2010/10/06
(86) N° demande PCT/PCT Application No.: CA 2009/000569
(87) N° publication PCT/PCT Publication No.: 2009/132444
(30) Priorité/Priority: 2008/04/28 (US61/048,516)

(51) Cl.Int./Int.Cl. *G06F 9/44* (2006.01),
H04L 29/02 (2006.01)

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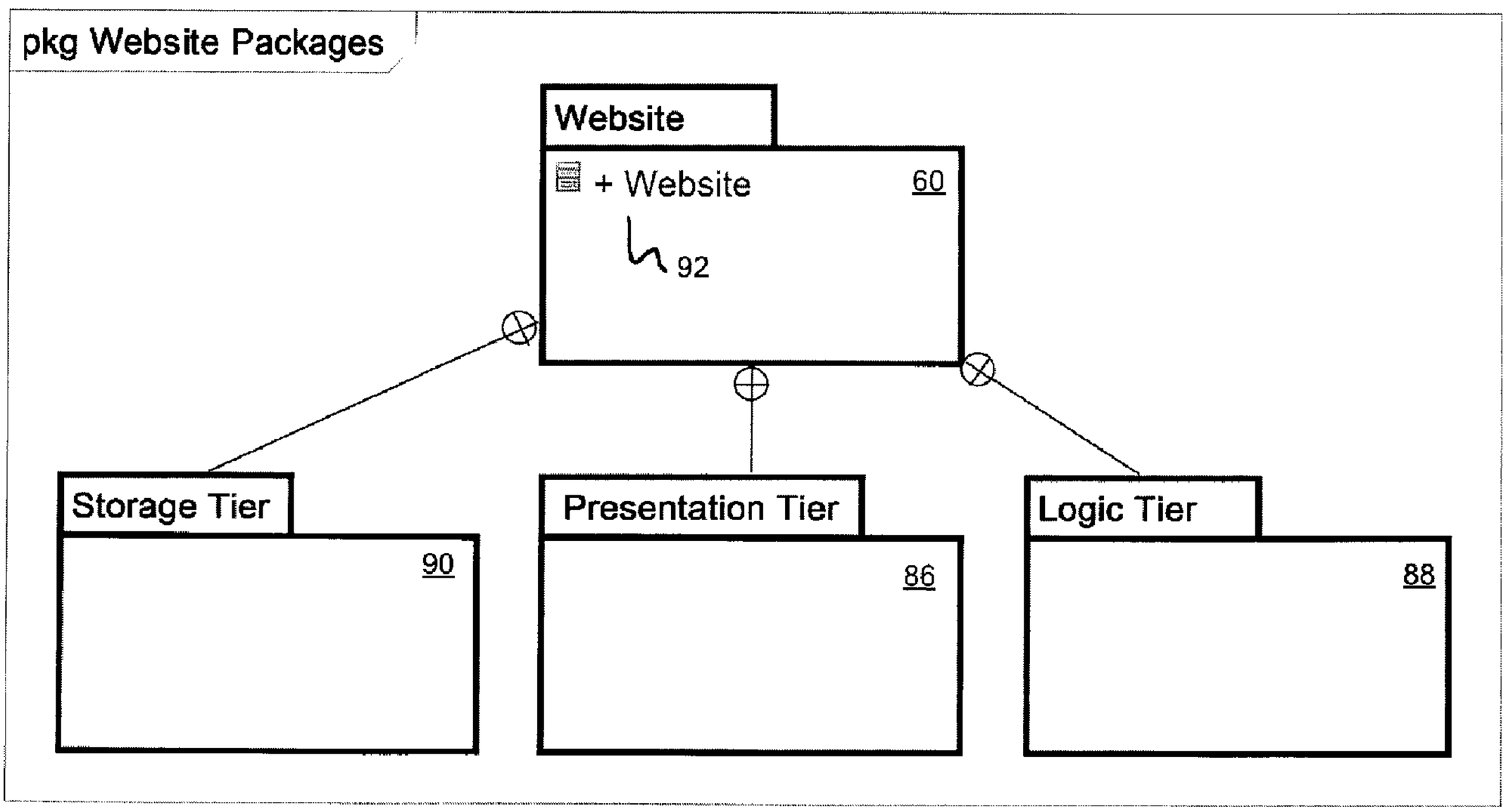
(54) Titre : SYSTEME ORIENTE OBJET DE CREATION ET DE GESTION DE SITES WEB ET DE LEURS CONTENUS
(54) Title: OBJECT-ORIENTED SYSTEM FOR CREATING AND MANAGING WEBSITES AND THEIR CONTENT



(57) Abrégé/Abstract:
The invention teaches a method for creating and managing a website as an object oriented system, comprising: providing on a system server a plurality of hierarchical classes of objects, each of the classes representing one aspect of the storage, presentation and logic of a website; providing on a web server an interface operable to present representations of objects instantiating the plurality of hierarchical classes and receive commands meant to one of : instantiate a new object, destroy a presented object, and change a property of a presented object; and storing on a database server objects as a traversable tree in accordance with the plurality of hierarchical classes.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 November 2009 (05.11.2009)

PCT

(10) International Publication Number
WO 2009/132444 A1

(51) International Patent Classification:
G06F 9/44 (2006.01) *H04L 29/02* (2006.01)

(21) International Application Number:
PCT/CA2009/000569

(22) International Filing Date:
28 April 2009 (28.04.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/048,516 28 April 2008 (28.04.2008) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) Title: OBJECT-ORIENTED SYSTEM FOR CREATING AND MANAGING WEBSITES AND THEIR CONTENT

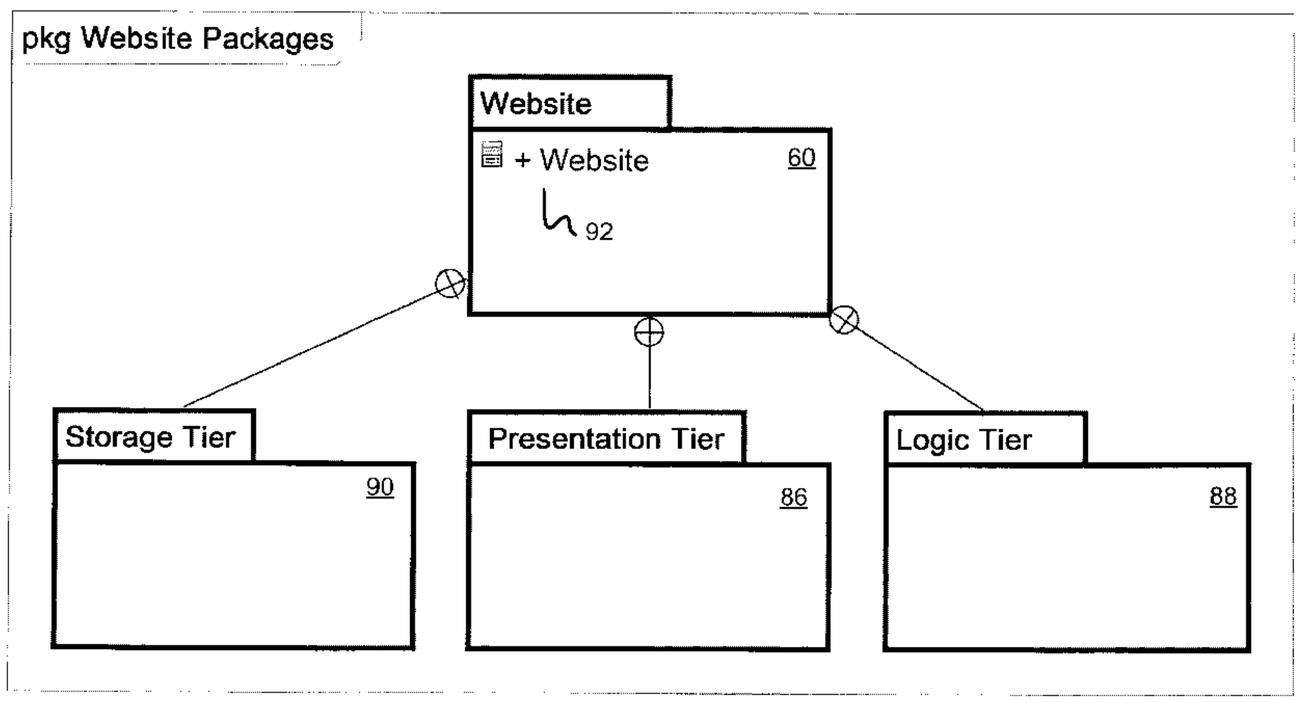

Figure 4

(57) Abstract: The invention teaches a method for creating and managing a website as an object oriented system, comprising: providing on a system server a plurality of hierarchical classes of objects, each of the classes representing one aspect of the storage, presentation and logic of a website; providing on a web server an interface operable to present representations of objects instantiating the plurality of hierarchical classes and receive commands meant to one of : instantiate a new object, destroy a presented object, and change a property of a presented object; and storing on a database server objects as a traversable tree in accordance with the plurality of hierarchical classes.

WO 2009/132444 A1

OBJECT-ORIENTED SYSTEM FOR CREATING AND MANAGING WEBSITES AND THEIR CONTENT

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of application serial number US61/048,516 filed April 28, 2008.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention is directed to ways to create and manage websites and their content. More particularly, the invention is directed to an object-oriented way to create and manage dynamic websites and their content.

2. Description of the Related Art

[0003] Today, web pages and their content are typically created, managed and delivered using a variety of tools and systems. Programming tools (e.g. Adobe Dreamweaver™) are commonly used for web page creation, and authoring tools (e.g. Microsoft Word™ or Adobe PhotoShop™) are commonly used for content creation. Content Management Systems (e.g. Drupal™ or OpenCMS™) may also be used for controlling and transforming content after it has

been created, and version control systems and database and web servers are used for storing and delivering the web pages and their content to end user browsers.

[0004] While in some cases it may be valuable from a "separation of concerns" perspective (i.e. having the creative department use one set of tools, and the IT department use others), the use of tools and systems that are not integrated makes it necessary to integrate the work product of each department in a separate, final step to permit a given web page and its content to be published to the Internet. One problem with this approach is that it is time consuming, and this problem is exacerbated by the tendency that websites (and their content) are rarely static. Almost all websites change frequently, being updated constantly to reflect changes in the organization or individual publishing the website or in its (or his/her) environment.

[0005] The absence of an integrated system makes creating and revising content and a set of web pages on a website (or on any given web page of a website) unduly difficult in terms of both effort and complexity. Once design mock-ups and digital assets (e.g. art, photos, and videos) have been developed, the website's web pages are built with these design elements using HTML, CSS and JavaScript programming languages to achieve the effects called-for in the design. Next (or in parallel), news articles, product data sheets and other information are developed to form the content for the site.

[0006] At this point the user faces a choice of whether or not to use a Content Management System (a "CMS"). Content Management Systems are typically employed if the content on a website is expected to change frequently. If not, then the website publisher will typically "hard-code" the content directly into each web page file.

[0007] If a CMS approach is chosen, the next step is to place all content items into a relational database, and to turn each web page file (via programming) into a "page

template" that is bound to the CMS. The CMS then dynamically (or, in some systems, statically during a compilation process) creates individual web pages of a website by combining the content in the database with the layout, presentation and behavior defined in the web page template. At this point, the final web page is ready for delivery to an end user's browser.

[0008] A significant problem with the technologies and processes described above is that it is very difficult to build and integrate all of the content and web page (i.e. layout, presentation, and behavior) components needed for a sophisticated website. If a CMS is employed to manage content changes, the initial build is even more difficult, and even if a CMS is employed, it is still very difficult to make subsequent changes to site structure ("site map") and web page components without involving considerable programming.

[0009] For illustration, consider this simple example:

[0010] Without a CMS, combining content and web page visual aspects (layout, presentation and behavior) may be done like this using HTML and JavaScript:

```
<body>
  <div>
style="background-color: yellow";
        onclick="showMenu(someElementID)"
onmouseover="this.className=fredHighlight"
onmouseout="this.classname="fred"
class="fred">
        <p>
        This is some text
</p>
  </div>
</body>
```

[0011] The above code would produce a section on a web page with a yellow background color (layout and presentation) as well as set up some code to handle mouse clicks, etc. (behavior). Finally, it would display the line "This is some text" (content) on the page.

[0012] Using a CMS, the above code would become:

```
<body>
  <div>
style="background-color: yellow";
onclick="showMenu(someElementID)"
onmouseover="this.className=fredHighlight"
onmouseout="this.classname="fred"
class="fred">
        <p>
        $Content
</p>
  </div>
</body>
```

[0013] The term "$Content" is a variable whose value (e.g. "This is some text") is defined and stored in a database that is populated by the website publisher. If the value of $Content is indeed "This is some text", then the CMS code above would produce, from the end user browser's perspective, exactly the same web page and content as the non-CMS code above. However, note that by implementing the CMS, the content in the database could be changed to any value (say, for example, "Hello World") and this would be automatically displayed on the web page the next time it is rendered.

[0014] The CMS approach therefore provides an improvement relative to the hard coding of all content into individual web pages in situations where the content is expected to change relatively frequently. However, the CMS approach also has significant drawbacks in that it does not facilitate changes in web page visual aspects. What if, for example, a website publisher wants to change the background color, or more interestingly to change what happens when the end user browser clicks or hovers on certain elements within a web page? How would the publisher add an entirely new web page to display new content?

[0015] Changes of this sort are examples of changes to web page visual aspects (including structure, layout, presentation and behavior), and cannot be implemented using current technologies without additional programming.

SUMMARY OF THE INVENTION AND ADVANTAGES

[0016] The present invention is addressed to these challenges.

[0017] The following summary provides a simplified overview of the subject matter that is described herein, and is not intended to identify any critical elements, nor to delineate the scope of the described or claimed subject matter. The sole purpose of the summary is to outline in a simplified form the aspects of the subject matter that will be described in greater detail below.

[0018] Briefly described, the subject matter disclosed herein relates in various embodiments to systems and methods that support the creation and lifecycle management of all the attributes and methods contained within a typical website in a completely object-oriented manner, such that traditional web programming languages, version control and content management systems are not required. A three tier approach is applied, providing a presentation tier, a logic tier and a storage tier.

[0019] At the presentation tier, some of the objects created and managed include:

- Sitemap and Navigation
- Pages and layout
- Page elements (aka widgets)
- Forms and database views
- Styles, and
- User event (mouse clicks, key presses, etc) handling

[0020] At the logic tier:

- Business rules, including workflows, and
- Server-side event handling

[0021] And at the storage tier:

- Configuration and object persistence
- Structured (headers, footers, body text, lists, blogs, news items - generically "content") and non structured (e.g., PDF files) user data storage
- User defined tables, and
- Search and retrieval of stored data

[0022] In contrast to existing website production and delivery systems, the system and method described herein allows each object to be managed (created, updated, versioned) separately from each other, while retaining the relationships (containment, parent, child, sibling, is a, etc.) between the objects. For example, a content display object and its relationship to content items and pages that may contain it.

[0023] With this object-oriented design, objects within a website can be created and changed independently from each other without requiring textual programming. Objects are created and configured via a drag/drop or fill-in-the-blank metaphor, as are their behaviors and inter-relationships (e.g. Page to element, Form to table, table to fields, etc.).

[0024] In accordance with one aspect of the invention there is provided a method for creating and managing a website as an object-oriented system. The method involves providing, on a system server, a plurality of hierarchical classes of objects, each object of the plurality of hierarchical classes of objects represents one aspect of the storage, presentation, and logic of a website. Each object of the plurality of hierarchical classes of objects is managed separately from each other while retaining relationships between the plurality of hierarchical classes of objects. The method also involves providing, on a web server, a user-interface operable to present representations of objects instantiating the plurality of hierarchical classes of objects, and to receive commands meant to one of instantiate a new object, destroy a presented object, and change a property of a presented object. The method further involves storing, on a database server, objects as a traversable tree in accordance with the plurality of hierarchical classes of objects, and rendering, on the system server, a user-requested portion of the website by traversing a

corresponding portion of the traversable object tree that defines the user-requested portion of the website, and generating a dynamic webserving that renders the user-requested portion of the website in response to properties of the traversed objects from the corresponding portion of the traversable object tree. The web server redirects all traffic from an object editor to the system server, and the system server stores web page and content data changes received from a configuration tool and returns the web page and content data changes to a web browser in a manner that is compatible for the web browser to properly render the web page and content data changes visually. All web page and content data changes are stored and retrieved from a relational database on the database server.

[0024] Presenting representations of objects may include presenting symbolic representations of objects.

[0025] Providing a user-interface may include providing a What-You-See-Is-What-You-Get (WYSIWYG) user-interface.

[0026] Receiving commands may involve receiving user-inputs.

[0027] In accordance with another aspect of the invention there is provided a system for creating and managing a website as an object-oriented system. The system includes a system server computer operable to provide a plurality of hierarchical classes of objects, each object of the plurality of hierarchical classes of objects represents one aspect of the storage, presentation, and logic of a website, and each object of the plurality of hierarchical classes of objects is managed separately from each other while retaining relationships between the plurality of hierarchical classes of objects. The system also includes a web server computer in communication with the system server computer and operable to provide a user-interface operable to present representations of objects instantiating the plurality of hierarchical classes of objects, and receive commands meant to one of instantiate a new object, destroy a presented object, and change a property of a presented object. The system further includes a database server computer in communication with the system server computer and operable to store objects as a traversable tree in accordance with the plurality of hierarchical classes of objects. The system server computer is further operable to render a user-requested portion of the website by traversing a corresponding portion of the traversable object tree that defines the user-requested portion of the website, and generating a dynamic webserving that renders the user-requested portion of the website in response to properties of the traversed objects from the corresponding portion of the traversable object tree,

the web server computer is further operable to redirect all traffic from an object editor to the system server computer. The system server computer is further operable to store web page and content data changes received from a configuration tool and return the web page and content data changes to a web browser in a manner that is compatible for the web browser to properly render the web page and content data changes visually. All web page and content data changes are stored and retrieved from a relational database on the database server computer.

[0027a] The web server computer may be further operable to present representations of objects that are symbolic representations of objects.

[0027b] The web server computer may be further operable to provide a user-interface that is a What-You-See-Is-What-You-Get (WYSIWYG) user-interface.

[0027c] The web server computer may be further operable to receive commands that are user-inputs.

[0027d] In accordance with another aspect of the invention there is provided a system for creating and managing a website as an object-oriented system. The system includes provisions for providing a plurality of hierarchical classes of objects, each object of the plurality of hierarchical classes of objects represents one aspect of the storage, presentation, and logic of a website, and each object of the plurality of hierarchical classes of objects is managed separately from each other while retaining relationships between the plurality of hierarchical classes of objects. The system also includes provisions for providing a user-interface, including provisions for presenting representations of objects instantiating the plurality of hierarchical classes of objects, and provisions for receiving commands meant to one of instantiate a new object, destroy a presented object, and change a property of a presented object. The system further includes provisions for storing objects as a traversable tree in accordance with the plurality of hierarchical classes of objects, and provisions for rendering a user-requested portion of the website, including provisions for traversing a corresponding portion of the traversable object tree that defines the user-requested portion of the website, and provisions for generating a dynamic webserving that renders the user-requested portion of the website in response to properties of the traversed objects from the corresponding portion of the traversable object tree. The provisions for providing a user-interface includes provisions for redirecting all traffic from an object editor to the provisions for providing a plurality of hierarchical classes of objects. The provisions for providing a plurality of hierarchical classes of objects includes provisions for storing web page and content data changes received from

a configuration tool and returning the web page and content data changes to a web browser in a manner that is compatible for the web browser to properly render the web page and content data changes visually. All web page and content data changes are stored and retrieved from a relational database on the provisions for storing objects.

[0027e] The provisions for presenting representations of objects may include provisions for presenting symbolic representations of objects.

[0027f] The provisions for providing a user-interface may include provisions for providing a What-You-See-May be-What-You-Get (WYSIWYG) user-interface.

[0027g] The provisions for receiving commands may include provisions for receiving user-inputs.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] Other advantages of the present invention will be readily appreciated, as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0029] Figure 1 is a UML 2.1 use case diagram illustrating how a website creator, a website manager and website end-user might interact with one embodiment of the present invention;

[0030] Figure 2 is a UML 2.1 deployment diagram illustrating the deployment of the embodiment of Figure 1 on an internetwork of communication and computing devices;

[0031] Figure 3 is an abstraction layer diagram of a communication and computing devices of Figure 2, illustrating a hardware layer, operating system layers and an application program layer;

[0032] Figure 4 is a UML 2.1 package diagram illustrating packages of hierarchical classes for representing a website, including a topmost Website class, a presentation tier package, a logic tier package and a storage tier package.

[0033] Figure 5 is a UML 2.1 class diagram illustrating exemplary classes from the presentation tier package;

[0034] Figure 6 is a UML 2.1 class diagram illustrating exemplary classes from the logic tier package;

[0035] Figure 7 is a UML 2.1 class diagram illustrating exemplary classes from the storage tier package;

[0036] Figure 8 is a user interface diagram illustrating a main screen of an editor for creating and managing objects instantiating the classes of Figures 4 through 7 to represent a particular website.

[0037] Figure 9 is a UML 2.1 activity diagram illustrating the operation of an object rendering component deployed in Figure 2.

[0038] Figure 10 is a UML 2.1 activity diagram detailing an exemplary rendering of the object rendering component of Figure 9.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0039] Introduction

[0040] Referring to the Figures, like numerals indicate corresponding parts throughout the several views.

[0041] Figure 1 generally illustrates a system for creating and managing a website **20** as an object-oriented structure. A website creator **22**, website manager **24** and website end-user **26** respectively create, manage and use the dynamic website, communicating through their respective web browsers **28** with a web server **30**.

[0042] Terminology

[0043] Throughout this specification, the term "web page" refers to the visual aspects of any given page of a website, including layout (e.g. the size and location of visual elements or "widgets" on each page), presentation (e.g. style, colors, and format of widgets), and behavior (e.g. what happens when a user moves a mouse **32**, clicks a button or menu, hovers, etc.),

[0044] The term "content" refers to the information (e.g. text and graphics, such as, for example, a news article) that is delivered to an end user browser **28** via the web pages of a given website.

[0045] The term "webserving" means a portion of code -- generally some combination of HTML, CSS and JavaScript -- sent from a web server **30** to a web browser **28** to direct the browser **28** to perform desired functionality, such a presenting a webpage or a portion of a webpage.

[0046] Those skilled in the art will understand that in an internetworked system **20** an action is often the result of coordinated activities occurring at multiple nodes in the system **20**. In the case of a system **20** built on the Internet, these nodes are often distributed ad hoc and unpredictably across multiple jurisdictions. The actions as described and claimed herein are intended to encompass at least: (a) actions performed directly and completely within the jurisdiction of the patent, (b) actions coordinated within the jurisdiction but with at least some

activities performed outside the jurisdiction, (c) actions coordinated outside the jurisdiction but with at least some activities performed within the jurisdiction, and (d) actions performed for the benefit of a node within the jurisdiction or a person using that node. An example of such coordination would be serving a layout for a web page from one node and serving content for insertion into the layout from one or more other nodes, including through the use of server-side scripting, client-side scripting, and AJAX techniques.

[0047] Structure

[0048] Figure 2 is a deployment diagram of the system **20**, which is deployed as an internetwork **34** of communication and computing devices **36**. As will be discussed in greater detail below, the communication and computing devices **36** are variously configured as clients **38, 40, 42** and servers **30, 44, 46**. More specifically, a client might be a website creator's client **38**, a website manager's client **40** or a website end-user's client **42**. A server might be a web server **30**, a system server **44** or a database server **46**.

[0049] Each of the clients **38, 40, 42** might be a duly configured general purpose programmable computer or a more purpose-specific device **36**, such as a smartphone, a microbrowser, or portable media viewer with a wireless modem.

[0050] A server might similarly be a duly configured general purpose programmable computer, but might also be a farm of such computers or one or more virtualized computers embodied as processes operating on a physical general purpose programmable computer. Such farmed or virtualized computers might themselves be distributed over their own local or wide area network **34**, not shown.

[0051] In essence, the servers **30, 44, 46** and the clients **38, 40, 42** are roles or functions performed in the system **20** by properly configured devices **36**. Multiple roles or

functions could be performed by one device **36** and one role or function could be distributed over multiple devices **36**. The specific character of a device **36** (and more generally the hardware) and the network **34** topology is important to the extent that it supports the performance of the assigned roles or functions.

[0052] The web server **30**, system server **44** and database server **46** may be connected together in three-tier fashion to serve the presentation, logic and data aspects of dynamic websites, the web server **30** and the system server **44** communicating in HTML, CSS and JavaScript and the system server **44** and the database server **46** communicating in SQL.

[0053] The clients **38, 40, 42** may communicate with the web server **30** using the HTTP protocol to interact with the websites. More particularly, the creator's client may communicate to create a website, the manager's client may communicate to manage a website, and the end-user's client may communicate to use a website.

[0054] To implement this arrangement, the devices **36** each host an operating system **48** that provides an execution Environment supporting the required functionality. The operating systems **48** might also support distributed execution among the devices **36**.

[0055] In this way, the clients **38, 40, 42** each support a browser component **28** to implement communication with the web server **30**, for example such as Microsoft® Internet Explorer®, Firefox®, Safari® or Opera®. The creator's client and the manager's client might also support an editor applet component **50** to better implement communication with the system server **44** for editing website objects, as will be discussed further below.

[0056] Similarly the servers **30, 44, 46** have dedicated components supported by the operating system **48** execution environment. The web server **30** has a web server component **52** that instructs it on how to perform its role as a web server **30**, for example Apache® Apache®,

Microsoft® Internet Information Services® or Google® Google Web Server **30** ®. The system server **44** has an object editor component **54** and an object renderer component **56** that respectively instruct it on how to create, modify and destroy objects that represent aspects of a website and to render the objects into webservings that can be communicated by the web server **30**. The database server **46** has a database management system component **58** that instructs it on how to create, store, search, maintain and destroy objects that represent aspects of a website drawn from a website package **60** of classes, which will be described further with respect to Figures 4-7.

[0057] Figure 3 illustrates a common construction of a communication and computing device **36**, including a general purpose programmable computer. These devices **36** have a hardware layer **62**, an operating system layer **64** and an application program layer **66**. Those skilled in the art will recognize the aspects in which like virtualized hardware and devices **36** depart from like physical ones.

[0058] The hardware layer **62** provides the device **36** with computing and communication hardware, including: (a) a processor **68** to execute processes of instructions and compute data, (b) user-input hardware such as a keyboard **70** and a selection device **72** (for example a mouse **32**) to receive input from a user, (c) user-output hardware such as a video display **74** to provide information to a user, (d) mass storage **76** such as electromagnetic, optical or nonvolatile solid-state media to store data and processing instructions, (e) memory such as read only memory **78** and random access memory **80** to store data and processing instructions, and (f) a network interface **82** to support communication with other devices **36** in accordance with known protocols such as TCP/IP, all interconnected by buses such as address and data buses

and control lines such as interrupt and clock lines and such other connections and components as is conventionally required and known in the art.

[0059] Stored in a portion of the read only memory **78** and the mass storage **76** are the components of the operating system layer **64**, for example LINUX® or Microsoft® Windows® Server® for a device **36** such as general purpose programmable computer configured as a server **30, 44, 46** or LINUX® or Microsoft® Windows® VISTA® for a device **36** configured as a client **38, 40, 42**, or even Microsoft® Windows® CE® for a portable such client **38, 40, 42** device **36**. The operating system layer **64** provides the basic instructions to direct the processor **68** how to interact with the other hardware described above and more generally how to perform the functions of a communication and computing device **36**, including storing, accessing and computing data, and communicating with other devices **36**.

[0060] The operating system layer **64** also presents an application program interface **84** to the application program layer **66**, so the processor **68** can execute more sophisticated combinations of processes under the direction of higher level application programs stored in mass storage **76** and loaded into RAM **80** for execution, for example the components described in Figure 2.

[0061] Figure 4 illustrates packages **60, 86, 88, 90** of classes for completely representing a dynamic website in an object-oriented manner. In this regard, there is provided a Website package **60** that contains classes and packages **60, 86, 88, 90** for representing a dynamic website. The Website package **60** contains a Website class **92** that provides attributes and operations representing the overall nature of a website and further contains a Presentation Tier package **86**, a Logic Tier package **88**, and a Storage Tier package **90** that in turn contain classes that represent more particular aspects of the website

[0062] Figure 5 shows an example hierarchy of classes below the Website class **92** for representing presentation aspects of the website and inclusion in the presentation tier package **86**. Thus for example, the presentation tier package **86** could include a User Event Handling class **94** for handling client-side user-events and a Styles class **96** for specifying the style of the website. The presentation tier package **86** could also include a Navigation class **98**, for example a Sitemap class **100**, for defining ways to navigate the website. The presentation tier package **86** might also include a Pages class **102** for defining aspects of each webpage, in cooperation with a Layout class **103** for defining visual layout aspects of the webpage and a Page Elements **104** class for representing page widgets, for example database **58** views and forms as represented respectively by a Database Views class **106** and a Forms class **108**.

[0063] Figure 6 shows an example hierarchy of classes below the Website class **92** for representing logic aspects of the website and inclusion in the logic tier package **88**. Thus for example, the logic tier package **88** could include a Server-Side Event Handling class **110** for handling server-side events and a Business Rules class **112** for representing the business rules that establish the logical operation of the website, for example workflows as represented by a Work Flows class **114**.

[0064] Figure 7 shows an example hierarchy of classes below the Website class **92** for representing storage aspects of the website and inclusion in the storage tier package **90**. Perhaps most importantly, the storage tier package 90 includes a Data Source class **115** to enable objects to be either local, for example on the website manager's **24** own network, or hosted by a software as a service vendor on the system **20**. Thus for example, the website manager's 24 own network might provide a web application that the system **20** can interact with via objects of the Data Sources class **115** to allow an end-user **26** to access and interact with the local application

via web pages that are created and managed by the system **20**. In this regard, "Data Sources" are a class of object in the system **20** that sit on top of the data tier and contains and abstracts the information needed for the system **20** to "bind" to a set of web services exposed by any web application, which may encapsulate its own set of presentation, logic and storage tier objects. In the hosted case, objects of the Data Sources class **115** simply point to data objects within the system **20**. In this way, the website manager **24** can create web pages that render content from data objects that are stored and managed in other business applications that are exposed to the internet via XML web services, for example SOAP and REST.

[0065] The storage tier package **90** could also include a Digital Assets **116** class for representing digital assets **116** and a Databases class **118** for representing databases. The Databases class **118** could include a number of aggregate classes, including a User-Defined Tables class **120** for representing the data structure, including for example fields represented by a User Fields class **122**, a Search Queries class **124** for representing search queries, and a Search Query Results class **124, 126** for representing query results. The storage tier package **90** might also include an Object Configuration class **128** for representing the configuration of objects, including for example object persistence as represented by an Object Persistence class **130**. Additionally, the storage tier package **90** might include classes for representing content for the website, for example a Content Lists class **132** that represents a cataloguing of content items as represented by a Content Items class **134**. The Content Items class **134** might in turn include a number of aggregate classes such as a User Data - Nonstructured class representing unstructured data and a User Data - Structured class representing structured data, for example data having an author, title and body as respectively represented by an Author class **140**, a Title class **142**, and a Body class **144**.

[0066] Those skilled in the art will recognize the hierarchical nature of the classes and packages **60, 86, 88, 90** contained in the Website package **60**, such that traversing the tree of the hierarchy will produce a definition of the website or of that portion defined by the portion of the tree traversed.

[0067] Thus Figures 4-7 graphically depict the types of classes within an exemplary system **20** and the relationships between them. Many sites, as well as their child objects, can be hosted and managed by the system **20** at once. As shown, a site object can contain one or more page objects which, in turn, can contain one or more widgets (page elements **104**), etc.

[0068] Each of the objects of the system **20** has a defined set of behaviors, properties and events. Once a site object has been created, the manager can create, update and delete styles, pages, content lists, database **58** tables, workflows and digital assets **116** completely independently from each other. All object configurations are stored in the database management system **58** to enforce data integrity, versioning, search and retrieval.

[0069] After a site and its related objects have been configured, the system **20** is ready to serve data to client browser **28** requests. When a browser **28** requests data (e.g. a particular web page), the system **20** dynamically creates the data necessary for the web browser **28** to render the page accurately to the end user. This is done by traversing the object tree associated with a given request, reading the correct version of each object from the database **58**, binding all object data together and lastly creating an HTML representation of the requested data. This technique allows all of a web site's objects to be treated and handled in a truly object-oriented manner on the server side while ultimately transforming them into the structural

elements (HTML, CSS, Image files) needed by a web browser **28** to render and interact with end-users of the website.

[0070] Figure 8 shows a graphical user interface **146** of the object editor component **54**, presented by the browser component **28** on the creator's client or the manager's client, with the assistance of the editor applet component **50** if one exists, to enable the creator or manager to interact with the object editor component **54** on the system **20** sever via the web server **30** for the purpose of creating, modifying or destroying objects instantiating classes in the Website package **60** to create or manage a website.

[0071] The GUI **146** includes four main regions, a WYSIWYG design region **148**, an objects catalog region **150**, an object property table region **152**, and a button pad region **154**.

[0072] The catalog region includes an existing objects list **156** that catalogs all objects that currently exist to represent aspects of the website and an object palette **158** that catalogs all available classes for representing aspects of a website for which objects may be instantiated.

[0073] The design region **148** provides a "what-you-see-is-what-you-get" area for laying out the presentation aspects of a portion of a website, for example placing and sizing content item objects **160** ("widgets"). A context menu **162** may be available to conveniently set various common properties of a selected one of the content item objects **160**.

[0074] The object property table **152** provides a way to inspect and modify the properties of a selected object, including objects that may not be conveniently represented in the design region **148** such as objects instantiating classes in the logic tier package **88** or the storage tier package **90**.

[0075] The button pad region **154** provides a create button **164**, a destroy button **166** and a modify button **168**. The create button **164** instantiates an object selected from the object palette **158** and presents it for inspection and modification in the object property table **152**. The destroy button **166** destroys the selected object. The modify button **168** presents the selected object in the object property table **152** from inspection and modification.

[0076] Operation -- Creating and Managing

[0077] In operation, a website creator **22** or website manager **24** creates or manages a website through the GUI **146** described in Figure 8. He can select from the existing objects catalog **150** any of the objects that currently represent aspects of the website and the selected object will be presented in the object property table **152** and, in the case of objects that can be represented by the WYSIWYG paradigm, selected in the design region **148**. The properties of the selected object can be modified in the object property table **152** upon pressing the modify button **168**. Alternatively, common properties of objects presented in the design region **148** can be modified using the context menu **162**.

[0078] Objects in the WYSIWYG design area can be selected, moved, resized, reflowed, etc. as directed by the mouse **32** or another user input device **36**. New objects can be dragged from the object palette **158** and placed as desired onto the design area.

[0079] Pressing the create button **164** instantiates an object selected from the object palette **158** and presents it for inspection and modification in the object property table **152**. Pressing the destroy button **166** destroys the selected object.

[0080] In general, the object editor (presented in a standard web browser **28**) hosts web pages and objects that form the user interface for creating and managing websites, including pages, forms, tables and structured content. All user interface elements within the

object editor can be hosted in an AJAX standard web browser **28** with no client-side plug ins. The object editor sends user input and receives and renders system **20** responses via standard internet technologies, namely using the AJAX design pattern along with XHMTL compatible data, all transferred via http to a standard web server **30**.

[0081] The web server **30** redirects all traffic from the object editor (or from the client's browser **28**) to the system server **44**. In simplest terms, the system server **44** is responsible for storing page and content data changes received from configuration tool or from display, and returning data changes in a manner that is compatible for a browser **28** to properly render it visually. All data changes are stored and retrieved from relational database **58**. In this regard, the web server **30** provides an interface operable to present representations of and functions as means for representing objects instantiating the plurality of hierarchical classes and to receive commands meant to one of: (1) instantiate a new object, (2) destroy a presented object, and (3) change a property of a presented object. As embodied, this interface includes a user-interface and in fact a WYSIWYG user-interface, this representation includes symbolic representation and the commands include user-input.

[0082] The database server **46** performs standard database **58** tasks for the system **20**, including: persistence and retrieval, indexing and search, transactions and rollback, enforcement of data typing and relational integrity as well as replication and archiving.

[0083] At a deeper level, the system server **44** consists of a complete or partial set of the objects that define a website, with one topmost Website object for each user's web site, as well as objects for each page, table, content item, etc. that a given site may contain. Each object is derived from a set of hierarchical classes and sub-classes that allow each object to:

- store and retrieve their own configuration data from the database **58**;

- store and manage an indefinite history of changes to itself such that any previous state of itself can be restored should the latest version of an object not be what a user wants;
- render itself in a manner that is compatible with web browsers **28**;
- accept user input and process it in an object specific way; and,
- define their own rules for how to handle user – or system **20** events. E.g., Mouse **32** clicks or record adds/updates.

[0084] In this regard, system server 44 provides and functions as means for providing a plurality of hierarchical classes of objects, each of the classes representing one aspect of the storage, presentation and logic of a website.

[0085] By using object orientation, new object instances (or classes of objects) can be added to the system **20** or changed without affecting other objects in the system **20**. Further, new objects can be derived from existing objects, thereby inheriting the features of the base object while still allowing customization of the new object. For example, a blog object can be created that is based upon the content list object, thereby inheriting its storage and enumeration mechanism while allowing its own, encapsulated version control. In this regard, the database server **46** stores and functions as means for storing objects as a traversable tree in accordance with the plurality of hierarchical classes.

[0086] Operation -- Using

[0087] Referring now to Figures 2 and 9, when a website end-user **26** wants to use a website, he directs the browser component **28** on his device **36** to the web server **30** to request presentation of a particular portion of the website. That portion might be a webpage or a lesser portion, for example in the case of AJAX techniques.

[0088] The web server component **52** on the web server **30** receives this request and conveys it to the system server **44**, where the object renderer component **56** receives it.

[0089] In a receipt and parsing step **170**, the request for webserving is parsed to determine what is being requested and what portion of the website the request relates to.

[0090] In a define webserving step **172**, the objects that define the portion of the website relevant to the request are read by traversing the tree hierarchy of the objects.

[0091] In a render webserving step **174**, a webserving is assembled in HTML, CSS and JavaScript code that renders requested portion of the website as defined in the relevant objects.

[0092] In a transmit webserving step **176**, the webserving is transmitted to the web server **30** for transmission to the browser component **28** of the end-user.

[0093] Figure 10 illustrates an example traversal of the hierarchy of objects defining a webpage during execution of the define webserving step **172**. In this example traversal, the overall website object is read **178**, then the relevant page object is read **180**, then in parallel two relevant page widget objects are read. With respect to one of the two page widget objects, a database view object is read **182**, which ends the traversal of that branch. With respect to the other one of the two page widget objects, a content list object is read **184**, following which a content item object is read **186**, which ends the traversal of the other branch and the relevant portion of the tree.

[0094] Thus the system server **44** renders and functions as means for rendering a requested portion of a website by traversing the corresponding portion of the object tree and generating a dynamic webserving in response to the properties of the traversed objects.

[0095] In greater detail, referring back to Figure 9, when the end-user requests a given web page within a given site, the request (via an URL – e.g., http://yoursite.com/page1) is transferred via the web server **30** and http to the system server **44**. Within the system server **44**, the top level website object locates requested page object from the object repository in the DBMS **58**. Next, the "published version" of the page object enumerates all of the published versions of each widget object(s) contained within the requested page object and tells them to create themselves. Note that the page object has no knowledge of the internals of each widget: their versioning information, data format on disk or how they behave is all encapsulated within each widget object. Note also that any changes to the page (e.g., new/deleted/updated widgets) would automatically be reflected each time a page is requested.

[0096] Once each page widget is created in memory, it is activated – allowing each widget to run its own specific code and bind to its data. In the case of content block widgets or "list viewers", the data is retrieved by binding to and reading from content list objects. Each widget on a given page binds its own data source; for example, with reference to Figure 10, the page binds the content block widget and the other widget, and the other widget binds its data source.

[0097] Once a content list object is requested by a content block widget, it enumerates and creates its child objects, content item(s). Again, each list item is an object, encapsulating the knowledge of its internal versions and state information, as well as how to read, process and present its data within itself.

[0098] Once each page widget object has been created, performed its initialization, and received its data from it data sources (e.g., content lists), it renders itself within the page container for viewing in the end-user's browser **28**. That is, each widget dynamically

produces the HTML, CSS and JavaScript necessary within the requested page for rendering in the web browser **28** and processing of user input.

[0099] Lastly, the system server **44** sends the fully rendered page (or only the changed portion of the page if the page is already loaded within the end-user's browser **28**) back to the end-user's browser **28** for presentation and user input.

[00100] Obviously, many modifications and variations of the present invention are possible in light of the above teachings and may be practiced otherwise than as specifically described while within the scope of the appended claims. In addition, the reference numerals in the claims are merely for convenience and are not to be read in any way as limiting.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method for creating and managing a website as an object-oriented system, comprising:

(a) providing, on a system server, a plurality of hierarchical classes of objects, wherein each object of the plurality of hierarchical classes of objects represents one aspect of the storage, presentation, and logic of a website, and wherein each object of the plurality of hierarchical classes of objects is managed separately from each other while retaining relationships between the plurality of hierarchical classes of objects;

(b) providing, on a web server, a user-interface operable to:

(i) present representations of objects instantiating the plurality of hierarchical classes of objects; and

(ii) receive commands meant to one of:

(1) instantiate a new object;

(2) destroy a presented object; and

(3) change a property of a presented object;

(c) storing, on a database server, objects as a traversable tree in accordance with the plurality of hierarchical classes of objects; and

(d) rendering, on the system server, a user-requested portion of the website by:

(i) traversing a corresponding portion of the traversable object tree that defines the user-requested portion of the website; and

(ii) generating a dynamic webserving that renders the user-requested portion of the website in response to properties of the traversed objects from the corresponding portion of the traversable object tree,

wherein the web server redirects all traffic from an object editor to the system server, wherein the system server stores web page and content data changes received from a configuration tool and returns the web page and content data changes to a web browser in a manner that is compatible for the web browser to properly render the web page and content data changes visually, and wherein all web page and content data changes are stored and retrieved from a relational database on the database server.

2. A method as claimed in claim **1**, wherein presenting representations of objects includes presenting symbolic representations of objects.

3. A method as claimed in claim **2**, wherein providing a user-interface includes providing a What-You-See-Is-What-You-Get (WYSIWYG) user-interface.

4. A method as claimed in claim **3**, wherein receiving commands includes receiving user-inputs.

5. A system for creating and managing a website as an object-oriented system, comprising:

(a) a system server computer operable to provide a plurality of hierarchical classes of objects, wherein each object of the plurality of hierarchical classes of objects represents one aspect of the storage, presentation, and logic of a website, and wherein each object of the plurality of hierarchical classes of objects is managed separately from each other while retaining relationships between the plurality of hierarchical classes of objects;

(b) a web server computer in communication with the system server computer and operable to provide a user-interface operable to:

(i) present representations of objects instantiating the plurality of hierarchical classes of objects; and

(ii) receive commands meant to one of:

(1) instantiate a new object;

(2) destroy a presented object; and

(3) change a property of a presented object; and

(c) a database server computer in communication with the system server computer and operable to store objects as a traversable tree in accordance with the plurality of hierarchical classes of objects, wherein the system server computer is further operable to render a user-requested portion of the website by:

(i) traversing a corresponding portion of the traversable object tree that defines the user-requested portion of the website; and

(ii) generating a dynamic webserving that renders the user-requested portion of the website in response to properties of the traversed objects from the corresponding portion of the traversable object tree, wherein the web server computer is further operable to redirect all traffic from an object editor to the system server computer, wherein the system server computer is further operable to store web page and content data changes received from a configuration tool and return the web page and content data changes to a web browser in a manner that is compatible for the web browser to properly render the web page and content data changes visually, and wherein all web page and content data changes are stored and retrieved from a relational database on the database server computer.

6. A system as claimed in claim **5**, wherein the web server computer is further operable to present representations of objects that are symbolic representations of objects.

7. A system as claimed in claim **6**, wherein the web server computer is further operable to provide a user-interface that is a What-You-See-Is-What-You-Get (WYSIWYG) user-interface.

8. A system as claimed in claim **7**, wherein the web server computer is further operable to receive commands that are user-inputs.

9. A system for creating and managing a website as an object-oriented system, comprising:

(a) means for providing a plurality of hierarchical classes of objects, wherein each object of the plurality of hierarchical classes of objects represents one aspect of the storage, presentation, and logic of a website, and wherein each object of the plurality of hierarchical classes of objects is managed separately from each other while retaining relationships between the plurality of hierarchical classes of objects;

(b) means for providing a user-interface, including:

(i) means for presenting representations of objects instantiating the plurality of hierarchical classes of objects; and

(ii) means for receiving commands meant to one of:

(1) instantiate a new object;

(2) destroy a presented object; and

(3) change a property of a presented object;

(c) means for storing objects as a traversable tree in accordance with the plurality of hierarchical classes of objects; and

(d) means for rendering a user-requested portion of the website, including:

(i) means for traversing a corresponding portion of the traversable object tree that defines the user-requested portion of the website; and

(ii) means for generating a dynamic webserving that renders the user-requested portion of the website in response to properties of the traversed objects from the corresponding portion of the traversable object tree,

wherein the means for providing a user-interface includes means for redirecting all traffic from an object editor to the means for providing a plurality of hierarchical classes of objects, wherein the means for providing a plurality of hierarchical classes of

objects includes means for storing web page and content data changes received from a configuration tool and returning the web page and content data changes to a web browser in a manner that is compatible for the web browser to properly render the web page and content data changes visually, and wherein all web page and content data changes are stored and retrieved from a relational database on the means for storing objects.

10. A system as claimed in claim **9**, wherein the means for presenting representations of objects includes means for presenting symbolic representations of objects.

11. A system as claimed in claim **10**, wherein the means for providing a user-interface includes means for providing a What-You-See-Is-What-You-Get (WYSIWYG) user-interface.

12. A system as claimed in claim **11**, wherein the means for receiving commands includes means for receiving user-inputs.

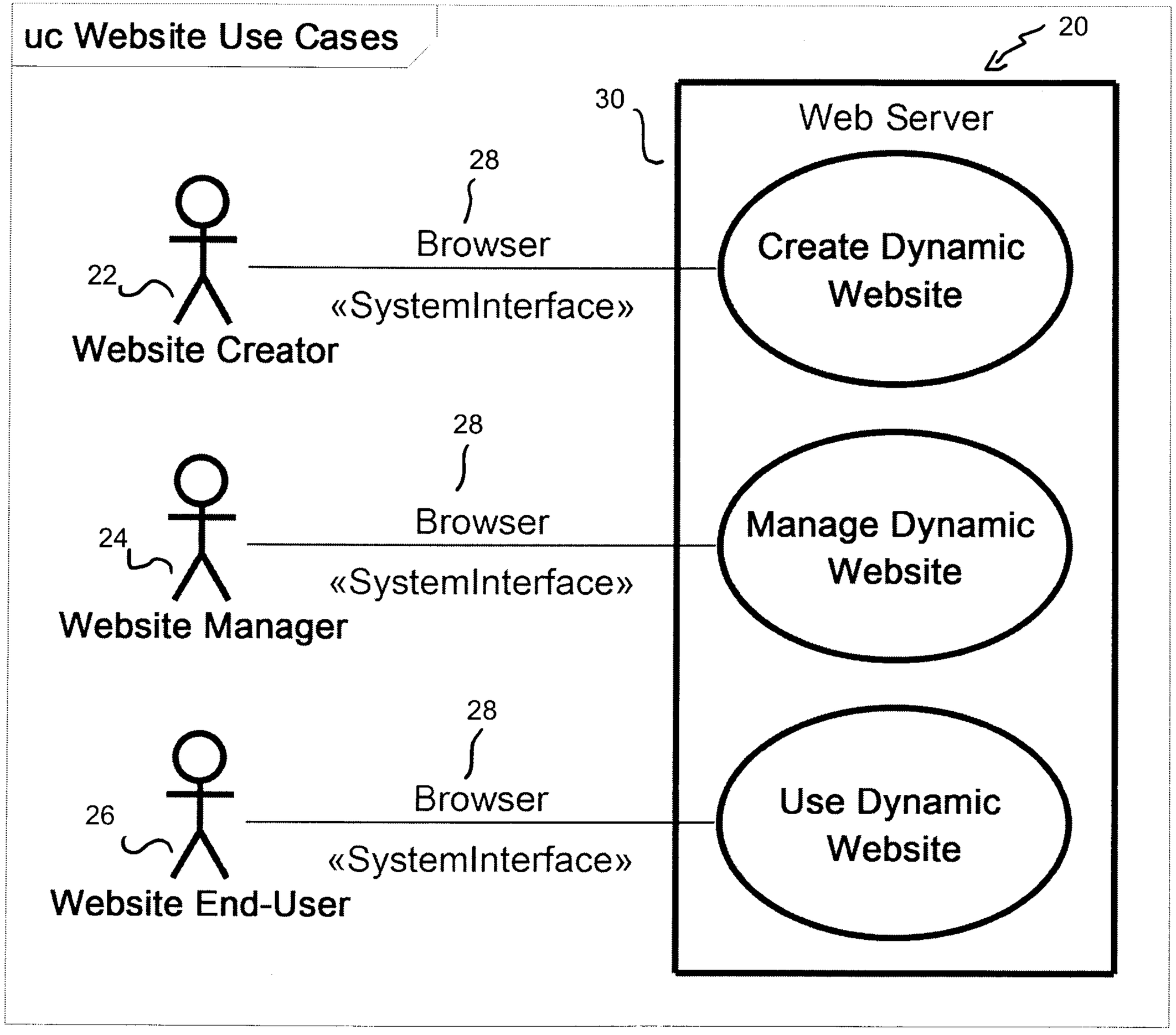

Figure 1

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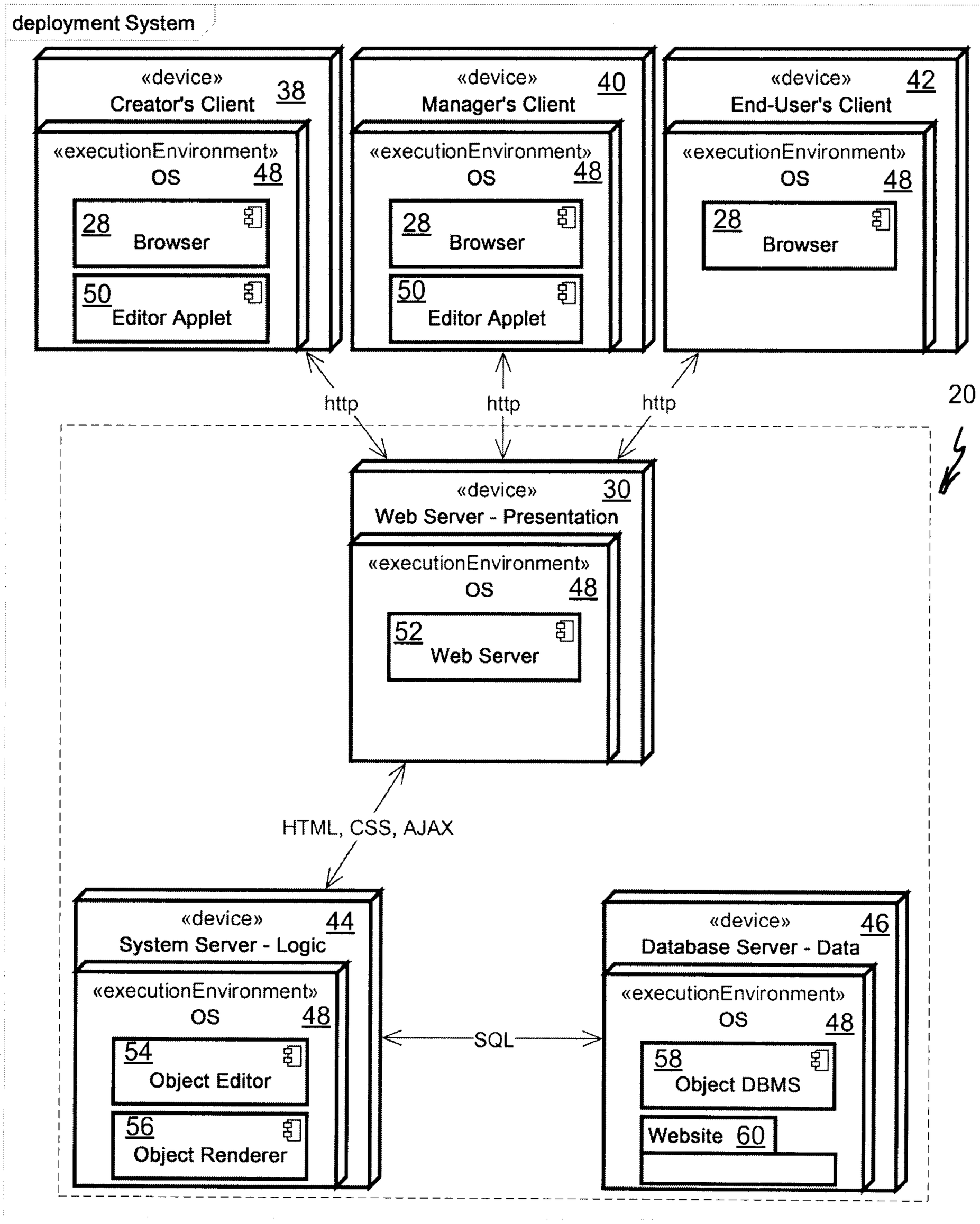
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Editor Applet
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End-User's Client
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Web Server - Presentation
30
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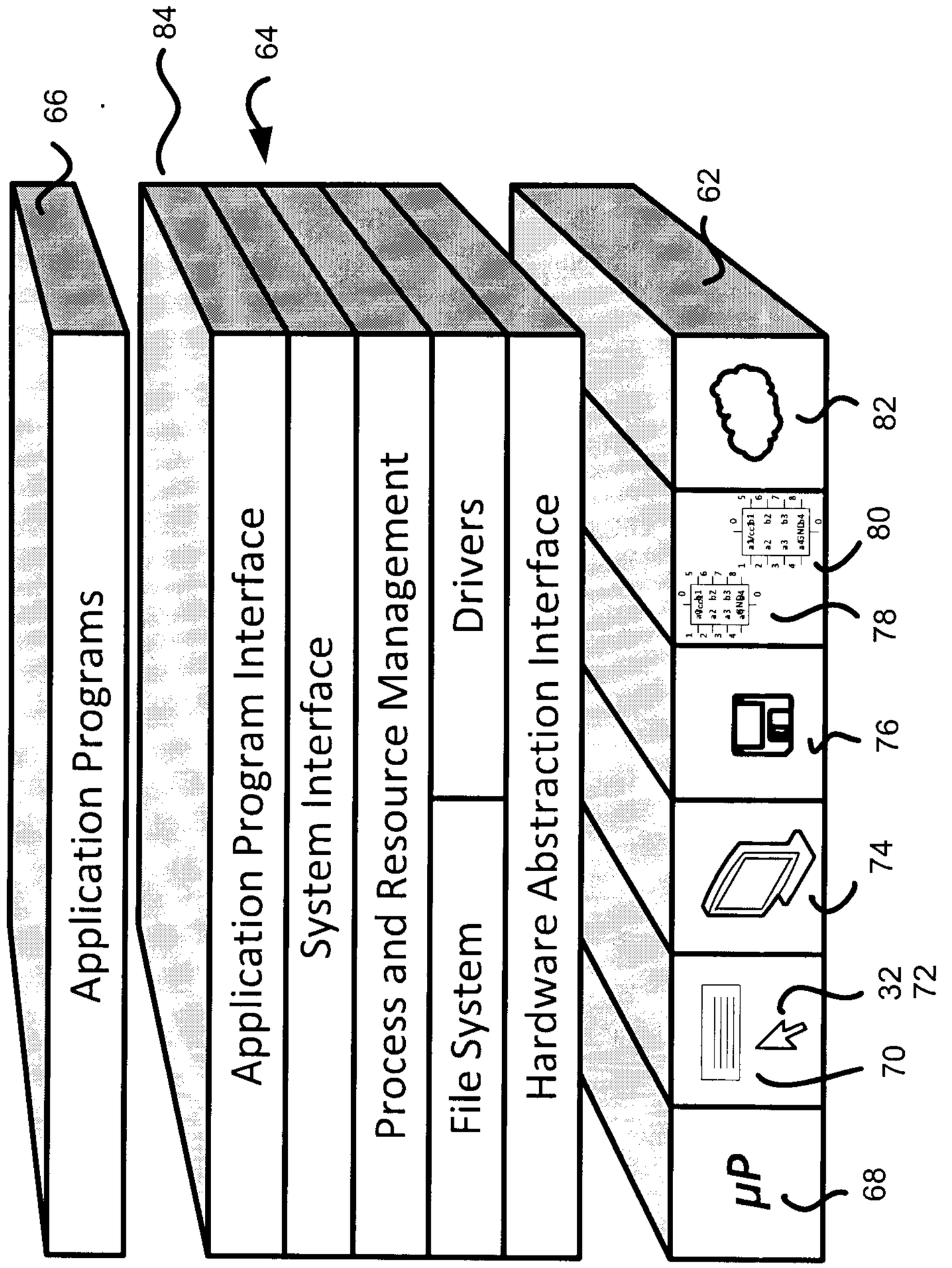
58
Object DBMS
Website
60

Figure 2


66
84
64
Application Programs
Application Program Interface
System Interface
Process and Resource Management
File System
Drivers
Hardware Abstraction Interface
62
82
80
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72
70
68
µP

Figure 3

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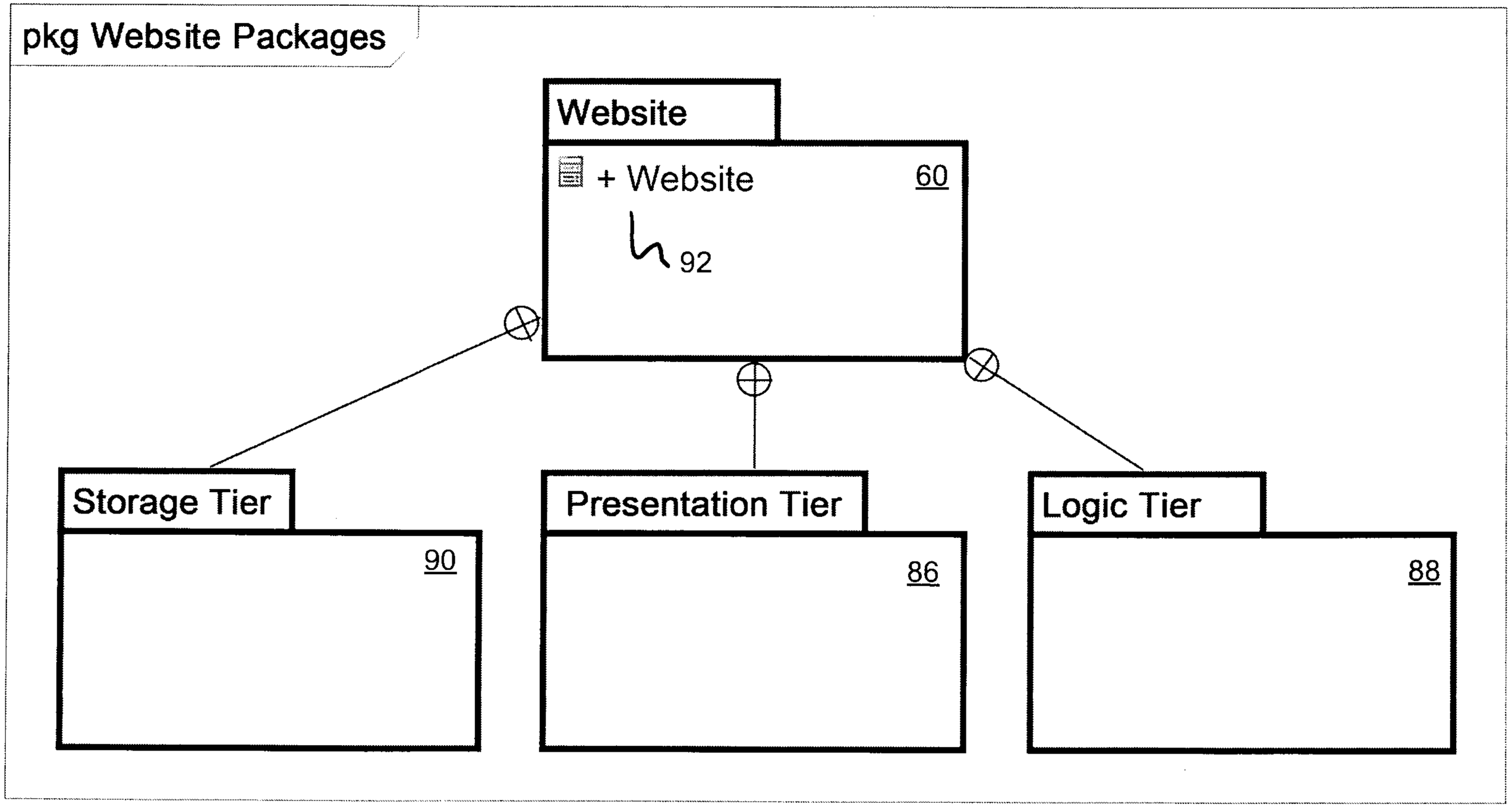

Figure 4

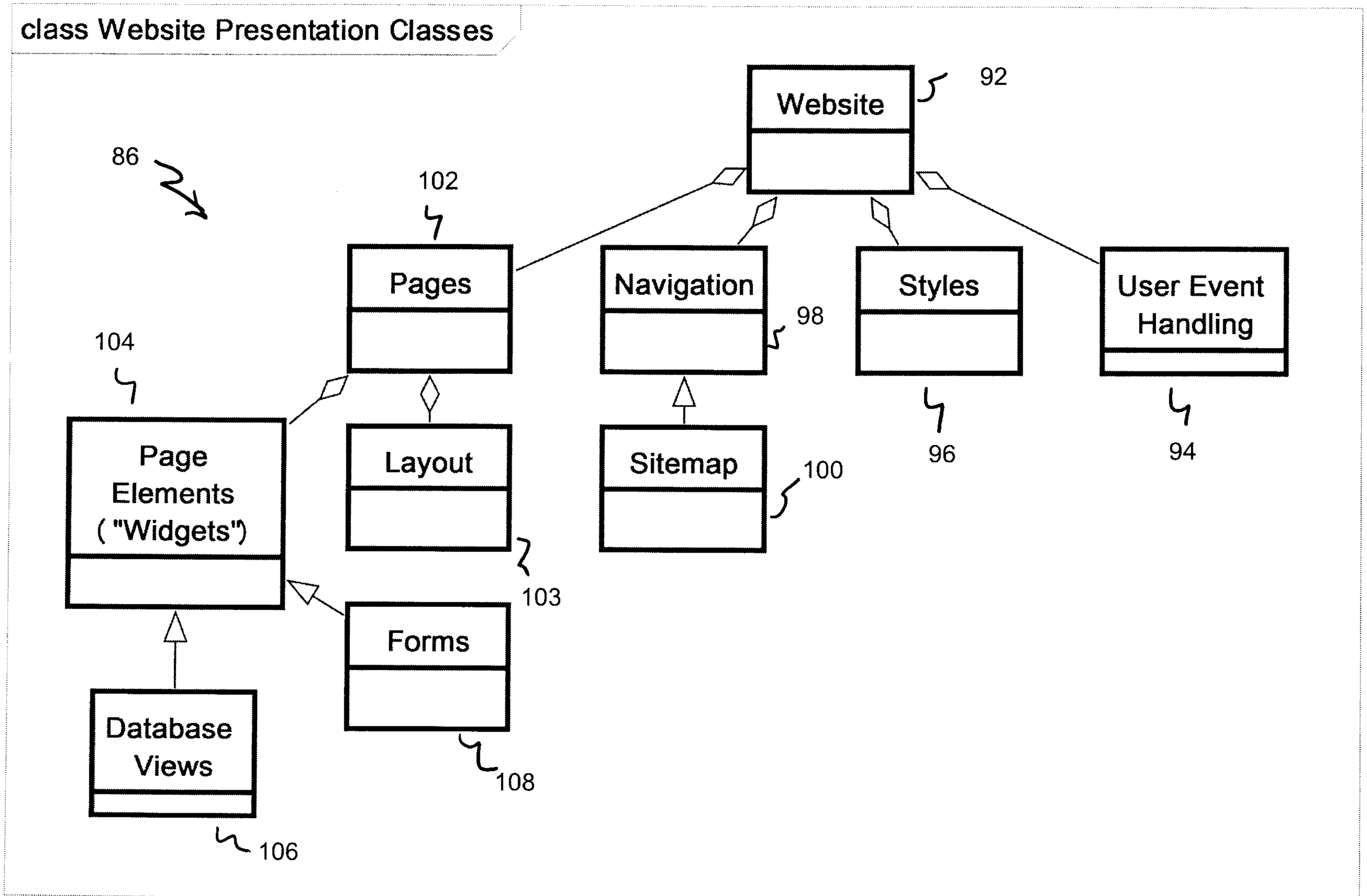

Figure 5

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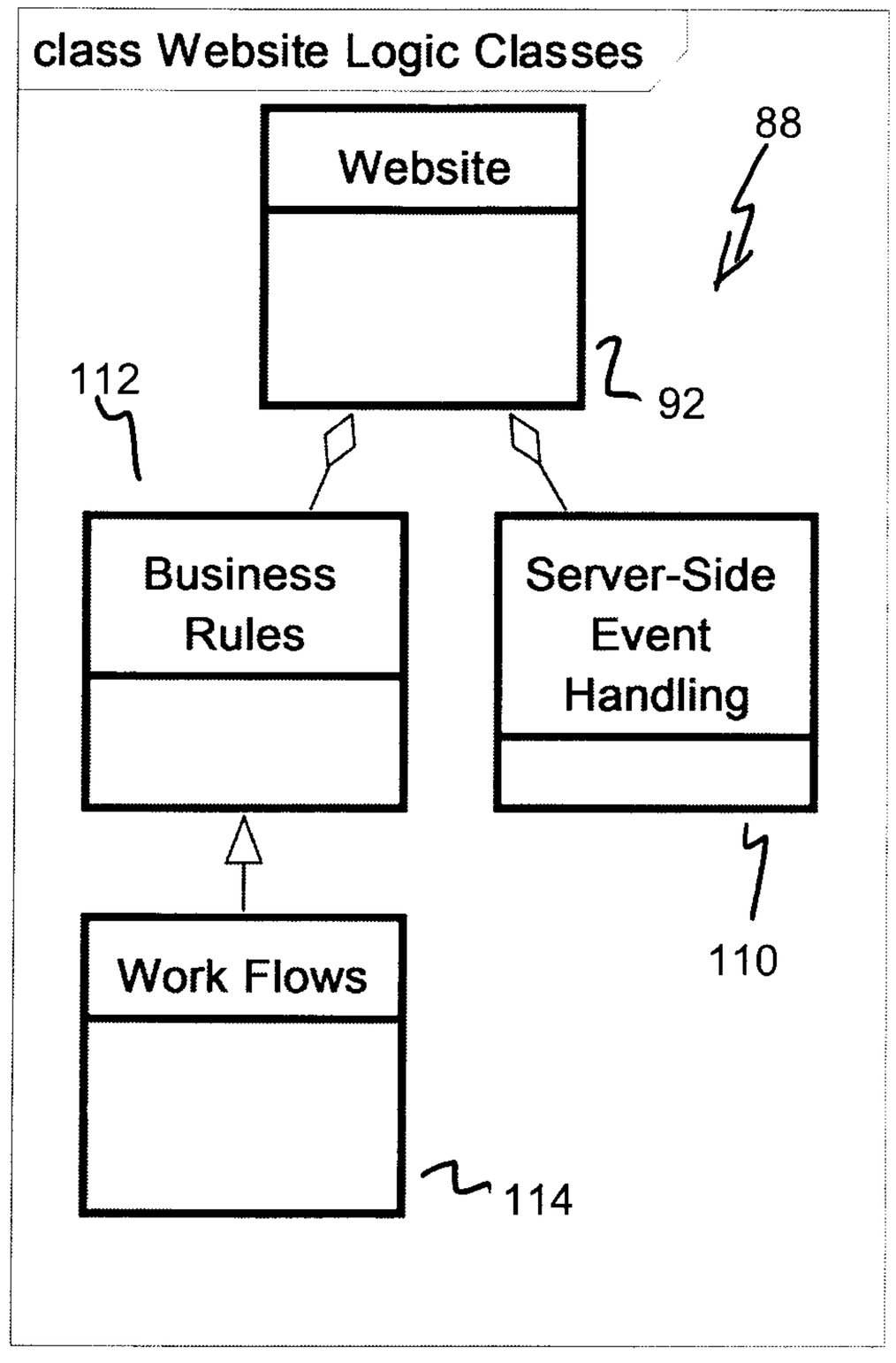

Figure 6

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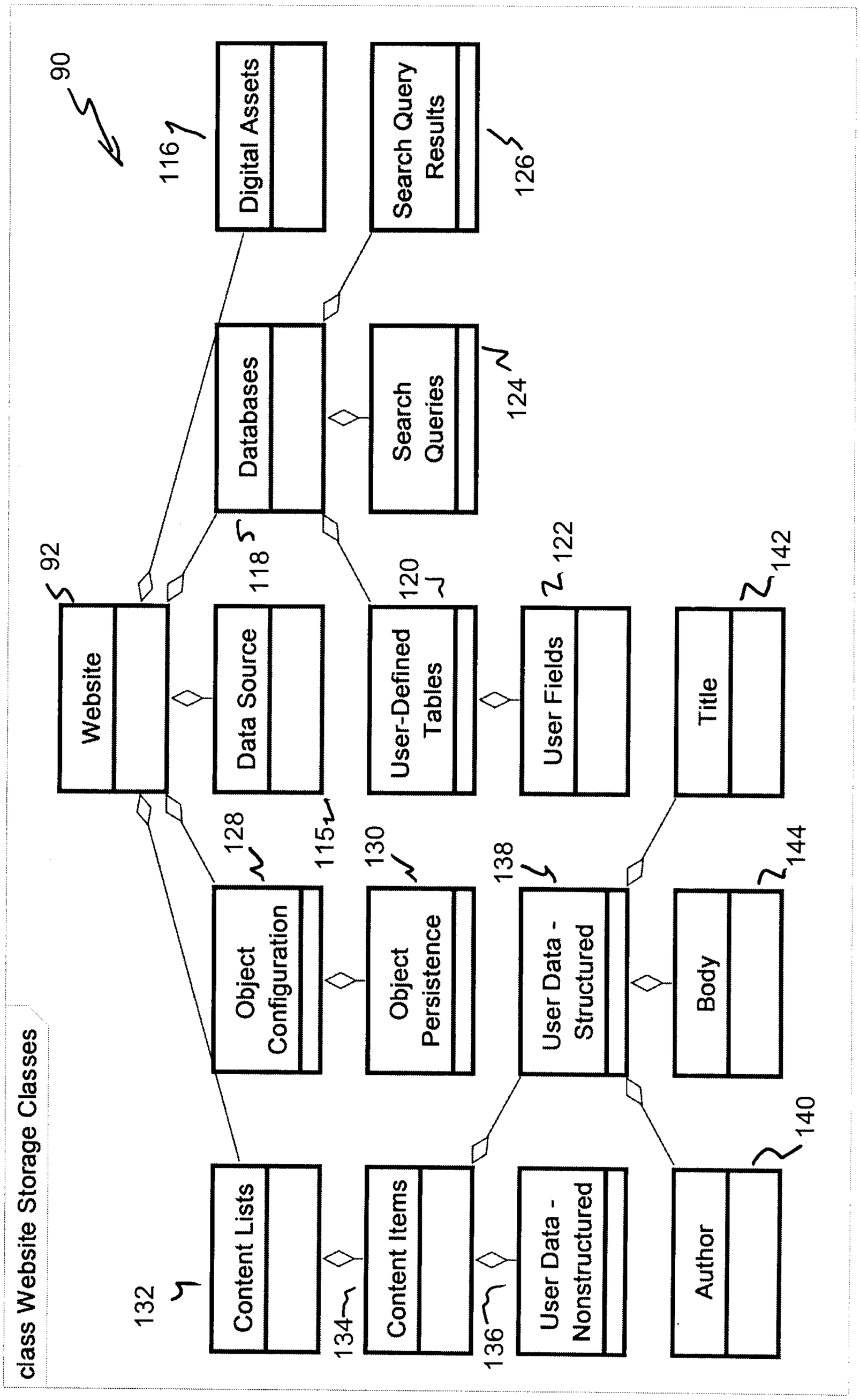
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116
Digital Assets
Search Query Results
126
Databases
Search Queries
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92
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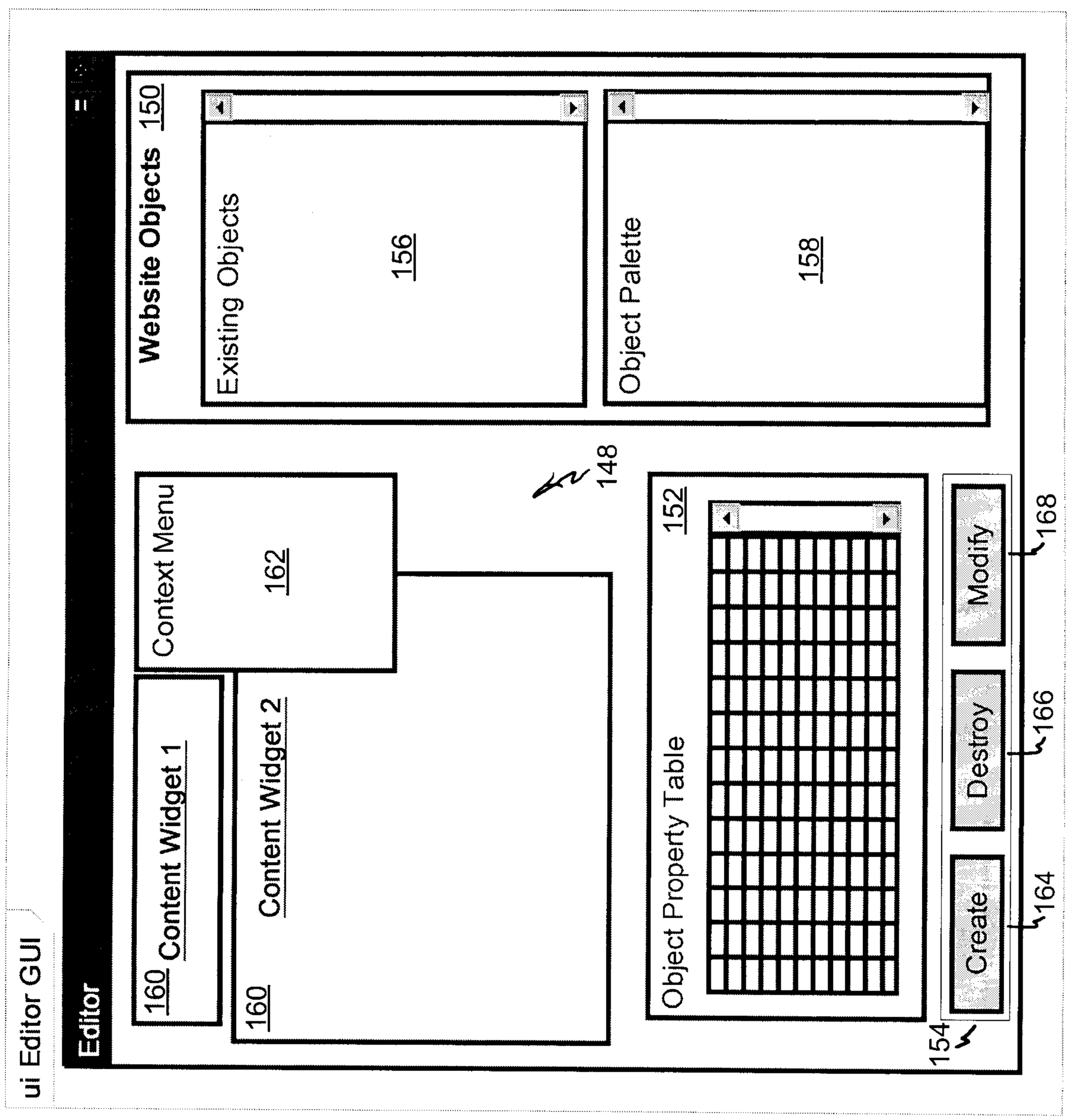
120
122
142
Website
Data Source
User-Defined Tables
User Fields
Title
128
115
130
138
144
Object Configuration
Object Persistence
User Data - Structured
Body
140
132
134
136
Content Lists
Content Items
User Data - Nonstructured
Author

Figure 7


146
148
ui Editor GUI
Editor
Website Objects 150
Existing Objects
156
Object Palette
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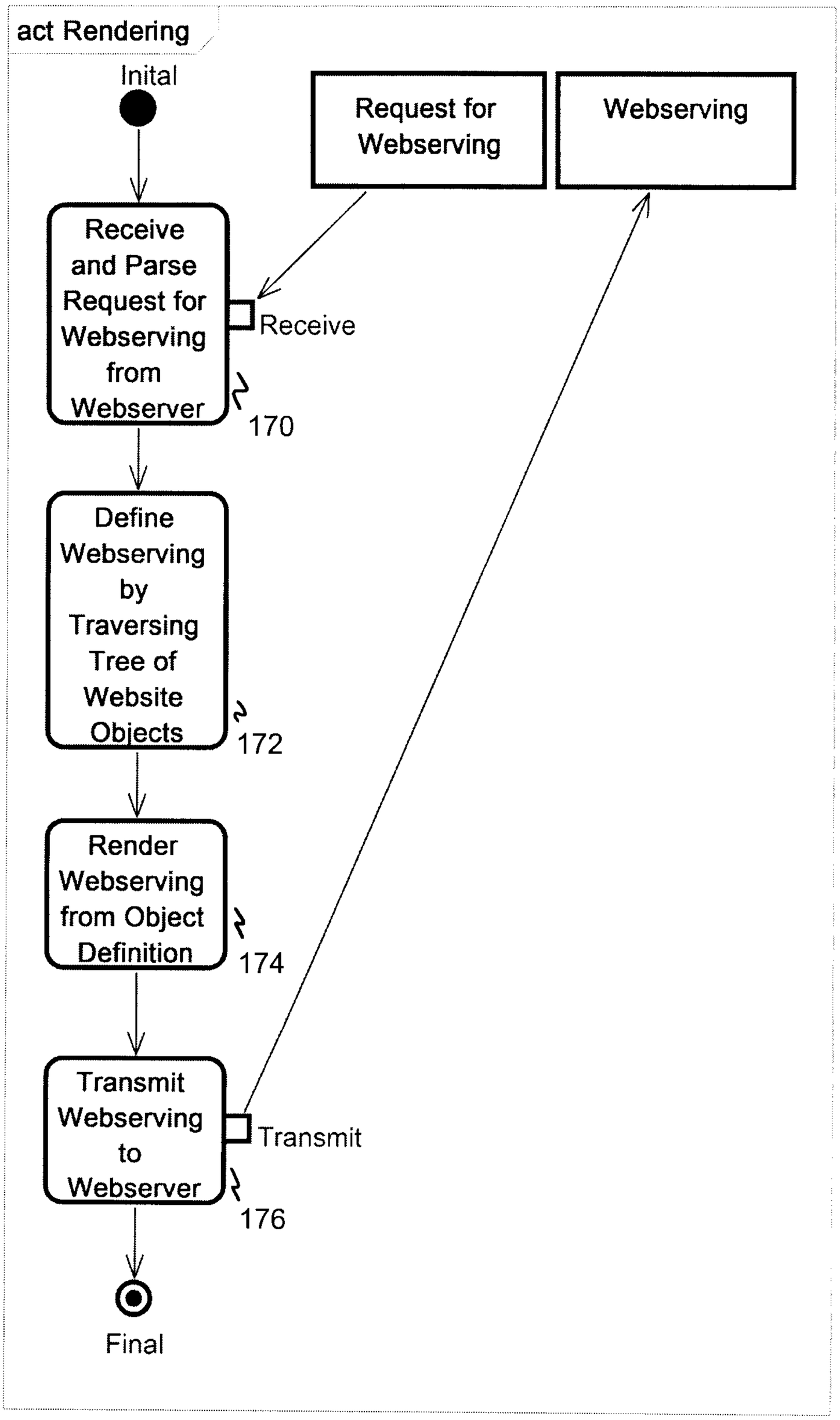
Context Menu
162
160 Content Widget 1
160 Content Widget 2
152
Object Property Table
154
Create
Destroy
Modify
164
166
168

Figure 8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Inital
Request for Webserving
Webserving
Receive and Parse Request for Webserving from Webserver
Receive
170
Define Webserving by Traversing Tree of Website Objects
172
Render Webserving from Object Definition
174
Transmit Webserving to Webserver
Transmit
176
Final

Figure 9

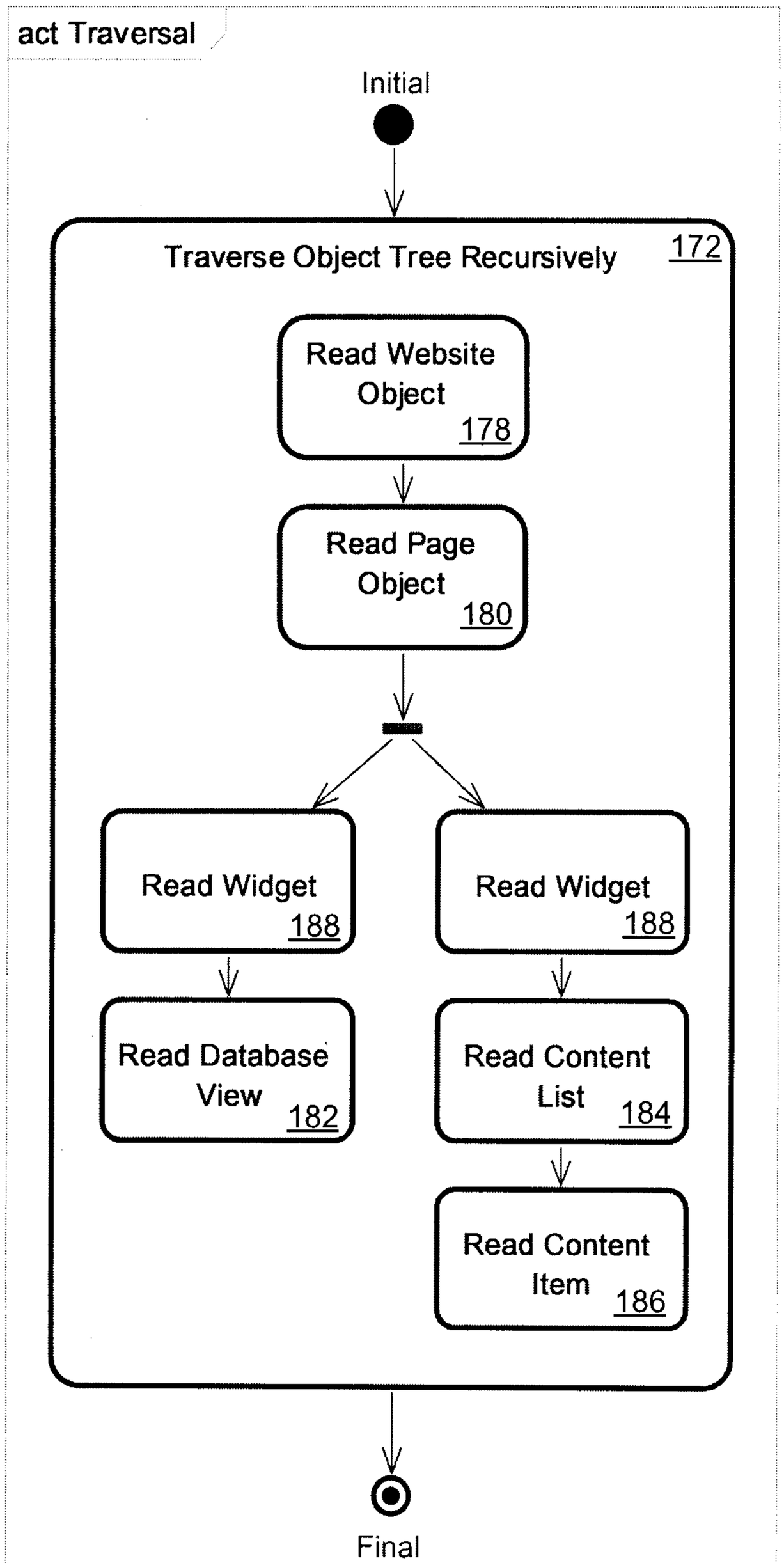
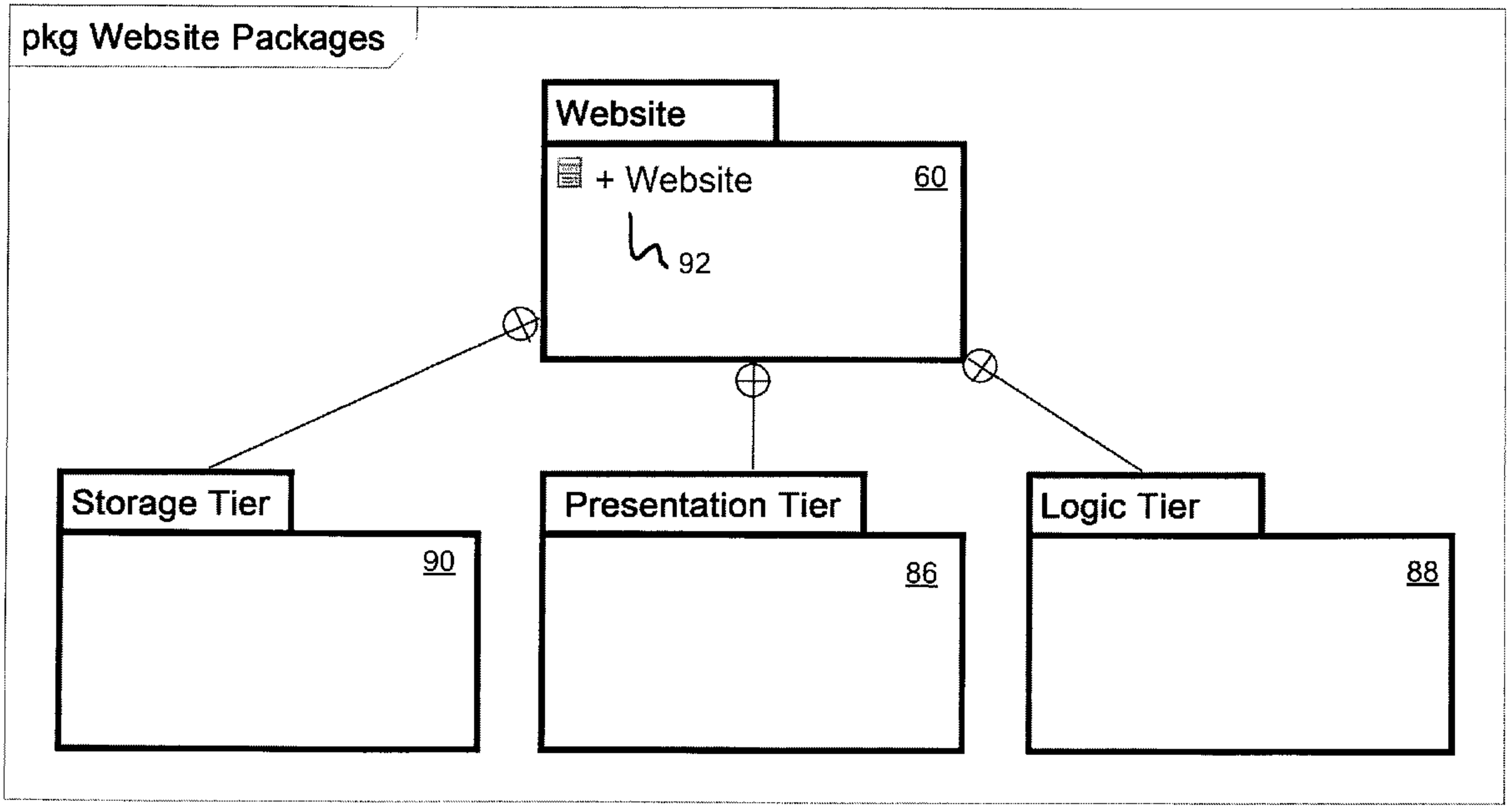

act Traversal
Initial
Traverse Object Tree Recursively
172
Read Website Object
178
Read Page Object
180
Read Widget
188
Read Widget
188
Read Database View
182
Read Content List
184
Read Content Item
186
Final

Figure 10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Website
+ Website
60
92
Storage Tier
90
Presentation Tier
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Logic Tier
88