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(54) **COMPUTER SYSTEMS AND METHODS FOR PLATFORM INDEPENDENT PRESENTATION DESIGN**

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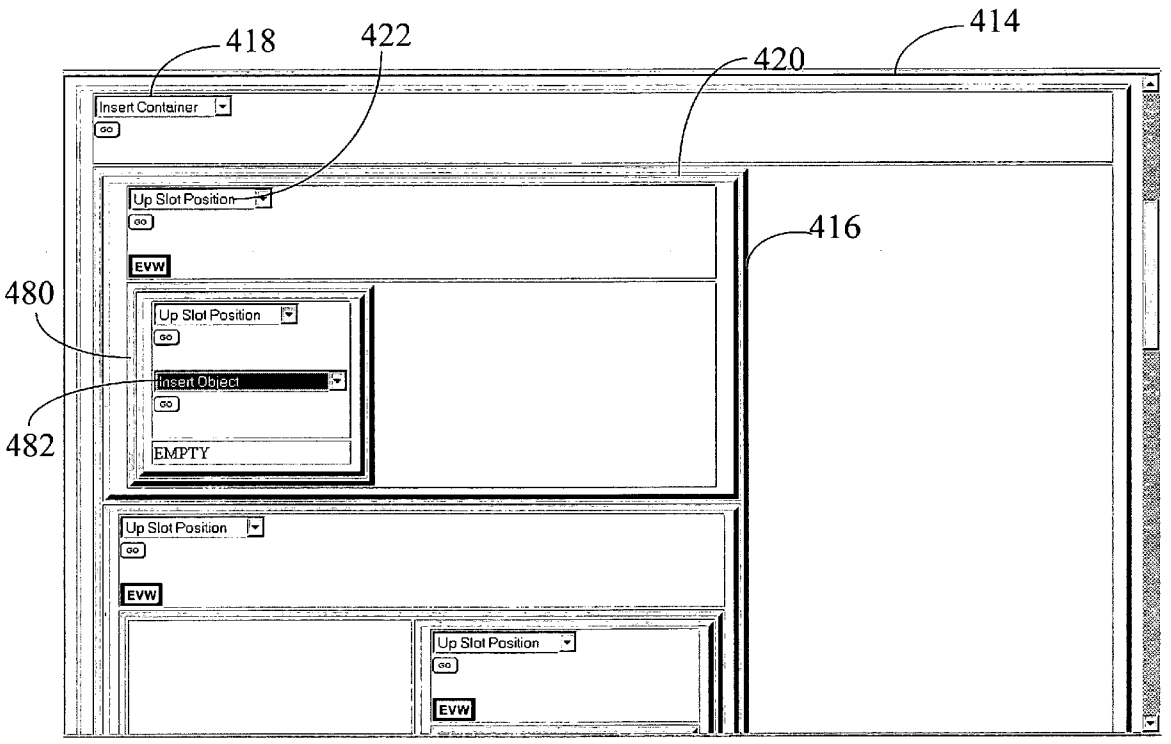
G06F 17/00 (2006.01)

(52) **U.S. Cl.** **715/243**

(57) **ABSTRACT**

Methods, computer systems and computer program products for constructing a presentation in a platform independent manner. A layout is defined that includes a top split. The top split includes a first orientation parameter specifying an orientation for any daughter split created within the top split. A request is received to create a daughter split within the top split. In response, the daughter split is constructed within the top split in accordance with the first orientation parameter. The daughter split includes a second orientation parameter specifying an orientation for any child split created within the daughter split. The layout is converted into the presentation. A database for storing the layout. The database including a layout table having a row for storing an identity of the layout and an identity of the top split in a hierarchy of splits within the layout. The database also including a layoutdata table that has a row for each split in the hierarchy of splits within the layout.



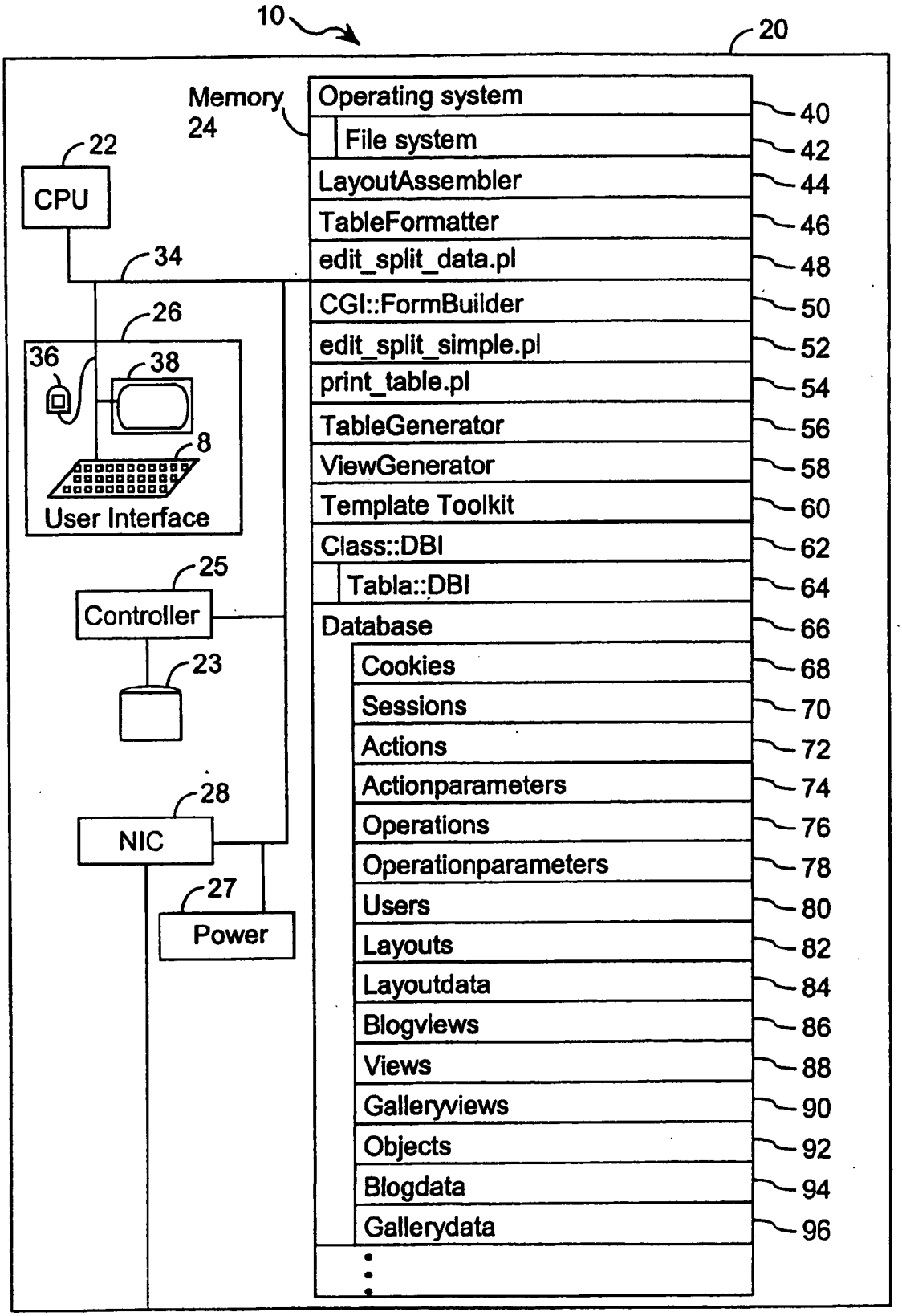

10
20
Memory
24
Operating system
40
File system
42
22
CPU
LayoutAssembler
44
TableFormatter
46
34
edit_split_data.pl
48
CGI::FormBuilder
50
26
edit_split_simple.pl
52
36
38
print_table.pl
54
TableGenerator
56
8
ViewGenerator
58
User Interface
Template Toolkit
60
Class::DBI
62
25
Tabla::DBI
64
Controller
Database
66
Cookies
68
23
Sessions
70
Actions
72
Actionparameters
74
28
Operations
76
NIC
Operationparameters
78
27
Users
80
Power
Layouts
82
Layoutdata
84
Blogviews
86
Views
88
Galleryviews
90
Objects
92
Blogdata
94
Gallerydata
96

FIG. 1

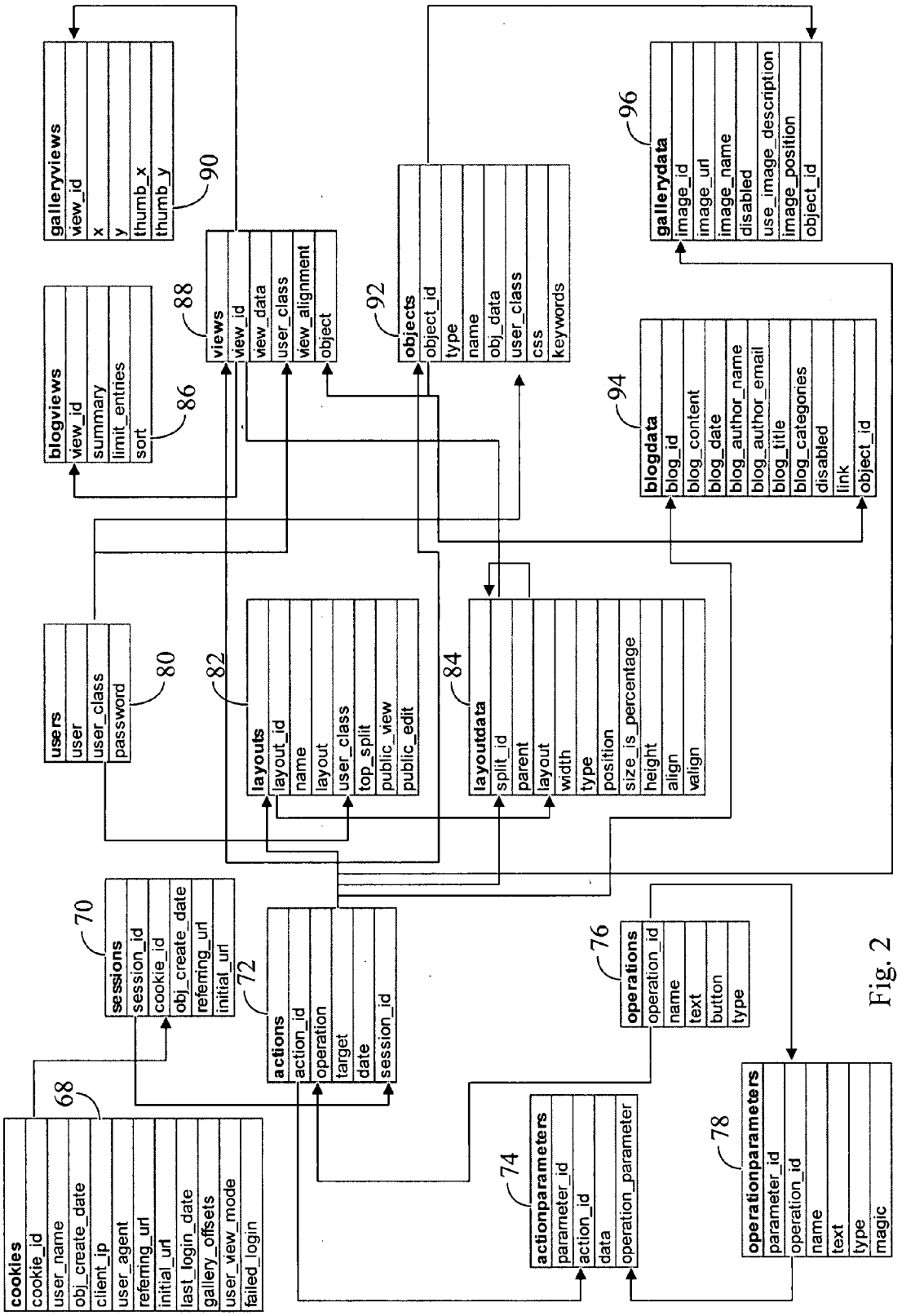

galleryviews
view_id
x
y
thumb_x
thumb_y
90
blogviews
view_id
summary
limit_entries
sort
86
views
view_id
view_data
user_class
view_alignment
object
88
objects
object_id
type
name
obj_data
user_class
css
keywords
92
gallerydata
image_id
image_url
image_name
disabled
use_image_description
image_position
object_id
96
blogdata
blog_id
blog_content
blog_date
blog_author_name
blog_author_email
blog_title
blog_categories
disabled
link
object_id
94
users
user
user_class
password
80
layouts
layout_id
name
layout
user_class
top_split
public_view
public_edit
82
layoutdata
split_id
parent
layout
width
type
position
size_is_percentage
height
align
valign
84
sessions
session_id
cookie_id
obj_create_date
referring_url
initial_url
70
actions
action_id
operation
target
date
session_id
72
operations
operation_id
name
text
button
type
76
cookies
cookie_id
user_name
obj_create_date
client_ip
user_agent
referring_url
initial_url
last_login_date
gallery_offsets
user_view_mode
failed_login
68
actionparameters
parameter_id
action_id
data
operation_parameter
74
operationparameters
parameter_id
operation_id
name
text
type
magic
78

Fig. 2

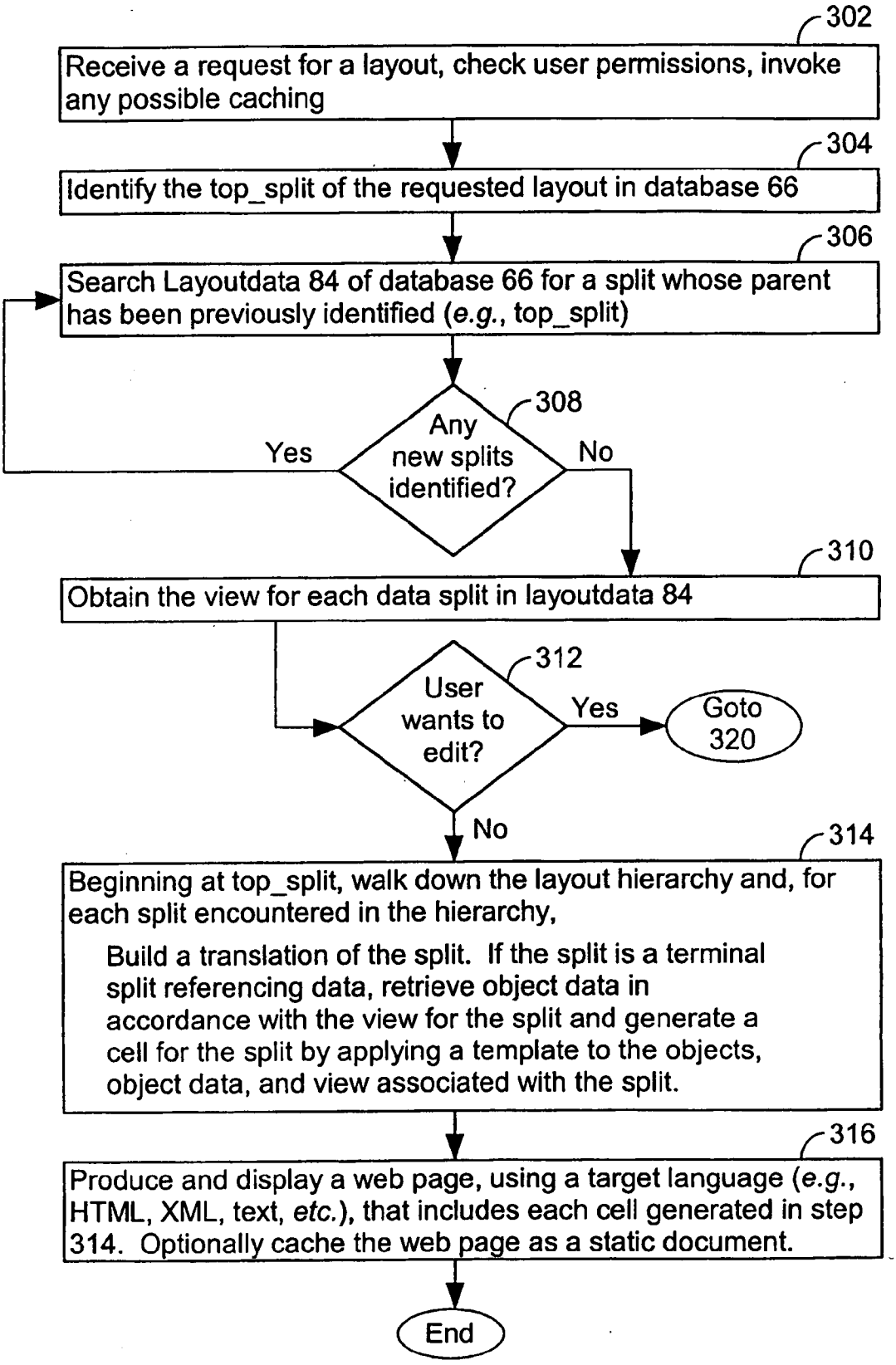

302
Receive a request for a layout, check user permissions, invoke any possible caching
304
Identify the top_split of the requested layout in database 66
306
Search Layoutdata 84 of database 66 for a split whose parent has been previously identified (e.g., top_split)
308
Any new splits identified?
Yes
No
310
Obtain the view for each data split in layoutdata 84
312
User wants to edit?
Yes
Goto 320
No
314
Beginning at top_split, walk down the layout hierarchy and, for each split encountered in the hierarchy,
Build a translation of the split. If the split is a terminal split referencing data, retrieve object data in accordance with the view for the split and generate a cell for the split by applying a template to the objects, object data, and view associated with the split.
316
Produce and display a web page, using a target language (e.g., HTML, XML, text, etc.), that includes each cell generated in step 314. Optionally cache the web page as a static document.
End

FIG. 3A

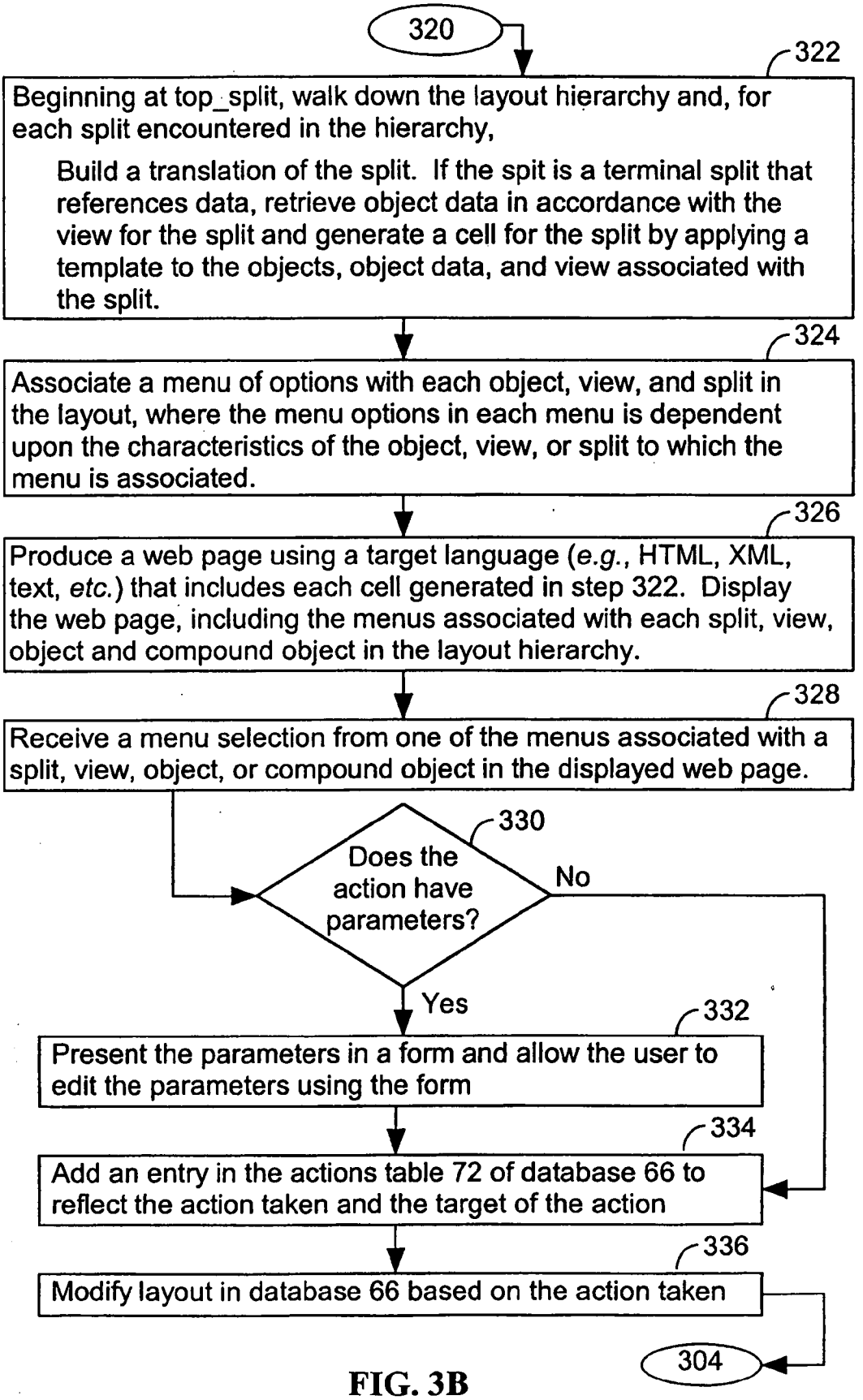

320
322
Beginning at top_split, walk down the layout hierarchy and, for each split encountered in the hierarchy,
Build a translation of the split. If the spit is a terminal split that references data, retrieve object data in accordance with the view for the split and generate a cell for the split by applying a template to the objects, object data, and view associated with the split.
324
Associate a menu of options with each object, view, and split in the layout, where the menu options in each menu is dependent upon the characteristics of the object, view, or split to which the menu is associated.
326
Produce a web page using a target language (e.g., HTML, XML, text, etc.) that includes each cell generated in step 322. Display the web page, including the menus associated with each split, view, object and compound object in the layout hierarchy.
328
Receive a menu selection from one of the menus associated with a split, view, object, or compound object in the displayed web page.
330
Does the action have parameters?
No
Yes
332
Present the parameters in a form and allow the user to edit the parameters using the form
334
Add an entry in the actions table 72 of database 66 to reflect the action taken and the target of the action
336
Modify layout in database 66 based on the action taken
304

FIG. 3B

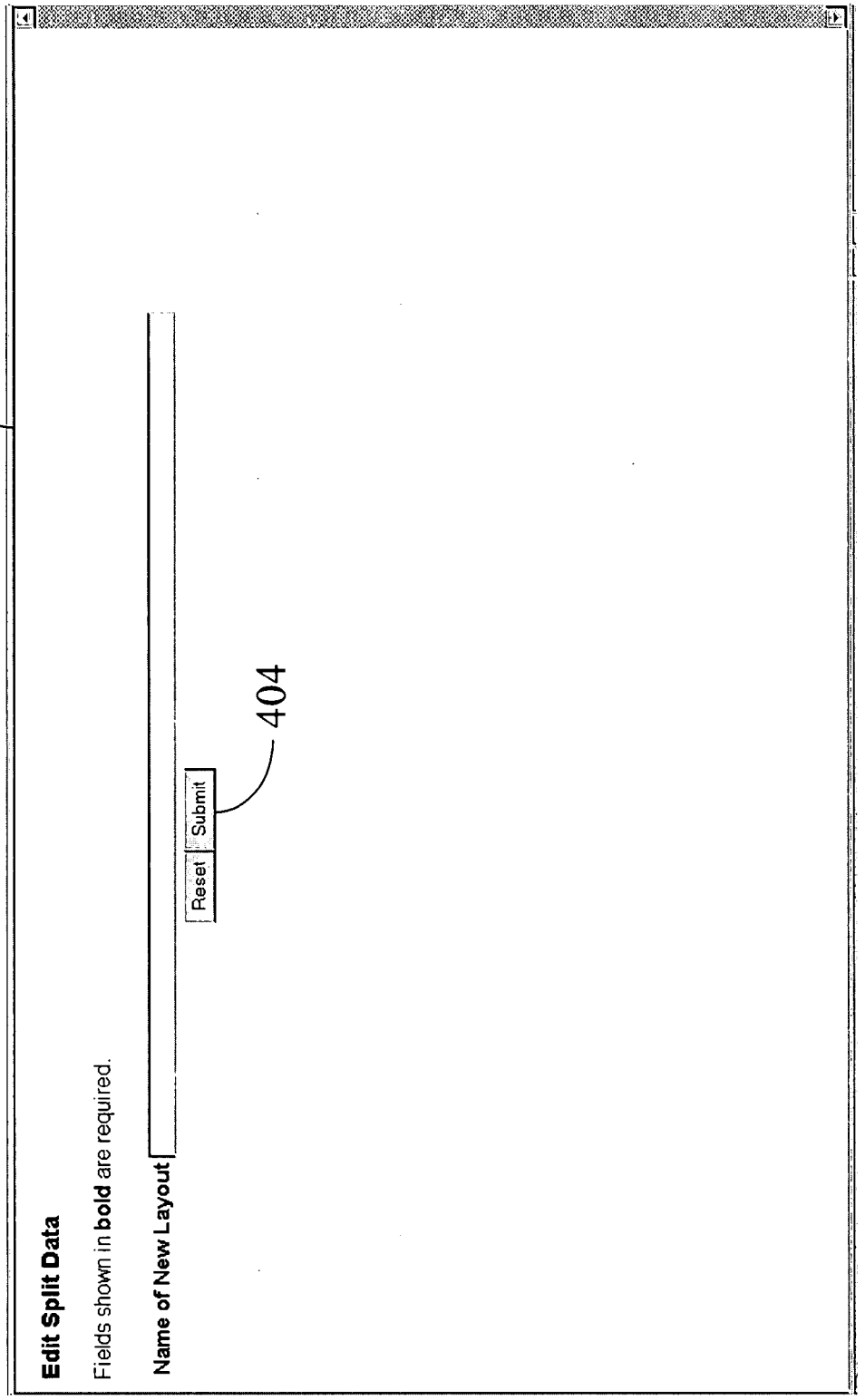

402
Edit Split Data
Fields shown in bold are required.
Name of New Layout
Reset
Submit
404

Fig. 4A

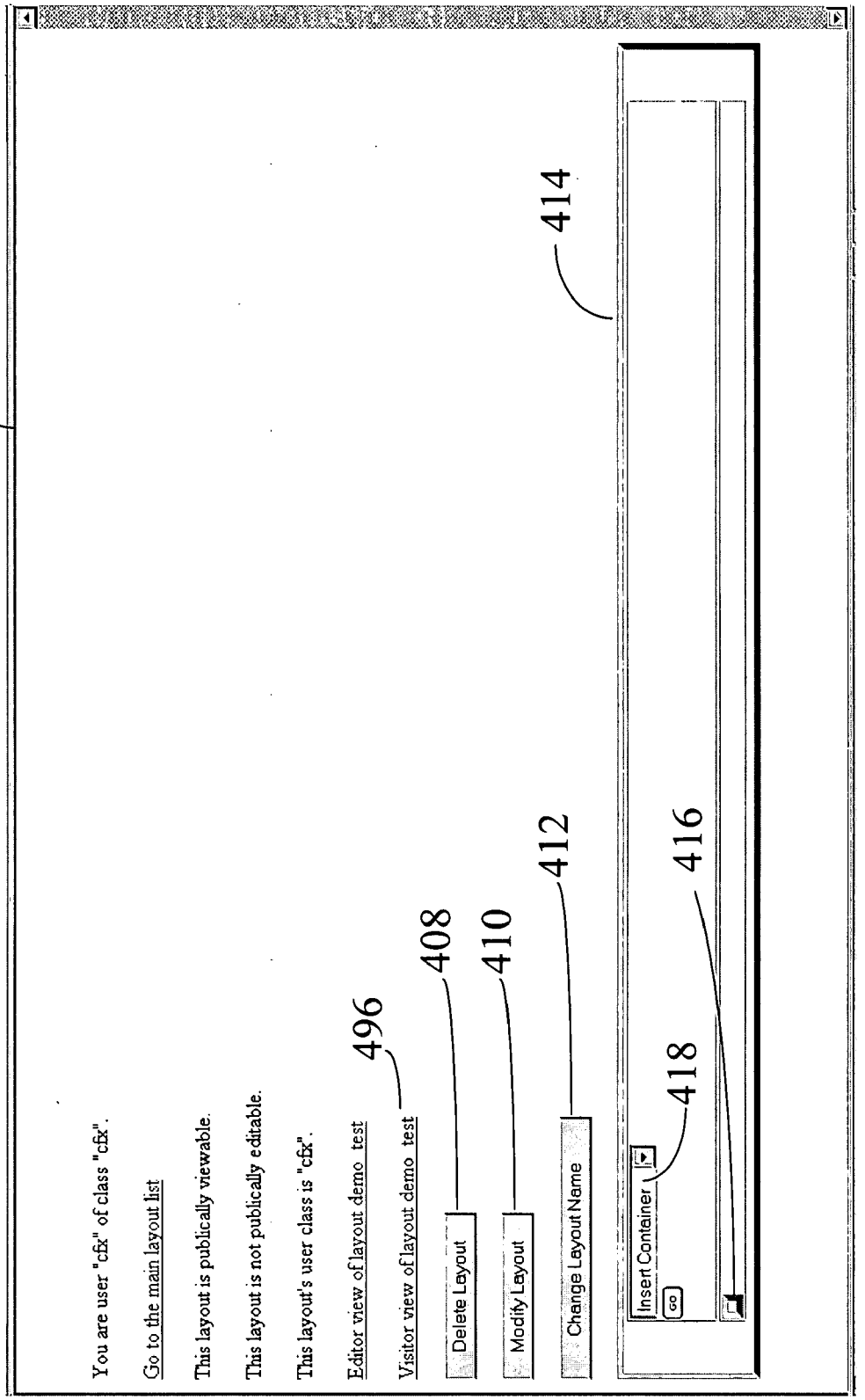

406
You are user "cfx" of class "cfx".
Go to the main layout list
This layout is publically viewable.
This layout is not publically editable.
This layout's user class is "cfx".
Editor view of layout demo test
Visitor view of layout demo test
Delete Layout
Modify Layout
Change Layout Name
Insert Container
GO
496
408
410
412
414
416
418

Fig. 4B

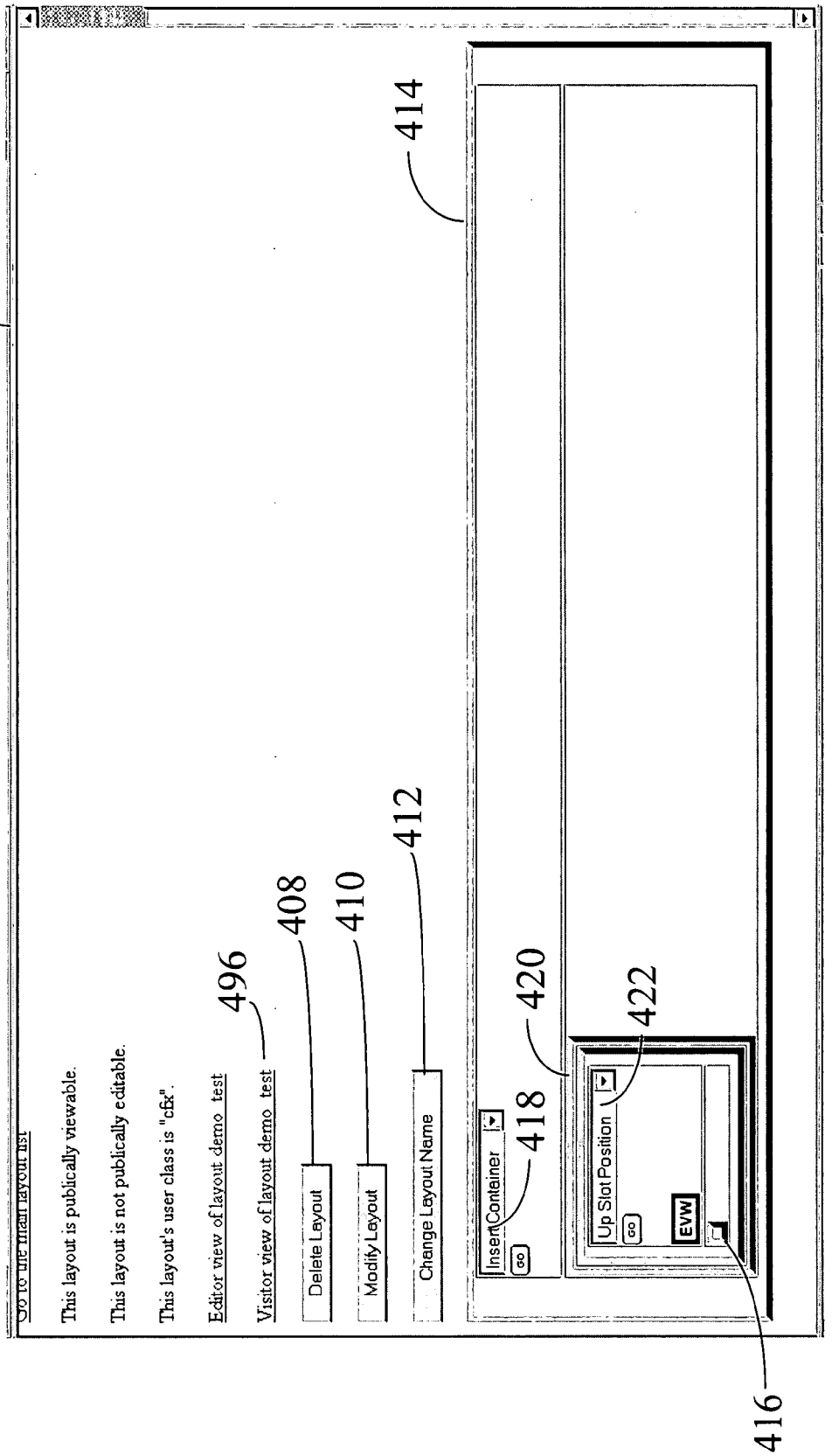

406
414
Go to the main layout list
This layout is publically viewable.
This layout is not publically editable.
This layout's user class is "c&x".
Editor view of layout demo test
496
Visitor view of layout demo test
408
Delete Layout
410
Modify Layout
412
Change Layout Name
420
Insert Container
418
go
422
Up Slot Position
go
EVW
416

Fig. 4C

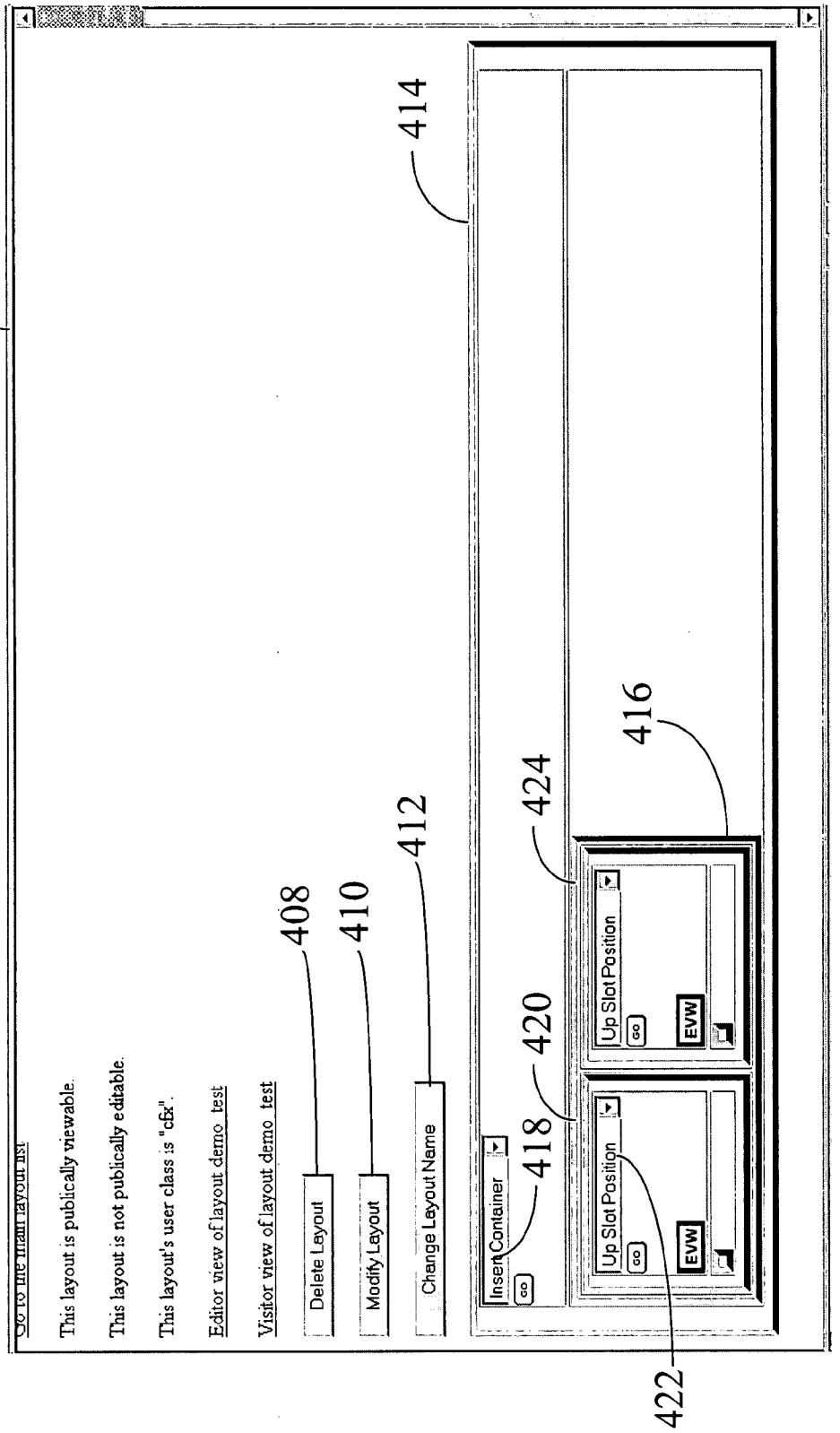

406
414
Go to the main layout list
This layout is publically viewable.
This layout is not publically editable.
This layout's user class is "cfx".
Editor view of layout demo_test
Visitor view of layout demo_test
Delete Layout
Modify Layout
Change Layout Name
408
410
412
Insert Container
Go
418
420
424
Up Slot Position
Go
EVW
416
422

Fig. 4D

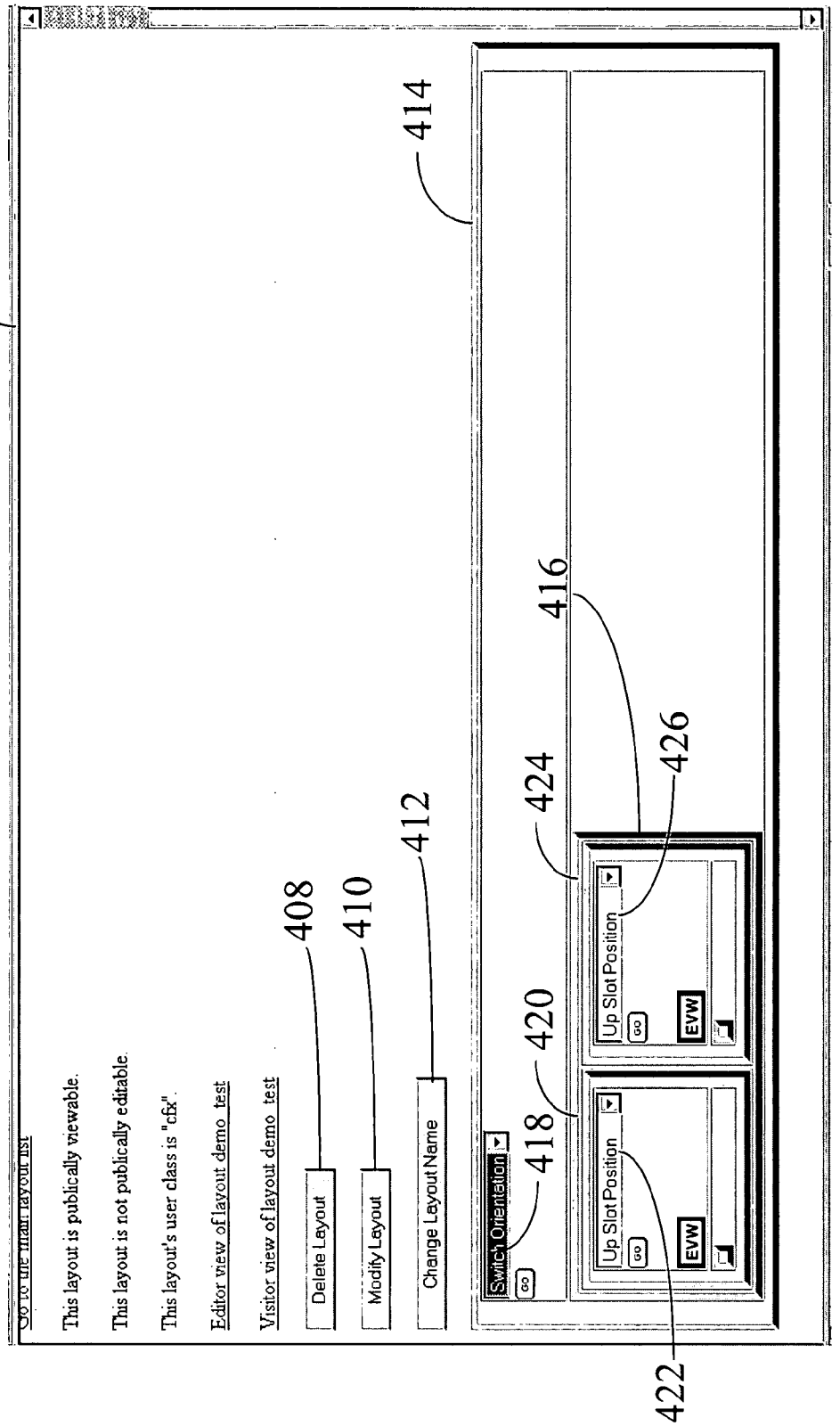

406
Go to the main layout list
This layout is publically viewable.
This layout is not publically editable.
This layout's user class is "cfx".
Editor view of layout demo test
Visitor view of layout demo test
Delete Layout
Modify Layout
Change Layout Name
Switch Orientation
Go
Up Slot Position
EVW
408
410
412
414
416
418
420
422
424
426

Fig. 4E

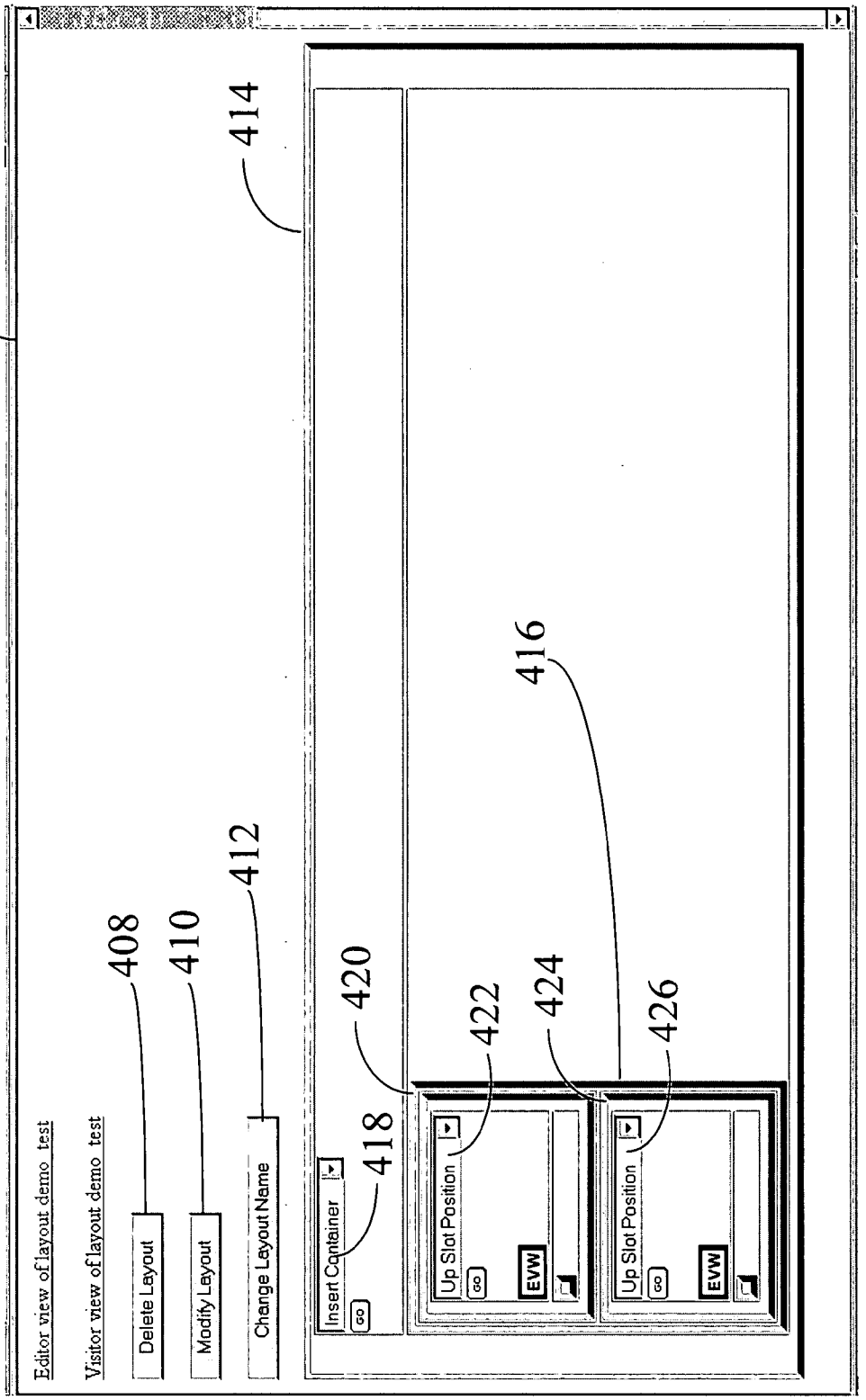

406
414
Editor view of layout demo test
Visitor view of layout demo test
Delete Layout
Modify Layout
Change Layout Name
408
410
412
Insert Container
GO
418
420
Up Slot Position
GO
EVW
422
424
Up Slot Position
GO
EVW
426
416

Fig. 4F

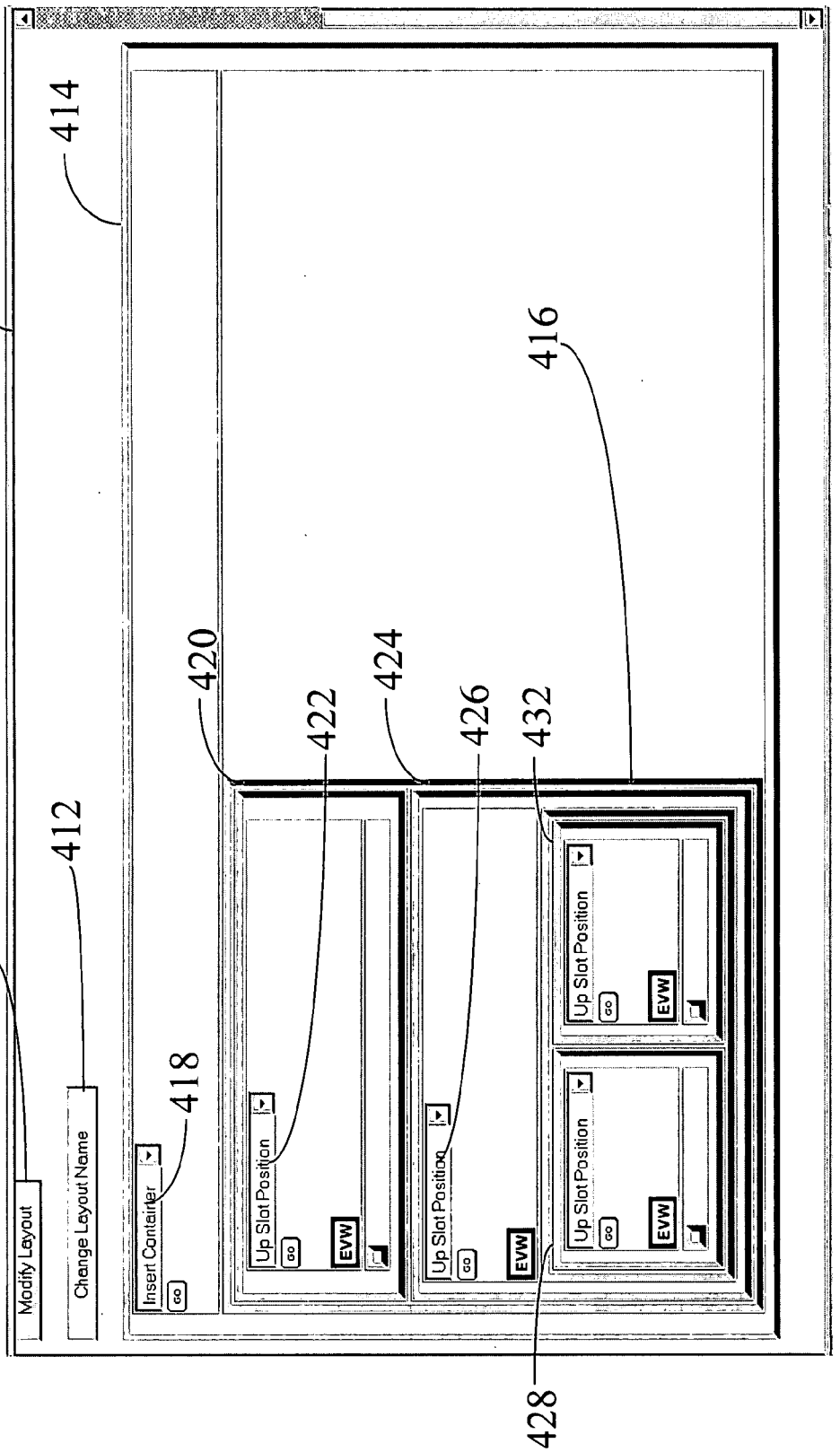

406
414
410
412
418
420
422
424
426
432
416
428
Modify Layout
Change Layout Name
Insert Container
Up Slot Position
EVW
Up Slot Position
EVW
Up Slot Position
EVW
Up Slot Position
EVW

Fig. 4G

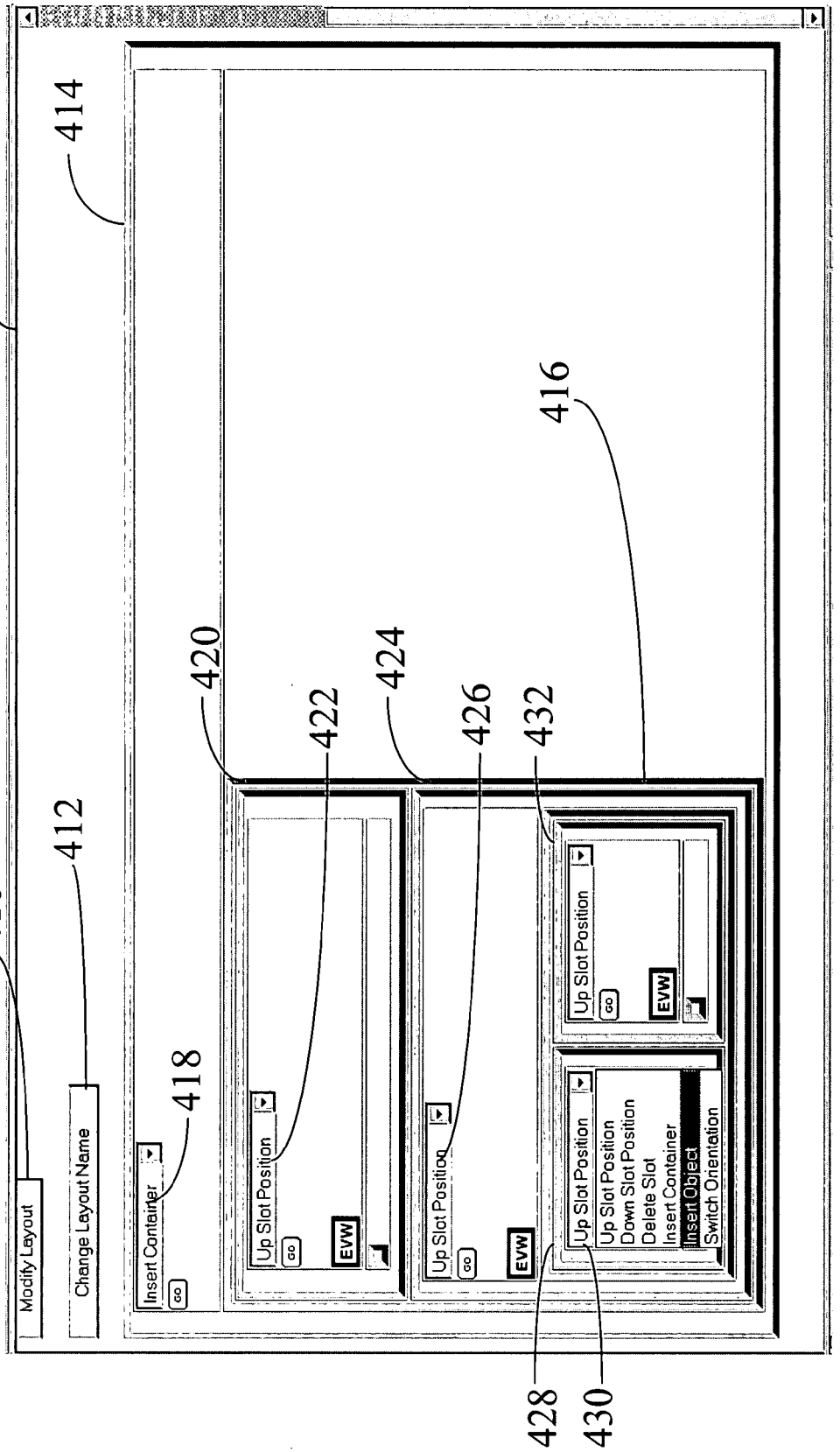

406
414
410
412
416
420
422
424
426
432
418
428
430
Modify Layout
Change Layout Name
Insert Container
GO
Up Slot Position
EVW
Up Slot Position
Down Slot Position
Delete Slot
Insert Container
Insert Object
Switch Orientation

Fig. 4H

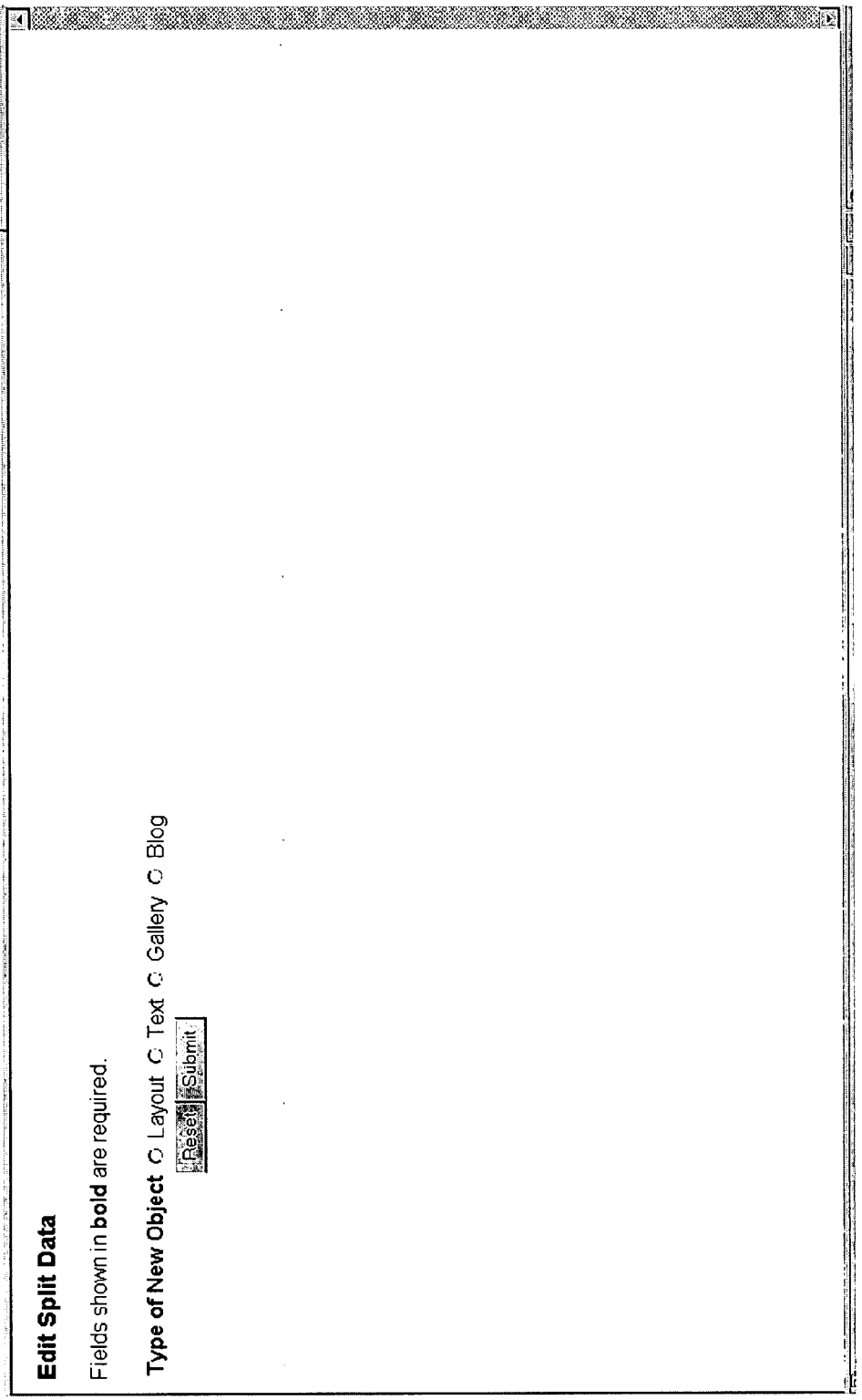

440
Edit Split Data
Fields shown in bold are required.
Type of New Object C Layout C Text C Gallery C Blog
Reset
Submit

Fig. 4I

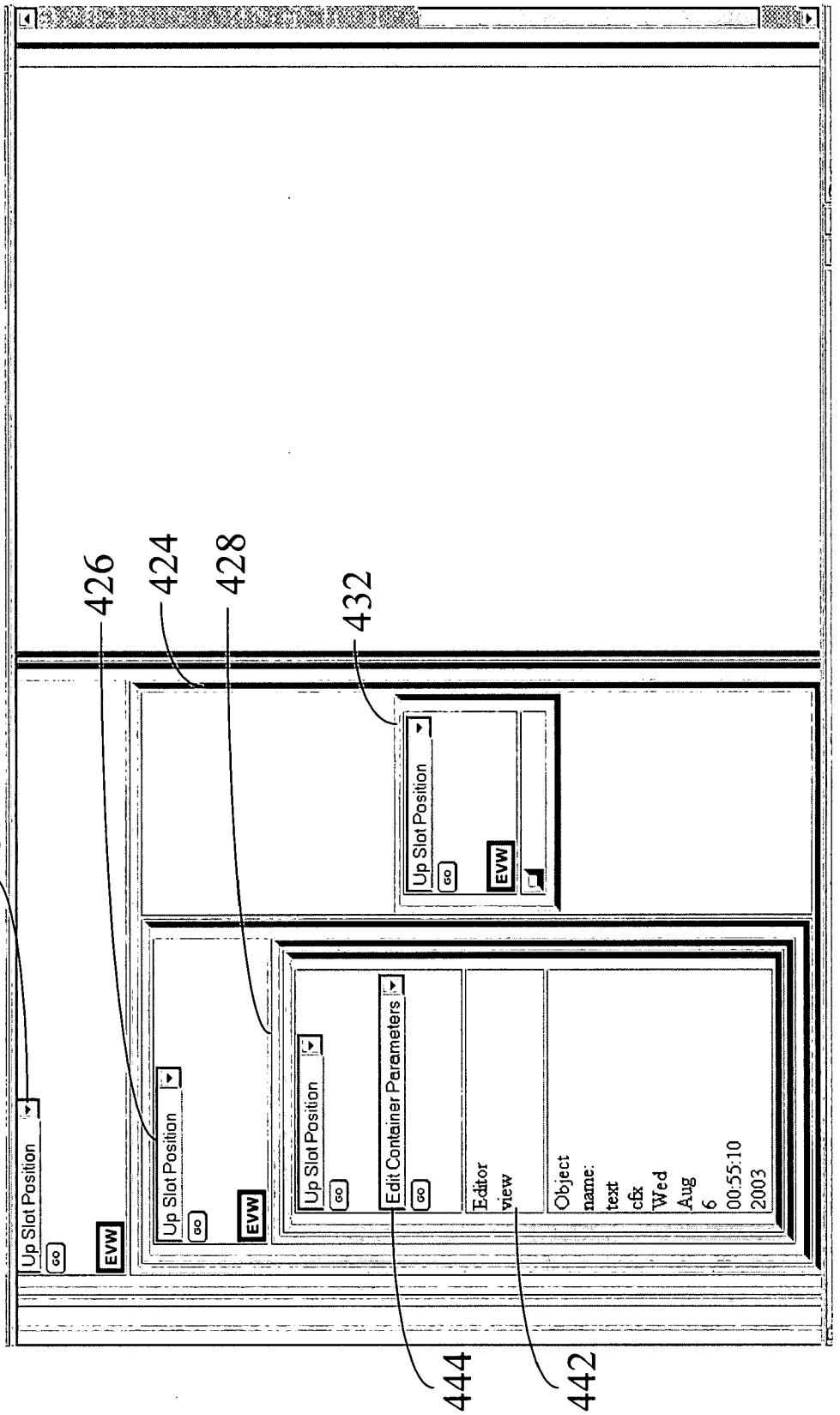

422
426
424
428
432
Up Slot Position
GO
EVW
Up Slot Position
GO
EVW
Up Slot Position
GO
Edit Container Parameters
GO
Editor
view
Object
name:
text
cfx
Wed
Aug
6
00:55:10
2003
Up Slot Position
GO
EVW
444
442

Fig. 4J

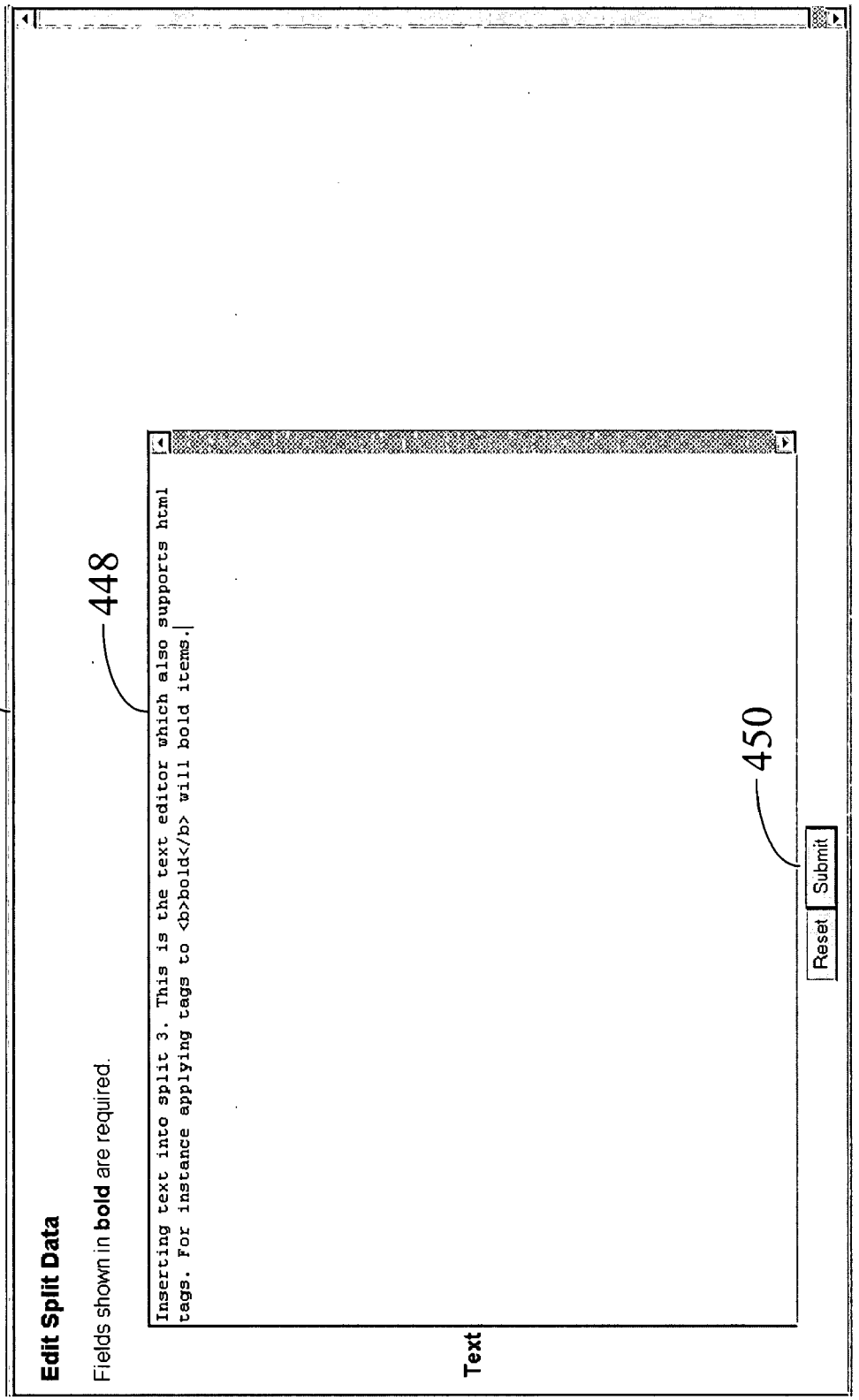

446
448
450
Edit Split Data
Fields shown in bold are required.
Text
Inserting text into split 3. This is the text editor which also supports html tags. For instance applying tags to bold will bold items.
Reset
Submit

Fig. 4K

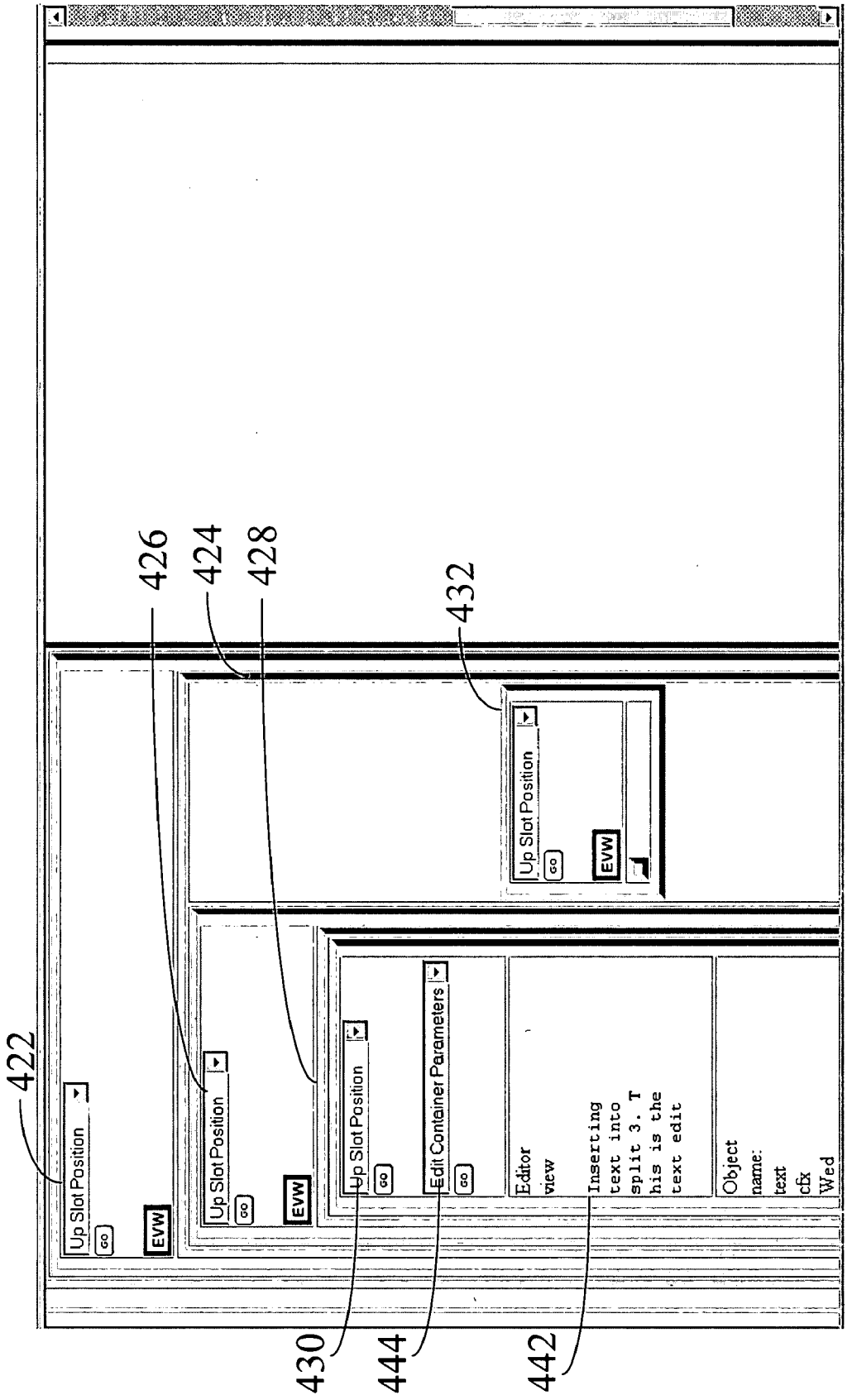

422
426
424
428
432
Up Slot Position
GO
EVW
Up Slot Position
GO
EVW
Up Slot Position
GO
Edit Container Parameters
GO
Editor
view
Inserting
text into
split 3. T
his is the
text edit
Object
name:
text
cfx
Wed
Up Slot Position
GO
EVW
430
444
442

Fig. 4L

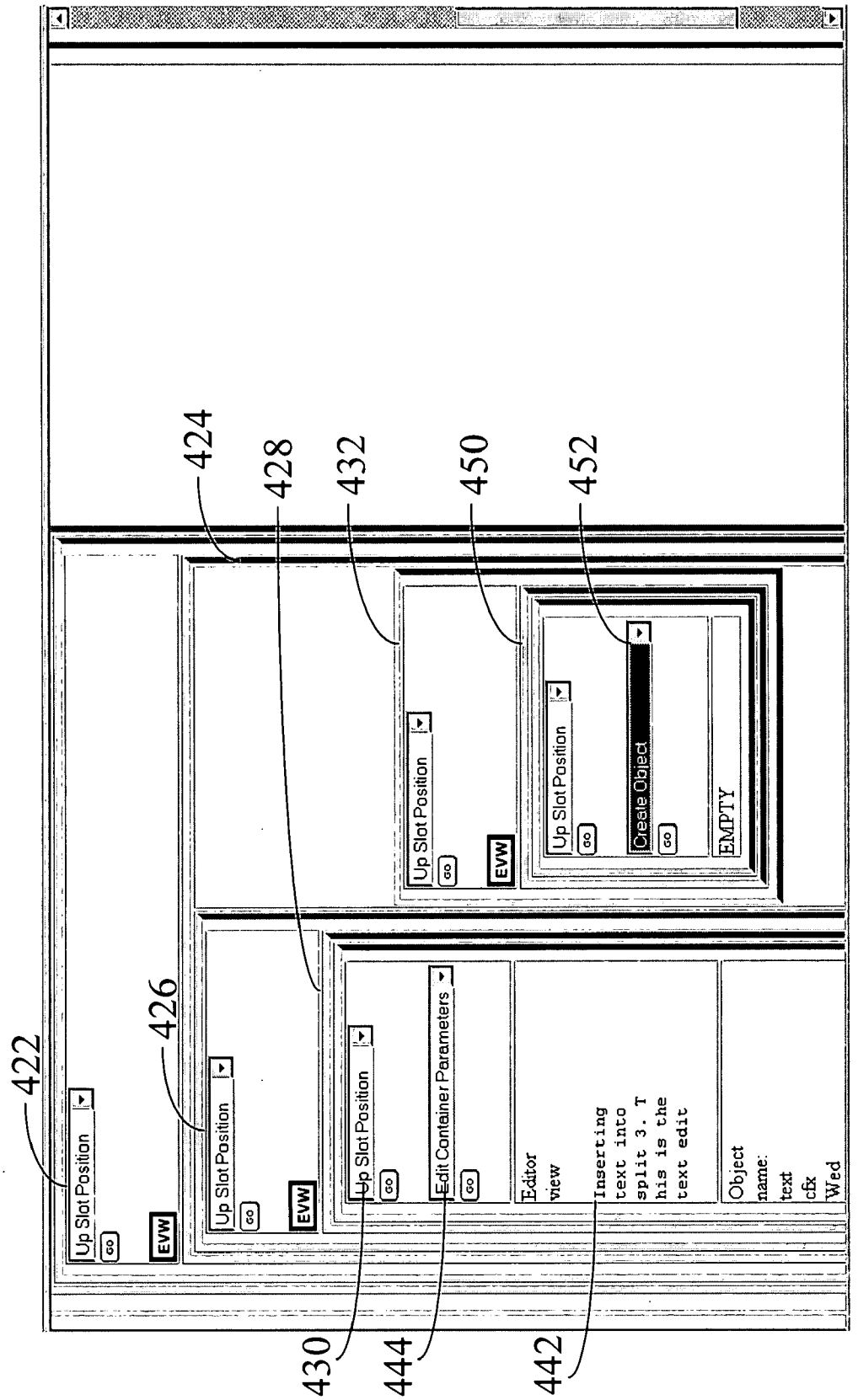

422
426
424
428
432
450
452
430
444
442
Up Slot Position
GO
EVW
Edit Container Parameters
Create Object
EMPTY
Editor
view
Inserting
text into
split 3. T
his is the
text edit
Object
name:
text
cfx
Wed

Fig. 4M

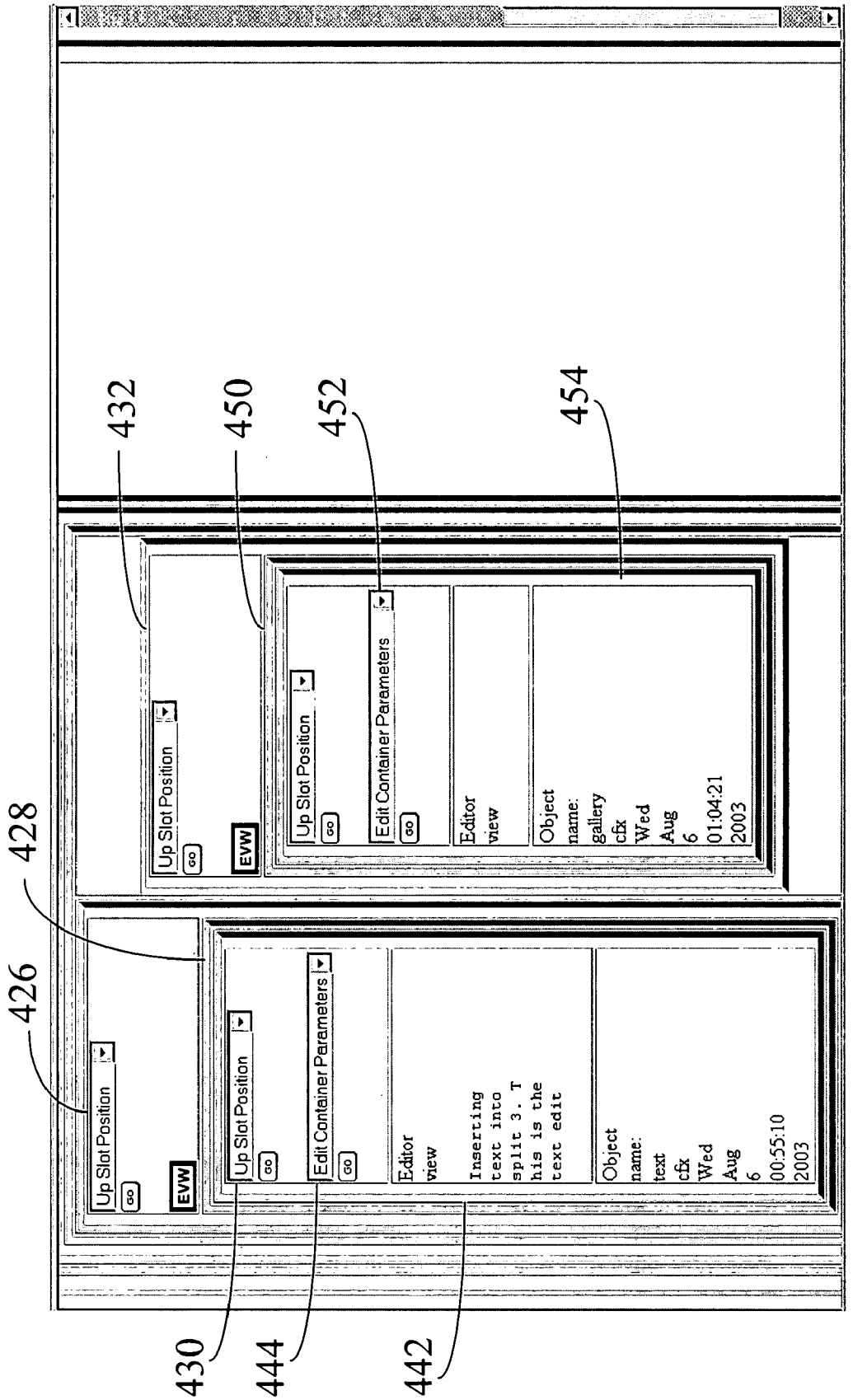

Up Slot Position
GO
EVW
Up Slot Position
GO
Edit Container Parameters
GO
Editor
view
Inserting
text into
split 3. T
his is the
text edit
Object
name:
text
cfx
Wed
Aug
6
00:55:10
2003
Up Slot Position
GO
EVW
Up Slot Position
GO
Edit Container Parameters
GO
Editor
view
Object
name:
gallery
cfx
Wed
Aug
6
01:04:21
2003
426
428
430
444
442
432
450
452
454

Fig. 4N

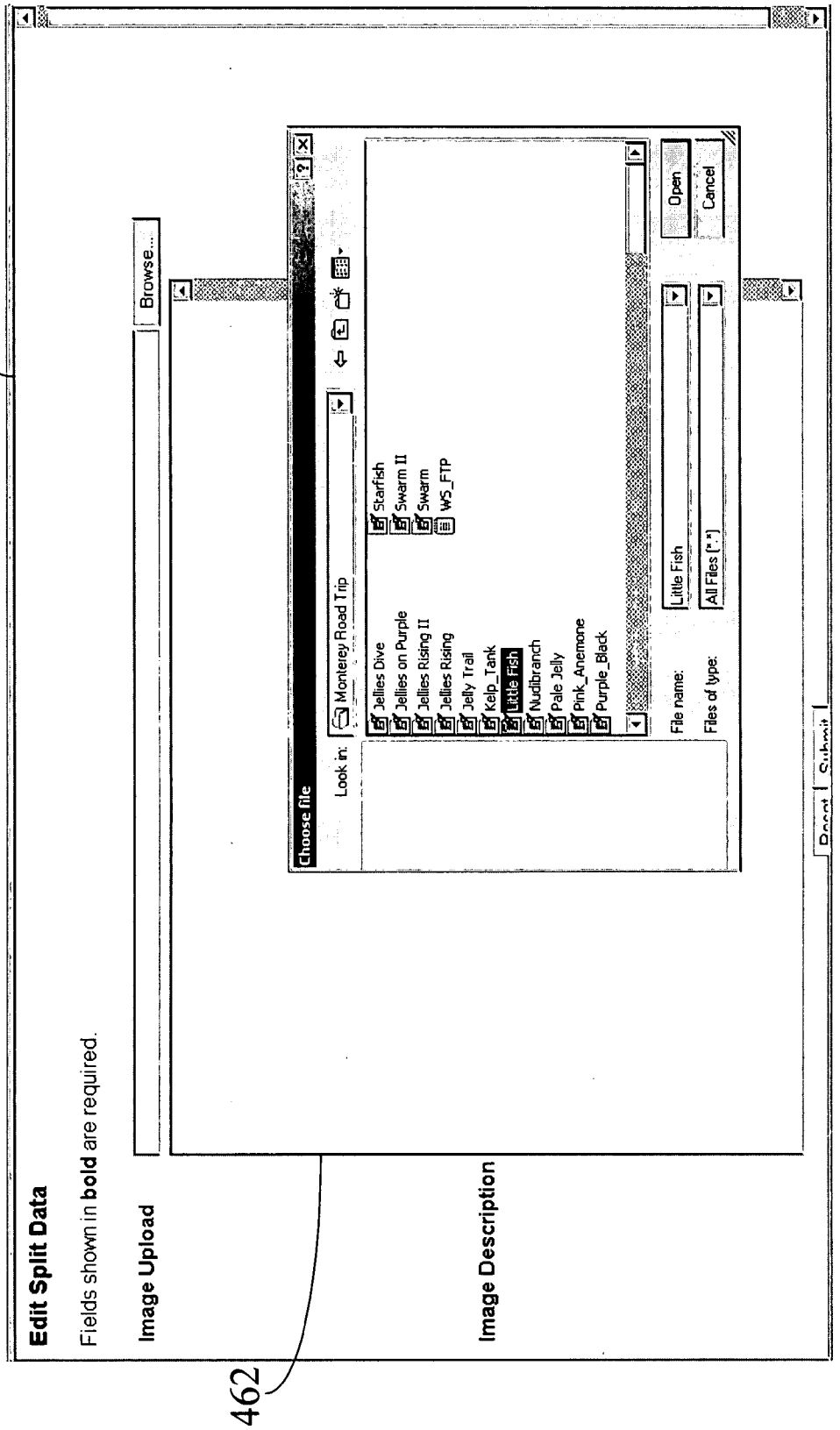

460
462
Edit Split Data
Fields shown in bold are required.
Image Upload
Browse...
Image Description
Choose file
Look in:
Monterey Road Trip
Jellies Dive
Jellies on Purple
Jellies Rising II
Jellies Rising
Jelly Trail
Kelp_Tank
Little Fish
Nudibranch
Pale Jelly
Pink_Anemone
Purple_Black
Starfish
Swarm II
Swarm
WS_FTP
File name:
Little Fish
Files of type:
All Files (*.*)
Open
Cancel
Reset
Submit

Fig. 40

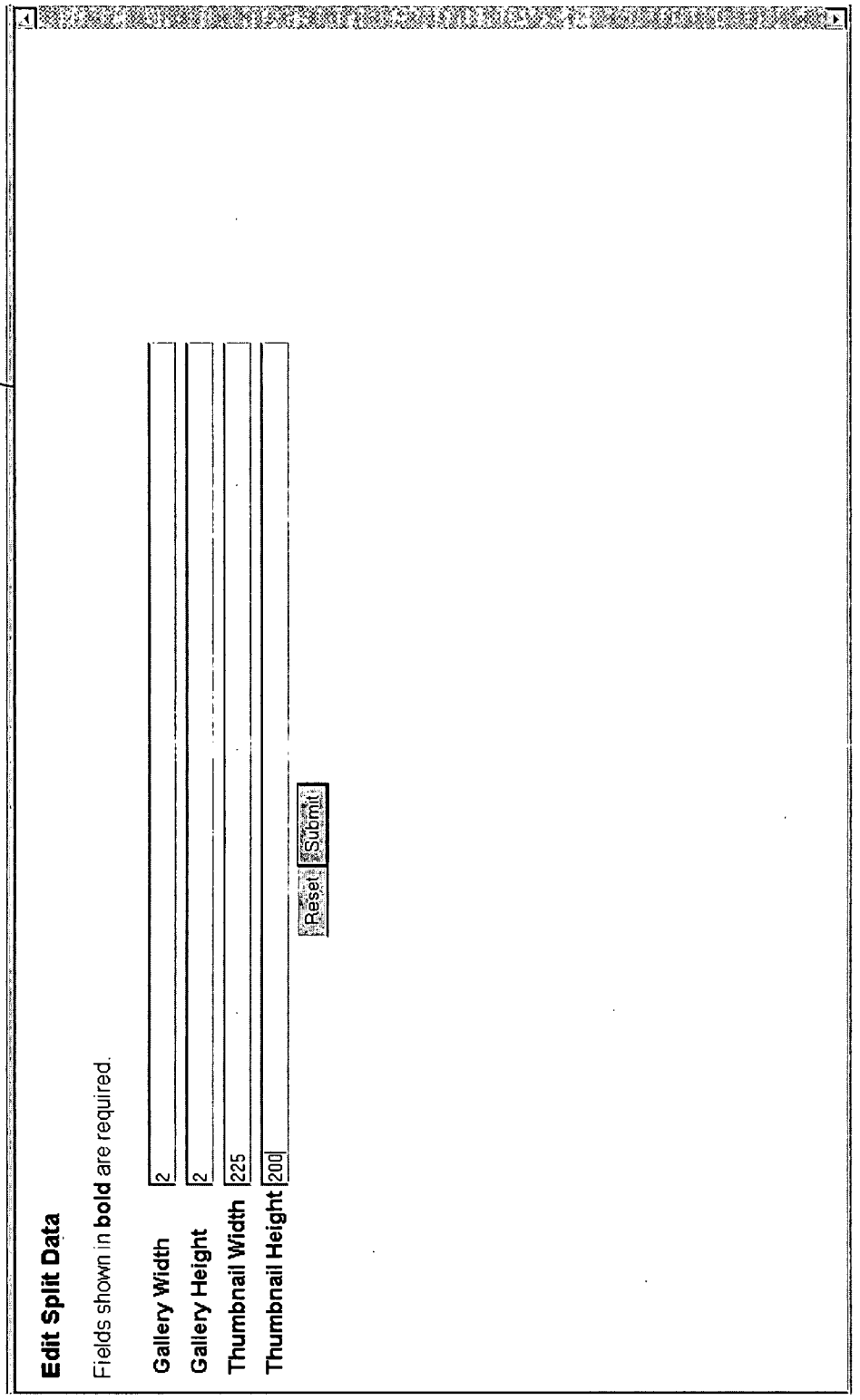

470
Edit Split Data
Fields shown in bold are required.
Gallery Width
2
Gallery Height
2
Thumbnail Width
225
Thumbnail Height
200
Reset
Submit

Fig. 4P

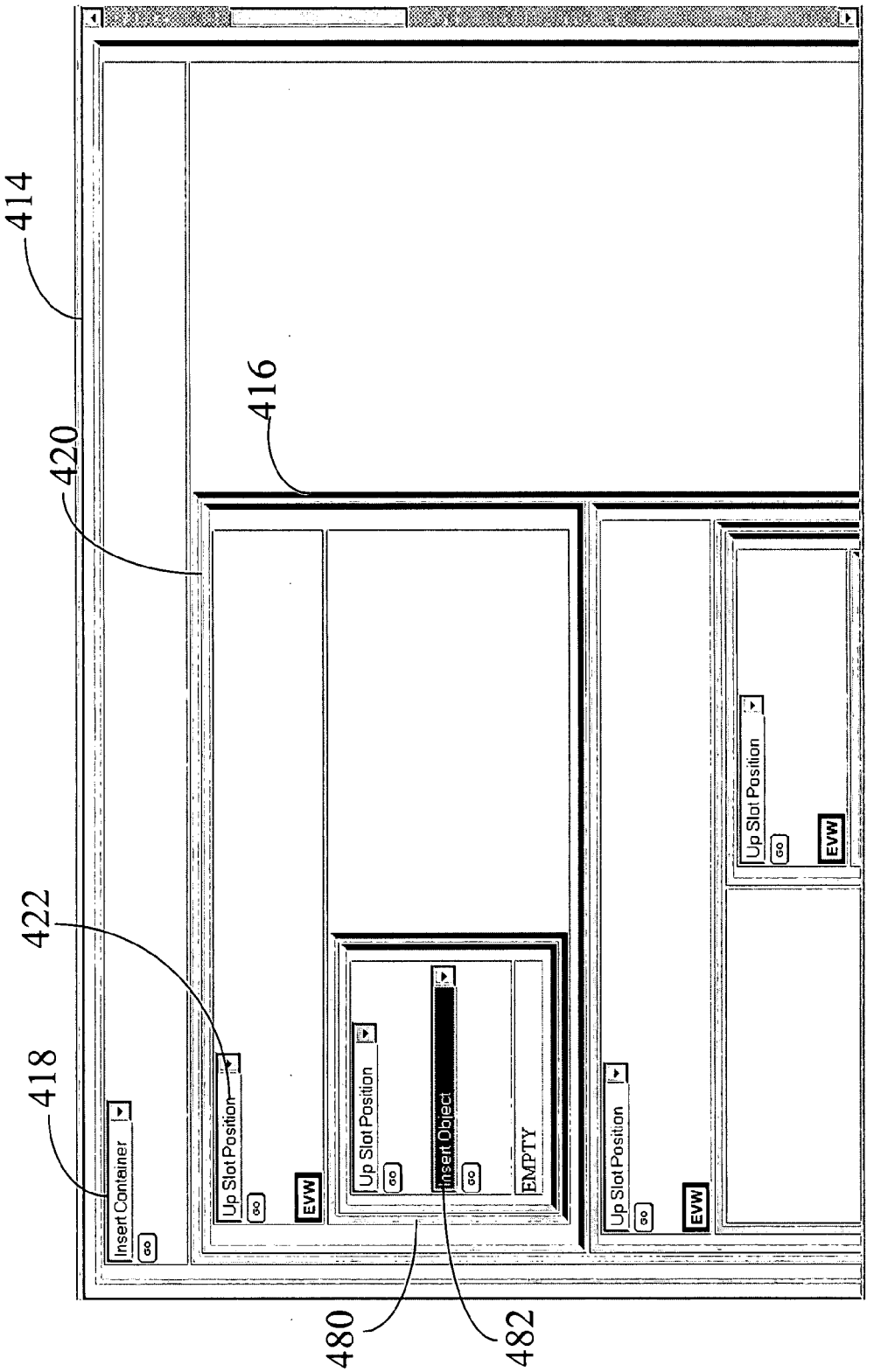

414
416
420
422
418
480
482
Insert Container
Up Slot Position
EVW
Up Slot Position
Insert Object
EMPTY
Up Slot Position
EVW
Up Slot Position
EVW

Fig. 4Q

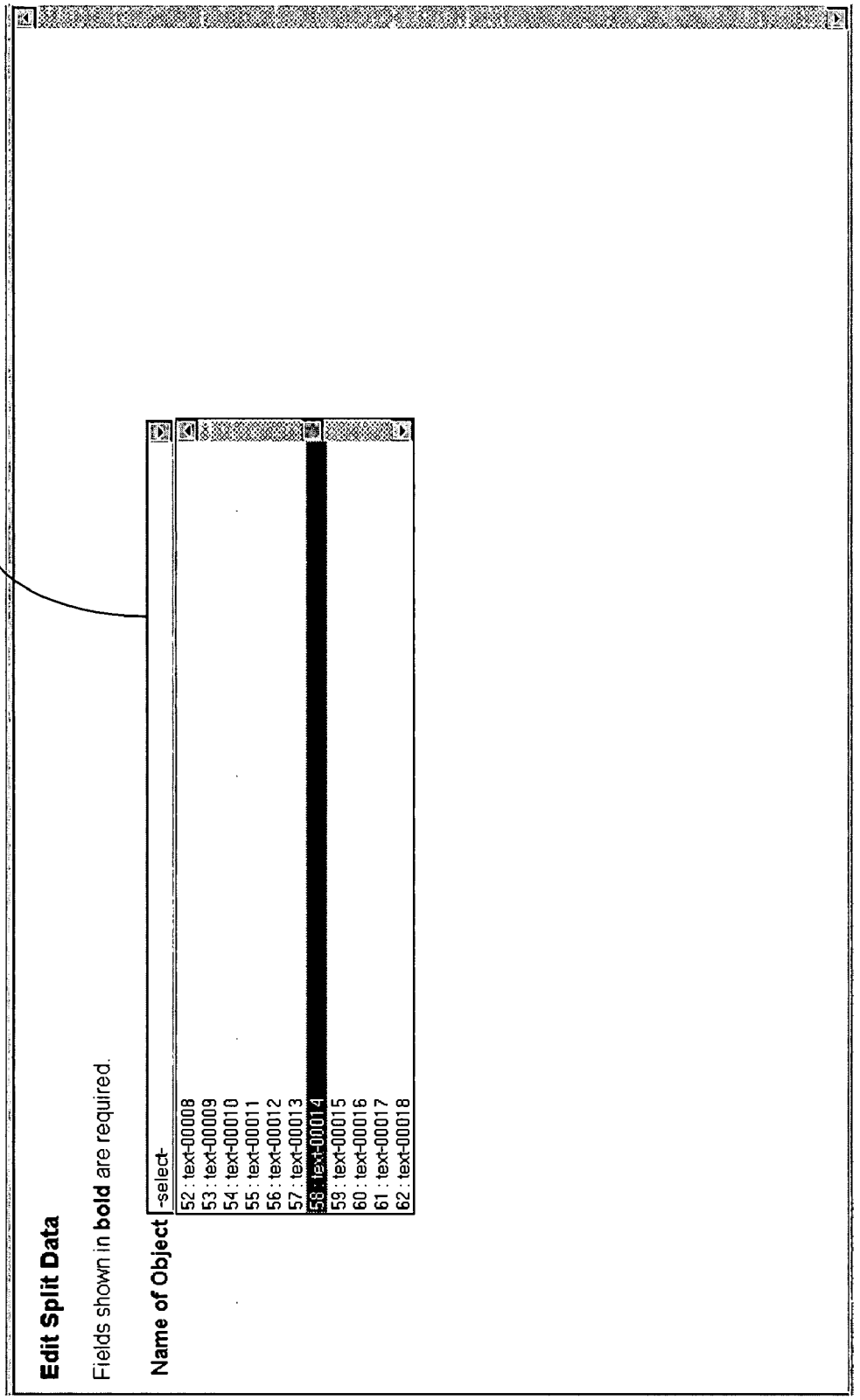

480
Edit Split Data
Fields shown in bold are required.
Name of Object
-select-
52 : text-00008
53 : text-00009
54 : text-00010
55 : text-00011
56 : text-00012
57 : text-00013
58 : text-00014
59 : text-00015
60 : text-00016
61 : text-00017
62 : text-00018

Fig. 4R

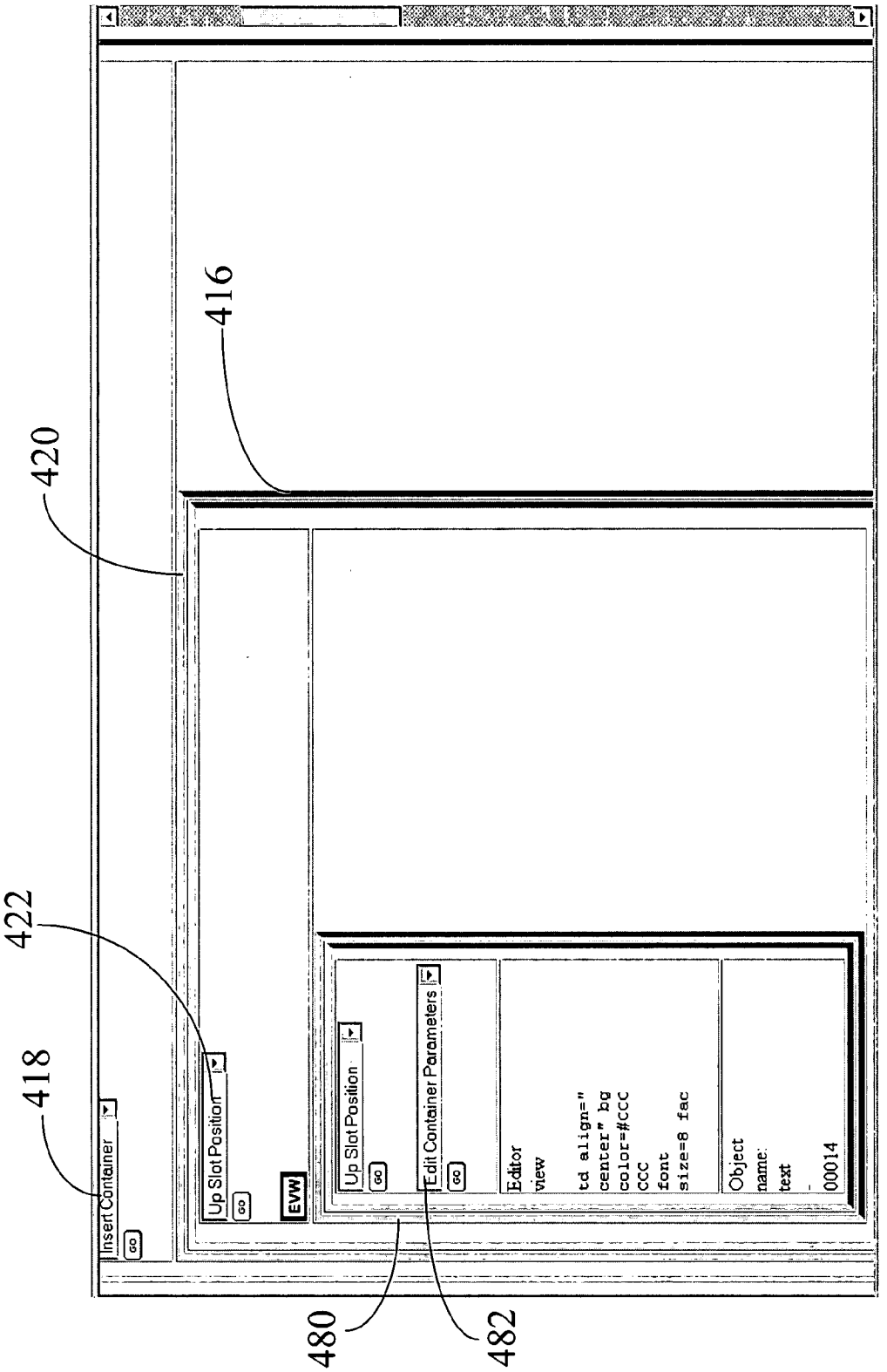

416
420
422
418
480
482
Insert Container
GO
Up Slot Position
GO
EVW
Up Slot Position
GO
Edit Container Parameters
GO
Editor
view
td align="
center" bg
color=#CCC
CCC
font
size=8 fac
Object
name:
text
-
00014

Fig. 4S

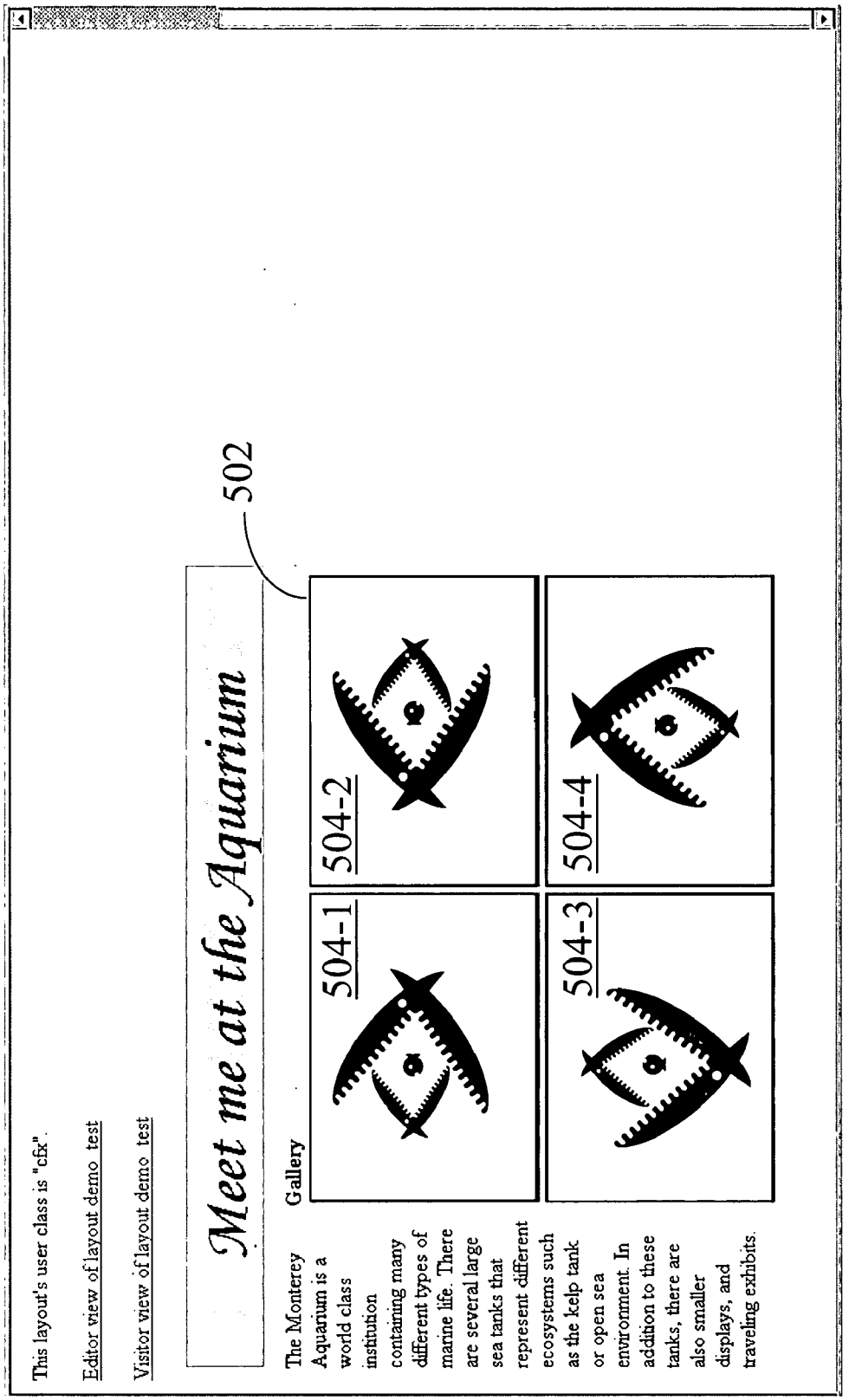

This layout's user class is "cfx".
Editor view of layout demo test
Visitor view of layout demo test
Meet me at the Aquarium
502
The Monterey Aquarium is a world class institution containing many different types of marine life. There are several large sea tanks that represent different ecosystems such as the kelp tank or open sea environment. In addition to these tanks, there are also smaller displays, and traveling exhibits.
Gallery
504-1
504-2
504-3
504-4

Fig. 4T

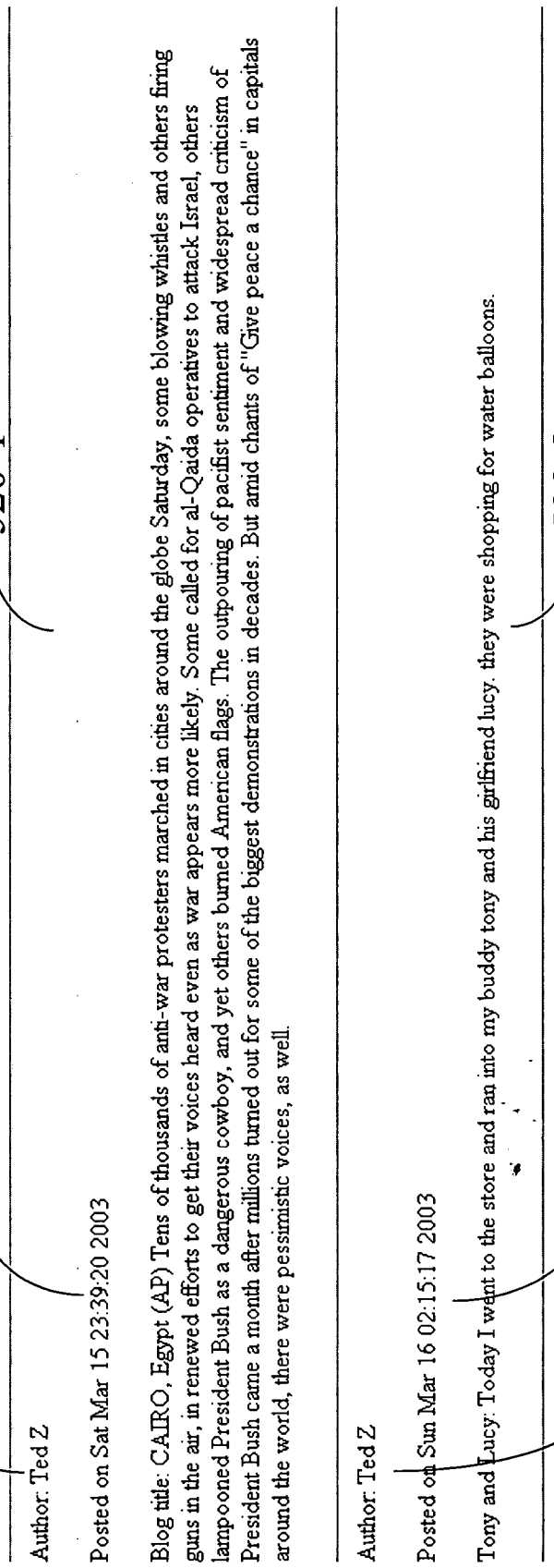

524-1
522-1
520-1
Author: Ted Z
Posted on Sat Mar 15 23:39:20 2003
Blog title: CAIRO, Egypt (AP) Tens of thousands of anti-war protesters marched in cities around the globe Saturday, some blowing whistles and others firing guns in the air, in renewed efforts to get their voices heard even as war appears more likely. Some called for al-Qaida operatives to attack Israel, others lampooned President Bush as a dangerous cowboy, and yet others burned American flags. The outpouring of pacifist sentiment and widespread criticism of President Bush came a month after millions turned out for some of the biggest demonstrations in decades. But amid chants of "Give peace a chance" in capitals around the world, there were pessimistic voices, as well.
Author: Ted Z
Posted on Sun Mar 16 02:15:17 2003
Tony and Lucy: Today I went to the store and ran into my buddy tony and his girlfriend lucy. they were shopping for water balloons.
524-2
522-2
520-2

Fig. 5

COMPUTER SYSTEMS AND METHODS FOR PLATFORM INDEPENDENT PRESENTATION DESIGN

1. FIELD OF THE INVENTION

[0001] The field of this invention relates to computer systems and methods for generating a presentation in a language and platform independent manner. A specific implementation of the present invention can be use to generate web pages in a language independent manner.

2. BACKGROUND

[0002] Increasingly computer software packages and programming languages have displaced traditional methods of producing images, video, and graphic design layouts. They have also been used to create and maintain web pages on the Internet. A multitude of programming languages and software packages have been created for such purposes. However, these programming languages and software packages are often highly specialized and typically require that the information to be presented be formatted in a specific language. This is especially true for the visual presentation of information on mediums such as Internet web pages.

[0003] For anything other than unformatted ASCII text, Internet web pages can typically only be viewed using software packages that are capable of interpreting World Wide Web specific languages such as HTML, Java, and ASP. Similarly, video typically must be streamed over the Internet through programs such as Real Player and QuickTime. Many such World Wide Web specific languages and Internet programs are built upon proprietary code base. Therefore, Internet web pages created using such programs and products can only be seen when specialized software, such as an Internet browser or other form of interpreter, is invoked. All of this leads to the nearly universal requirement that information intended for display on the Internet must be stored in a specific language.

[0004] One of the consequences of the Internet language requirement is that content providers that want to present their information across multiple formats typically must store their information in several different ways so that the various types of different devices that the content provider wants to support will be capable of displaying the information. However, storage of the same content in multiple different languages can be time consuming and expensive for content providers. Furthermore, in the rapidly advancing field of Internet web page design and display, it is not always clear if one particular format will be able to reach all of the intended user base or if that format will become obsolete in the future. For example, if a content provider makes a substantial investment in coding web content in ASP and/or HTML, the content provider is at risk if HTML standards or the ASP code changes in the future. If the HTML or ASP standard changes, then the content provider must make an additional substantial investment in time and resources updating all of the content so that it is compatible with the new HTML or ASP standard. Also newer languages can emerge either to support specific devices (e.g. Pocket C for Palm handheld devices), or for more general application (e.g., such as PHP, see www.php.net). Updating content to display in new languages is another expense that must be incurred by content providers.

[0005] In many cases, web pages and other visual presentations are coded in such a way that both the information to be displayed and the order of the information to be display are stored in a single file. Everything in such a file is then considered to be static, because nothing else can be inserted into the file or changed, unless the file is opened and altered. Static files that contain all the information for a web page can be generated in three different ways. First, they can be hand coded. Hand coding involves manually writing out lines of code containing the data and instructions on how to order that data. Hand coding is very labor intensive and an unsatisfactory approach for anything other than the simplest web page designs. Second, static files that code for web pages can be generated using a specialized editor. Such specialized editors have the advantage over hand coding in that they can be used to introduce many programming shortcuts, such as the ability to fill in commonly used lines of code on command. Thus, specialized editors are advantageous for hand coding because they speed up the process of web page development. However, specialized editors have two drawbacks. Like hand coding, they require that the user be familiar with the commands of the web specific code (e.g. HTML, Java, etc.). Second, they have the drawback described earlier that web pages produced by such editors are based in a specific web language and are therefore at risk of becoming obsolete when the web language is revised.

[0006] The third approach to creating static files that code for web pages is the use of What You See Is What You Get (WYSIWYG) interfaces to generate the web page. Such platforms (e.g., Microsoft Frontpage) use a graphical user interface to allow users to place information onto a canvas using point and click or drag and drop methods. In this approach, specially designed functions are provided in order to arrange items on a page and conduct other tasks. These functions generate code containing the data, its attributes, and the order the data is to be presented so that the user does not need to know how to code in order to create the visual presentation. The code is then saved as a static file as in the hand coding and specialized editor approaches. While the WYSIWYG approach removes the need to train users so that they can program in web specific programming languages, the approach still has the inherent drawback of generating static web files.

[0007] The creation of a single static file for each layout of information (e.g., web page) is particularly unsatisfactory in cases where the visual format of the layout is a constant but the information being displayed changes. In such situations, it becomes redundant from a data storage perspective and repetitive from a labor standpoint to create the same static file over and over with only the actual information in the file changing. An examples of such an instances is a multi-page photo gallery where the frames and control functionality is the same on each page and the only thing that changes is the images being displayed.

[0008] To address the situation where the overall look of a presentation, such as a collection of web pages, remains the same on each page but the information on each page changes, templates were developed. A template is a standard ordering and layout of information that does not contain the information to be inserted, only a placeholder where each piece of information can be inserted.

[0009] To illustrate the advantages of a template, consider the case of a hypothetical online store. The store name appears on the top of each web page associated with the online store. Further, a list of links to each section in the store appears on the left side of the pages associated with the store.

A display capable of depicting twelve products, with an order of four products across and three products down, appears in the center of each page associated with the store. A template can be created for such an arrangement, but the template will not contain the product information because such information (the products viewed in the central display) will depend on what section of the store is being displayed. Thus, the template and the data (the products) presented by the template are stored in two different locations. The use of a template in this illustration obviates the need to produce a large number of web pages, each displaying a different sent of products.

[0010] The use of templates then splits a presentation (e.g., collection of web pages) into two separate locations, one for the template and one for the data displayed by the template. The template is typically stored as a file and the information that is presented using the template is typically stored in a database. The use of templates is referred to as a dynamic solution because the information inserted into the template can change on a dynamic basis (e.g., as the user selects different sections of the online store or different web pages within the presentation, etc.).

[0011] Dynamic approaches to web presentation design eliminates the need to insert information into each and every file associated with the presentation, but it does not remove the dependency on specialized code to order the layout of data in a visual medium such as the Internet. For example, if the goal is to display information in an identical manner on two different platforms, platform specific code must be written for each platform in order to achieve the goal.

[0012] Given the above background, what is needed in the art are systems and methods for generating presentations that can be presented on any desired target platform and in any desired target language without modifying the presentation.

[0013] Discussion or citation of a reference herein will not be construed as an admission that such reference is prior art to the present invention.

3. SUMMARY OF THE INVENTION

[0014] The present invention addresses the problems found in the known art. In the systems and methods of the present invention, presentations are created in a platform independent manner. Thus, they can be presented on any desired target platform using any desired programming language without modification of the platform. Using the systems and methods of the present invention, presentations can be stored, retrieved, and modified in a way that eliminates any dependency on storing the presentation as a combination in a fixed set of code. This is accomplished by a novel combination of a treemap layout algorithm with a generic content engine and a backend storage database to keep all of the components of a web page in the most generic form possible. Language specific modules are then used to convert data, views of data, and the order of data into platform specific code. In this way, presentations can be displayed in more than one programming language or medium, and its data and views of data can be reused more than once in a layout or across multiple layouts.

[0015] One embodiment of the present invention provides a method of constructing a presentation in a platform independent manner. A layout that includes a top split is defined. The top split includes a first orientation parameter specifying an orientation for any daughter split created within the top split. A request is received to create a daughter split within the top split. The daughter split is generated within the top split in accordance with the first orientation parameter. The daughter split includes a second orientation parameter specifying an orientation for any child split created within the daughter split. Finally, the layout is converted to the presentation. In some embodiments where the daughter split is a data split, the method further comprises inserting a data object in the data split and associating a view with the data object. This view determines how the data object is presented in the data split. The data object can be a complex object such as a blog or a gallery.

[0016] Another embodiment of the present invention provides a computer program product for use in conjunction with a computer system. The computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein. The computer program mechanism is for constructing a presentation in a platform independent manner. The computer program mechanism has instructions for defining a layout that includes a top split. The top split includes a first orientation parameter specifying an orientation for any daughter split created within the top split. The mechanism further has instructions for receiving a request to create a daughter split within the top split and instructions for generating the daughter split within the top split in accordance with the first orientation parameter. The daughter split includes a second orientation parameter specifying an orientation for any child split created within the daughter split. The mechanism further includes instructions for converting the layout to the presentation.

[0017] Yet another embodiment of the present invention provides a computer system for constructing a presentation in a platform independent manner. The computer system comprises a central processing unit and a memory, coupled to the central processing unit. The memory stores instructions for defining a layout that includes a top split. The top split includes a first orientation parameter specifying an orientation for any daughter split created within the top split. The memory further stores instructions for receiving a request to create a daughter split within the top split. The memory further includes instructions for generating the daughter split within the top split in accordance with the first orientation parameter. The daughter split includes a second orientation parameter specifying an orientation for any child split created within the daughter split. The memory further includes instructions for converting the layout to the presentation.

[0018] Still another aspect of the present invention provides a database for storing a layout comprising a hierarchy of splits. The database comprises a layout table that includes a column for storing an identity of the layout and an identity of the top split in the hierarchy of splits. The database further comprises a layoutdata table that includes a row for each split in the hierarchy of splits, such that each respective split stored in the layoutdata table comprises (i) a parent field that specifies the parent split of the respective split, and (ii) a type field that specifies whether the respective split is a data split and, when the respective split is not a data split, defines an orientation of the respective split within the parent split of the respective split.

4. BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. **1** illustrates a computer system for generating a presentation in a language and platform independent manner in accordance with one embodiment of the present invention.

[0020] FIG. **2** illustrates a database schema for storing presentations in a language and platform independent manner in accordance with one embodiment of the present invention.

[0021] FIGS. **3**A-**3**B illustrate procedures for retrieving and editing a presentation in accordance with one embodiment of the present invention.

[0022] FIGS. **4**A-**4**T are screen shots that illustrate the generation of a presentation in a platform and language independent manner in accordance with one embodiment of the present invention.

[0023] FIG. **5** illustrates a portion of a blog in accordance with an embodiment of the present invention.

[0024] Like reference numerals refer to corresponding parts throughout the several views of the drawings.

5. DETAILED DESCRIPTION

[0025] Referring to FIG. **1** a specific embodiment of a system **10** in accordance with one aspect of the invention is illustrated. System **10** preferably comprises a server **20** that includes:

[0026] a central processing unit **22**;

[0027] a main non-volatile storage unit **23**, preferably including one or more hard disk drives, for storing software and data, the storage unit **23** typically controlled by disk controller **25**;

[0028] a system memory **24**, preferably high speed random-access memory (RAM), for storing system control programs, data, and application programs, including programs and data loaded from non-volatile storage unit **23**; system memory **24** can also include read-only memory (ROM);

[0029] an optional user interface **26**, including one or more input devices, such as a mouse, a keypad **8**, and display **38** and/or mouse **36**;

[0030] network interface circuitry **28** for connecting to any wired or wireless communication network, the network interface circuitry **28**;

[0031] one or more internal buses **34** for interconnecting the aforementioned elements of the system; and

[0032] a power source **27** for providing power to the above identified components.

[0033] Operation of server **20** is controlled primarily by operating system **40**, which is executed by central processing unit **22**. Operating system **40** can be stored in system memory **24**. In addition to operating system **40**, a typical implementation of system memory **24** includes a file system **42** for controlling access to the various files and data structures used by the present invention.

[0034] Database **66** is any form of data storage system including, but not limited to, a flat file, a relational database (SQL), and an OLAP database (MDX and/or variants thereof). In some specific embodiments, database **66** is a hierarchical OLAP cube. In preferred embodiments, database **66** is implemented as a RDBMS server, an objected-oriented database, or a file-based RDBMS server. In one embodiment, database **66** is implemented as a MySQL database (MySQL AB, http://www.mysql.com). In some embodiments, there is only a single database **66** while, in other embodiments, there are a plurality of databases **66**. In some embodiments of the present invention, system **10** includes a plurality of servers **20**. The servers **20** can be in one centralized location. However, more preferably, the servers **20** are distributed over a large geographic area. It will be appreciated that the software modules illustrated in memory **24** are listed in memory **24** for ease of presentation. In fact, any of the software modules and database **66** illustrated in memory **24** of FIG. **1** can be independently located in any memory that is addressable by system **20** including, but not limited to, remote servers.

[0035] The present invention provides a database-driven architecture that stores platform and language independent layout instructions in a database **66**. A layout is a visual presentation of information, such as a web page. Modules **44** through **64**, described in more detail below, allow a user to build, edit, and review these layouts. Each layout comprises a series of instructions that are hereinafter referred to as splits to emphasize that they do not encode absolute screen positions, but rather specify subdivisions in the layout. Because the splits do not encode absolute screen positions, they are suitable for any display device, from basic HTML rendered on a browser to Java Swing containers.

[0036] Each split in a layout can contain one or more splits or an object view. An object view is a description of how an object associated with the object view is to be displayed.

[0037] Advantageously, the layout data, including splits, object views and objects, are stored in database **66**. Further, all operations performed by a user are stored in the database. When an operation is executed, its implementation is referred to as an action. For instance, an implementation (action) for the operation "modify a text object" is "modify text object **234** to say 'hello'". All actions are stored in database **66** so that the path a user took to create a layout's current state can be recreated for various purposes. In addition, operations can be batched into macros so that complex tasks (e.g., creating a layout) can be expressed in a single action (e.g., as a macro).

[0038] The various advantages and features of the present invention will be presented by first describing the major components of a database **66** schema (FIG. **2**) in accordance with a preferred embodiment of the present invention (Section 5.1). Then, the process steps (FIG. **3**) taken by a user to edit or view a layout will be presented (Section 5.2). Next, a collection of exemplary screen shots showing the construction of a layout in accordance with one embodiment of the present invention (FIG. **4**) will be described (Section 5.3).

[0039] Section 5.4 provides a detailed example of how an operation on a complex object (a gallery view) is processed and stored in database **66**.

5.1. Exemplary Database Schema

[0040] Database **66** (FIG. **1**) illustrates the tables found in a database schema in accordance with one embodiment of the present invention. The columns of the database tables illustrated in FIG. **1** and the relationship between the various database tables are illustrated in FIG. **2**. In FIG. **2**, a "one to one" relationship between tables is illustrated as a straight line to straight line, a "one to many" relationship between tables is illustrated as a straight line to an arrow, and a "many to many" relationship between tables is illustrated as an arrow to an arrow.

[0041] Cookies **68** tracks user information such as IP addresses, user agent, user name, and the uniform resource location (URL) that referred the user to the site. Cookie table **68** is primarily a tracking and debugging table.

[0042] Session table **70** tracks session information for users. Section table **70** tracks the date of a session, the first URL viewed in that session, and the URL that referred the user to the site of that session. The cookie_id column in session table **70** is a foreign key to cookies table **68**. Session table **70** is primarily a tracking and debugging table.

[0043] Actions table **72** stores user invoked operations that create or edit layouts, splits, object views, or objects as actions. The operation column of action table **72** indicates the type of action the user has taken. The target column of action table **72** indicates the layout (layout_id), split (split_id), object view (view_id), or object (object_id) that the action is being committed upon.

[0044] Actionparameters table **74** stores any values associated with an action. Not all actions have a parameter. However, some actions have one or more parameters. An action that creates a blog entry, for instance, will have one parameter for the title of the blog and another one for the actual content in the entry. The column operation_parameter in the actionparameters table **74** is a foreign key to the operationparameters table **78**, described in more detail below.

[0045] Operations table **76** is a lookup table that includes information for all possible types of actions. Operationparameters table **78** contains additional information about operations. For instance, a single operation may need to alter more than one database table or column. Operationparameters table **78** provides additional information necessary to apply each step in the operation including Perl code to be enacted by the magic column. Actionparameters table **74** has a foreign key to this table so that system instructions for each action parameter can be obtained. A detailed example of the use of actions table **72**, operations table **76**, actionparameters table **74** and operationparameters table **78** work to process an operation is provided in Section 5.4 in conjunction with FIG. **4**P.

[0046] Users table **80** contains the login and password for each user. It also contains a user class value that governs what information each user can alter and view in database **66**.

[0047] Layout table **82** contains information about each layout stored in database **66**. A layout represents the complete collection of information for a specific presentation. For each layout stored in database **66**, layout table **82** dictates who can view and edit each layout through values stored in columns user_class, public_view, and public_edit. Specifically, the user_class column identifies the user class that has full access (read and write privileges) to the layout. The public_view and public_edit columns respectively specify whether visitors with a user class different from the layout's user class can view and edit the layout. Each layout is assigned a unique layout ID that is stored in the layout_id column of layout table **82**. The user assigns a name to each layout and this name is stored in the name column of layout table **82**. The top_split column specifies the top split of each layout stored in database **66**. The top split is the first layout instruction that is executed during a layout read procedure. Layouts have a hierarchical data structure such that the top split serves as the starting point from which all information concerning a particular layout is retrieved from database **66**. The top_split column of the layout table is a foreign key to layoutdata table **84**.

[0048] Layoutdata table **84** stores all the splits of all the layouts stored in database **66**. The parent column of layoutdata table **84** indicates the parent split that a given split falls under. If the split is a top_split, then in the layouts table the value for the split in the parent column is null. Layoutdata table **84** also includes several property columns that determine attributes of the split such as position relative to the other daughter splits sharing a parent, height, width, and alignment. However, no column in the layoutdata table **84** dictates the absolute position of a split in a given display. This is one of the advantages of the data architecture of the present invention. As will be explained in more detail below, a treemap algorithm is applied to successive splits in the layout hierarchy in order to determine the absolute position of each split in the layout. Usage of the treemap algorithm in this novel way removes any requirement for hard coding splits and allows for the development of code independent and platform independent presentations. The type column in layoutdata table **84** determines whether a given split is directional with respect to the parent split (e.g., horizontal or vertical) or if the split is a data split. In some embodiments the type column specifies that the splits are to be arranged in a circle or a rectangle. In fact, in some embodiments, the type column specifies any arrangement of items based on position.

[0049] Objects are stored in object table **92**. Each object is assigned an object_id that is stored in the object_id row of object table **92**. Additionally, each object is given a user defined name that is stored in the name row of object table **92**, a user class who can edit the data that is stored in the user_class row of object table **92**, and the type of data the object contains that is stored in the type row of object table **92**.

[0050] Blogdata table **94** tracks a special form of object called a blog. Blog objects are complex objects and therefore require database table **94** in addition to database table **92** to store all their data. The term "blog" is a form of "web-based diary". A blog object is considered complex because it contains a series of time stamped entries that are entered by users who have read/write privileges to the blog.

[0051] FIG. **5** illustrates a portion of a blog with two time stamped entries **520**. Each blog entry **520** is stamped with the date **522** in that it was created. Further, the author **524** of each blog entry **520** is noted in the entry. Although not shown, each blog optionally has a blog title and a category that is stored in blogdata table **94**.

[0052] Each of the time-stamped entries in a blog can be considered a separate object. However, each entry in a given blog is assigned the same object_id and this object_id is stored in the object_id column of object table **92**. The name of the blog is stored in the name column of object table **92**. There is a one to many relationship between a blog, stored in object table **92**, and the blog entries for the blog, stored in blogdata table **94**. That is, each blog entry in a blog is stored in a separate row in blogdata table **94**.

[0053] Each blog entry in blogdata table **94** has a title that is stored in the blog_title column of blogdata table **94**. Each blog entry is given a unique identifier that is stored in the blod_id column of blogdata table **94**. The content of a blog entry is stored in the blog_content column of blogdata table **94**. The date of a blog entry is stored in the blog_date column of blogdata table **94**. Further, the blog entry author's name and e-mail address are respectively stored in the blog_author_name, and blog_author_email columns of blogdata table **94**. The disabled column of the blogdata table **94** tracks whether the blog has been disabled. The link column of the blogdata table **94** provides a link, such as a link to a picture gallery described in more detail below, that provides a means for linking an object to a given blog entry.

[0054] Like blogs, gallery objects are complex objects meaning that they need a separate database table, in addition to object table **92**, to store all their data. This separate database table is gallerydata table **96**. An exemplary gallery is gallery **502** of FIG. **4**T. The obj_data column of object table **92** contains the object gallery title. Each gallery entry **504** is stored as a row in gallerydata table **96**. As such, there is a one to many relationship between a gallery object, stored in object

table **92**, and the gallery entries, which are stored each independently stored as rows in gallerydata table **96**.

[0055] Each gallery entry **504** in a gallery **502** (FIG. **4**T) has the same object identifier (object_id). Further, each gallery entry **504** is assigned a unique image identifier, which is stored in the image_id column of the gallerydata table **96**. Each gallery entry **504** is stored at a particular URL address that is stored in the image_url column of the gallerydata table **96**. Each gallery entry **492** is also assigned an image name that is stored in the image_name column of the gallerydata table **96**. Each gallery entry **504** has a flag to indicate whether or not the image is disabled. This flag is stored in the disabled column of gallerydata table **96**.

[0056] As seen in the case of blogs and galleries, objects can be complex. The database schema illustrated in FIG. **2** illustrates two types of complex objects, blogs and galleries. However, the present invention is not limited to such data forms. Those of skill in the art will appreciate that many other types of complex objects can be constructed in view of the teachings of the present invention and all such complex objects are within the scope of the present invention.

[0057] Objects are pure data that contain little if any information on how the objects are to be displayed in a presentation. Such presentation information is stored in object views. In other words, a view controls how a corresponding object looks in a presentation. Views have two important properties. First, there can be more than one view per object. This allows the same set of data to be displayed with different properties in more than one layout. An example of an instance where there is more than one view for an object is the case of a photo gallery that has 75 by 75 pixel thumbnails when used as a minor item within a layout, and has 150 by 150 pixel thumbnails when used as a major item in a different layout. Second, in preferred embodiments, there is only one view per data split.

[0058] Views are stored in the views database table **88**. There are also special views for certain objects. For instance, there are blog views and gallery views that respectively handle the particular attributes of blog objects and gallery objects. Blog views and gallery views are respectively stored in blogviews table **86** and galleryviews table **90**.

[0059] Each row of view table **88** has an object field that identifies the object to which the view applies. Further, each view has a view identifier that is stored in the view_id column of view table **88**. There is a one to one correspondence between the view identifier of a view and the split identifier of the corresponding split that holds the object regulated by a particular view. In other words the view_id of views table **88** is exactly equal to the split_id of the data split in layoutdata table **84** that contains this view. When an object is added to a split in a layout, a view is created in order to regulate how the object appears in the split. Each view has a user class field, which is stored in the user_class field of view table **88**, that identifies the user class that has full access to the view.

[0060] Blogviews, stored in blogviews table **86**, includes a view_id column that is keyed to the view_id column of the corresponding view in view table **88**. Each blogview includes a summary field that specifies the number of words that a presentation should use to summarize blog entries in the summary view of the blog. Further, there is a "limit entries" field that specifies the maximum number of entries to display in a blog at any given time. Further, a blogview includes a sort field that determines whether the blog entries should be sorted (e.g., by date, etc.).

[0061] The gallery views, stored in galleryviews table **90**, have a view identifier field that is stored in the view_id column. The view_id of each respective galleryview in table **90** is identical to the view_id of the view in views table **88** that corresponds to the respective galleryview. Each galleryview has x and y dimensions that respectively specify the number of images to be displayed on a row and the number of rows to be displayed. For example, if x, y is 3, 2, two rows of images are displayed, with three images on each row. If the gallery has more than six images in the case where x, y is 3, 2, then remainder of the images are not presented in the galleryview but can be used, for example, as a separate gallery page. The thumb_x and thumb_y columns in a galleryview specify the thumbnail size of each image used in the gallery.

[0062] In some embodiments of the present invention, database **66** is written to and read from using Class::DBI **62** (FIG. **1**), which is available from the Comprehensive Perl Archive Network (CPAN) at http://www.cpan.org/index.html. Class::DBI **62** is a Perl class that works on the basis that each table in a database has a corresponding class. Perl is a cross platform programming language. See, for example, Schartz and Pheonix, *Learning Perl*, O'Reilly & Associates, 3rd edition, 2001, which is hereby incorporated by reference in its entirety. In some embodiments, database **66** is a MySQL database. The advantage of using Class::DBI **62** is that information can be written to and read from database **66** without writing any customized SQL code. However, Class::DBI **62** is merely one example of how the systems and methods of the present invention can be constructed and do not serve to limit the invention in any way. Any form of database architecture can be used in the present invention, including a flat file. Furthermore, such databases can be updated using any form of database language, including SQL.

[0063] As illustrated in FIG. **1**, some embodiments of the present invention provide class Tabla::DBI **64** that inherits from Class:DBI (available form CPAN). In such embodiments, the various modules described in Table 1 inherit from Tabla::DBI in order to interact with corresponding database tables present in database **66**:

TABLE 1

Tabla::DBI modules

Module	Function
Tabla::DBI::Action	User actions
Tabla::DBI::ActionParameter	Action parameters
Tabla::DBI::Configuration	Site configuration parameters
Tabla::DBI::Cookie	User cookie management
Tabla::DBI::Layout	Layouts
Tabla::DBI::Object	Objects
Tabla::DBI::Operation	Operations
Tabla::DBI::OperationParameter	Operation parameters
Tabla::DBI::Session	User session management
Tabla::DBI::Split	Splits
Tabla::DBI::User	Users
Tabla::DBI::View	Views
Tabla::DBI::Data::Gallery	Gallery data (images)
Tabla::DBI::Data::Blog	Blog data (blog entries)
Tabla::DBI::View::Gallery	Gallery views
Tabla::DBI::View::Blog	Blog views

5.2. Exemplary Layout Viewing and Editing

[0064] The architecture of a database **66** in accordance with one embodiment of the present invention has been described. What follows is a description of how such a database **66** is

used to create a presentation in a platform and language independent manner. All information is entered by a user through a series of actions that perform operations. Operations are logical units of work done to a layout and any of the sub-groupings contained within a layout. Performing an action will alter one of the database **66** tables by either inserting a new row or updating an existing row. For instance creating a new split inside a layout results in the insertion of a new row in the layoutdata table. In some embodiments, all of the user directed interaction with database **66** takes place through a web based GUI. However, more generally, users can create and edit information through any type of GUI that can access and modify database **66**.

[0065] In addition to altering database **66** when an action is committed, the operation performed and the action committed can be recorded in the actionparameters **74** table of database **66**. Recording every action and operation a user performs on the system allows for the ability to undo or redo actions performed so that users can correct mistakes made or try variations on their design by clicking buttons to undo or redo actions. Further, this feature allows for the creation of macros. A macro is a sequence of commonly used actions specified by a user.

[0066] Step **302**. In step **302** (FIG. **3**), a request is received for a layout stored in database **66**. A check is performed to determine whether the user making the request has the appropriate permission to make such a request. In some embodiments of the invention, this is accomplished by a table lookup to user table **80** to see if the requesting user is in a user class that has read/write privileges for the requested layout.

[0067] In some embodiments, the layout collection is requested by the print_table.pl script **54** (FIG. **1**) which, in turn, invokes various software modules in order to assemble a full presentation of a layout. Print_table.pl **54** also checks user permissions and does caching. Caching is used to cache presentations when they are generated. In this way, the presentation does not have to be regenerated in cases where the presentation has not been altered since the last time the presentation was requested.

[0068] In some embodiments print_table.pl **54** authenticates a user with HTTP browser cookies. In some embodiments, user options and a user session are tracked in two separate cookies using the Tabla::DBI::Cookie, Tabla::DBI::Session, and Tabla::DBI::User modules. In some embodiments, when a layout has not changed since the last time it was viewed, a cached version of the visual representation of the layout is retrieved from memory **24** or disk **23**. When the layout has not changed since the last time it was viewed it is stored in a cache (not shown) once it has been generated.

[0069] Step **304**. A layout is displayed starting with its top split. In step **304**, layout table **82** is searched for the identity of the top split that corresponds to the layout requested by the user.

[0070] Steps **306** and **308**. Once the top split for a requested layout has been identified, the layoutdata table **84** (FIG. **2**) is searched for splits whose parent is the top split. In practice, this search involves identifying every split in table **84** whose "parent" identifier is the same as the "top_split" identifier in the requested layout. In step **308**, a determination is made as to whether any new splits were identified in the layoutdata table **84** during the last instance of step **306**. If so (**308**—Yes), then a new query of the layoutdata table **84** is made. In the new query, any split whose parent identifier is the same as the split_id of a split identified in a previous instance of step **306** is selected. To illustrate, consider the case in which the top_split identifier for a requested split is **1001**. In step **306**, a search is made for all splits whose parent identifier equals 1001 and two such split are found. The two splits that are found have split identifiers (split_ids) **1018** and **1021**, respectively. Split **1018** and **1021** each designate split **1001** as the parent identified (parent). In step **308**, a determination is made that new splits have been found in the last instance of step **306** (splits **1018** and **1021**) (**308**—Yes). Therefore step **306** is reinvoked to identify any split having a parent id of **1018** or **1021** (**1001** has already been searched). If no new splits are found (**308**—No) process control passes on to step **310**. Steps **306** and **308** collect all the split in a layout in this iterative manner because the splits in a layout are arranged in a hierarchical manner, as determined by a treemap algorithm, discussed in more detail below.

[0071] When steps **306** and **308** have completed, there is a hierarchy of splits collected. There are two types of splits. The first type of split defines a branch in the hierarchy and contains no data. The second type of split terminates a branch of the hierarchy and either includes data or is empty. An empty terminal split is a container without content. As such, the only place in the layout that objects can be stored is in terminal splits that include data. The splits collected in step **306** need not be arranged in their proper hierarchical order at this stage. This hierarchical order only has significance when a presentation based on the layout is to be displayed.

[0072] Step **310**. Once the layout hierarchy is collected, the view for each terminal split that has a corresponding view is retrieved. This is accomplished by searching views table **88** for the view having a view_id that matches or otherwise corresponds to the terminal split's split_id. Each view references an object through the object column of views table **88** of database **66**. These referenced objects are collected at a later stage from object table **92**.

[0073] In some embodiments, print_table.pl **54** invokes LayoutAssembler **44** to collect all the splits and views in a requested layout. LayoutAssembler **44** is a convenience wrapper around the Tabla::DBI functionality. Data collection is made possible because the Class::DBI auto-retrieve functionality in the Tabla::DBI::Layout, Tabla::DBI::Split, Tabla::DBI::View, and Tabla::DBI::Object modules described in Table 1, above, is used to define the relationships between splits, objects, and views in a given layout. Thus, in such embodiments, the order of collection flows logically from these relationships. For example, only once the view associated with a data split has been collected can Class::DBI retreive the objects associated with that view. After the layout is collected, the layout tree is stored in memory (e.g., memory **24** and/or **23**) as a Tabla::DBI::Layout object that inherits from Class::DBI.

[0074] Step **312**. In step **312**, a determination is made as to whether want to edit the layout. If so, (**312**—Yes) control passes to step **322**, which is described in more detail below. If not, (**312**—No) control passes to step **314**.

[0075] Step **314**. Step **314** is reached in the case where the user has requested to view a layout but does not wish to edit the layout. In step **314**, TableGenerator **56** is invoked to walk down the layout hierarchy of the requested layout in order to build a translation that represents the layout. In typical embodiments, the translation is a set of nested tables. As an example of this process, a horizontal split that has two members is expressed as a table with one column and two rows. The split view parameters (from layoutdata table **84**) such as

width and height are applied to the table that holds the split but not to the cells inside the table. If one of the two members has a split (a daughter split), a table, corresponding to this daughter split, is nested within the cell of the respective member. This process of nesting tables within the cells of the tables of parent splits continues until all the splits in the layout are represented. This form of table representation is referred to herein as a treemap representation.

[0076] When a terminal split in the layout that references one or more objects through a corresponding view is encountered, TableGenerator **56** invokes ViewGenerator module **58** to retrieve the objects referenced by the view. ViewGenerator module **58** uses the retrieved objects to build a cell for the terminal split. This cell, in turn, is positioned within the table that hosts the terminal split. ViewGenerator module **58** retrieves objects by using the object identifier field in the view (of views table **88**) associated with the terminal split to identify objects from object table **92**. In cases where the object is a complex object (e.g., a blog or gallerydata) the view associated with the complex object is used to determine what components of the object are collected. For example, in the case where a gallery view specifies a two by three matrix of images, only the first six referenced images are collected regardless of how many images are available for the complex object.

[0077] In some embodiments ViewGenerator module **58** generates a cell from object data by a applying a template from Template Toolkit **60** to the object, object data and the view. Template toolkit **60** is a public domain template processing system written in Perl with certain elements coded in the C programming language to enhance speed. The template toolkit is capable of creating static and dynamic web content and incorporates various modules and tools to simplify this process. It is available from www.template-toolkit.org.

[0078] Step **316**. In step **316** a web page (presentation) that includes the translation generated in step **314** is displayed. The modules used to generate the translation in step **314** determine what language the web page is written in (e.g., HTML, XML, text, etc.). The exemplary ViewGenerator module **58** and the Template toolkit **60**, described above, are specific implementations that generate translations written in HTML. However, any presentation language of interest (XML, text, etc.) can be used to make a presentation (translation) from the layout tree. Furthermore, the presentation language does not have to support tables or graphics. For instance, in text, the nested tables can be drawn with the symbols "/-\|" and images in image galleries can be simply shown as URLs. The particulars of the presentation language, therefore, dictate the view of the layout and the view of the individual objects, but the format of the layout tree remains unaltered regardless of the nature of the target presentation language.

[0079] Step **322**. Step **322** is reached in the case where the user has requested to view a layout but and wishes to edit the layout. In step **322**, TableGenerator **56** is invoked to walk down the layout hierarchy of the requested layout in order to build a translation that represents the layout in the manner described in step **314**, above.

[0080] Step **324**. In step **324**, a menu of edit options is associated with each object, view and split in the layout. The menu options in each menu is dependent upon the characteristics of the object, view, or split to which the menu is associated. FIG. **4**M provides an illustration of such menus. In FIG. **4**M, menus are attached to each object, view and split within a given layout. For example, menu **430** is associated with split **428**. Furthermore, the options available in each respective menu is dependent upon whether the respective menu is associated with an object, view or split. The options available in each menu are further dependent upon the nature of the these objects, views and splits. For example, if the options available for a blog will differ from the options available for a gallery.

[0081] In some embodiments TableFormatter module **46** (FIG. **1**) is used to associate menu options with editable portions of the requested layout. For every respective object, view or split in the requested layout, TableFormatter module **46** requests a list of operations that can be performed on the respective object, view, or split. In one embodiment of the present invention, this request is serviced by Tabla::DBI:: Operation module (Table 1). For an object, the Tabla::DBI:: Operation module uses the Tabla::DBI::Object module (Table 1) to understand the nature of the object (e.g., whether it is a simple object or a complex object). For a split (or view), the Tabla::DBI::Operation module uses the Tabla::DBI::Split module (Table 1) to understand the nature of the split as well as the views within the split.

[0082] For each respective object, view, or split in a layout, Tabla::DBI::Operation returns to TableFormatter module **46** a list of operations that can be performed on the respective object, view, or split. In a preferred embodiment, each of these operations is encoded as a URL. Each returned operation specifies the appropriate editor that is to be used to perform the operation on the associated object, view, or split. The types of editors available in one embodiment of the invention are described in more detail below. Further, operations can include parameters that provide information such as the appropriate layout name, the target ID, and the operation ID for the object, view, or split. In some embodiments of the invention, Template Toolkit **60** is used to associate the operations as menu options next to the particular object, view, or split to which they are associated.

[0083] Step **326**. In step **326** a web page (presentation) of the translation generated in step **322** and appended to in step **324** is displayed using procedures and modules that are the same as or similar to those described in step **316**, above. However, in a preferred embodiment the web page provides simplified versions of the objects, views, and splits in the translation rather than the full version created in step **316**. The purpose of the simplified version of the web page is to provide a working template of the presentation that can be edited and modified as described in subsequent steps below.

[0084] Step **328**. In step **328**, a menu selection designating an operation associated with an object, view or split within a given layout is received.

[0085] Step **330**. In step **330**, a determination is made as to whether the operation designated in step **328** has parameters (**330**—Yes) or is a simple parameterless operation (**330**—No). If the operation designated in step **328** has parameters (**330**—Yes), control passes to step **332**. Otherwise (**330**—No), control passes directly to step **334**.

[0086] Step **332**. If the operation designated in step **328** has parameters, the edit_split_data.pl **48** (FIG. **1**) editor is invoked. The edit_split_data.pl **48** editor is a Perl script that uses the CGI::FormBuilder module **50** to build an HTML form that can be filled in or edited by a user. CGI::FormBuilder module **50** is a Perl module that is designed to generate and process CGI form-based applications. It is available from www.formbuilder.org. Thus, in step **332**, a form that includes the parameters associated with the designated option are presented to the user. When the user has finished editing the form, it is submitted.

[0087] Step **334**. In the case where step **332** was not invoked for a given requested operation, no form page is generated when because the requested operation does not have param-

eters. The edit_split_simple.pl module **52** is invoked to process parameterless operations.

[0088] In the case where step **332** was invoked, the results of the form submission from step **332** are used by edit_split_data.pl module **48** to create a Tabla::DBI::Action object. In other words, edit split data.pl module **48** creates an entry (a row) corresponding to the form submission in the actions table **72** (FIG. **1**). In the case where step **332** was not invoked, the edit_split_simple.pl module **52** is used to create the Tabla::DBI::Action object.

[0089] Regardless of whether edit_split_data.pl module **48** or edit_split_simple.pl module **52** is used, the newly created Tabla::DBI::Action object is assigned a unique action_id value that is stored in the action_id column of actions table **72**. The newly created action is also given a target. In some embodiments, the target is passed down to edit_split_data.pl module **48** (or edit_split_simple.pl module **52**) in the "target" CGI parameter, embedded in the URL link by TableFormatter module **46**. The target is the identifier for the object (object_id), view (view_id), or split (split_id) that the action operates on. A reference to the operation requested (e.g., edit, delete, add, etc.) is also stored in the newly created action in the operation column of actions table **72**.

[0090] In the case where the operation includes parameters, the edit_split_data.pl module **48** stores each parameter as a row in the actionparameters table **74** and each parameter receives a unique parameter_id that is stored in the parameter_id column of actionparameters table **74**. The parameters stored in the actionparameters table **74** for a given action are joined to the action based upon the action_id value.

[0091] Step **336**. After an action has been stored in database **66**, the layout is modified in accordance with the newly stored action. In some embodiments, this is accomplished by the do_action( ) routine of the Tabla::DBI::Action module. After the action is processed and the layout modified, process control passes to step **304** where the layout is recollected and represented to the user in order to reflect the changes made to the layout.

5.3. Exemplary Construction of a Layout

[0092] Methods for viewing and editing layouts in accordance with one embodiment of the invention have been described with reference to FIG. **3**. FIG. **4** illustrates the construction of layout using such methods.

[0093] To create a new layout, a user provides a name for the layout. FIG. **4**A illustrates a form in which the user provides a name for a new layout that they wish to create. Submission of form **402** triggers an action that is stored in actions table **72** of database **66** (FIG. **2**). When the action is executed (e.g., by the do_action( ) routine of the Tabla::DBI::Action module), a new row is added to layouts table **82** for the new layout. In addition to creating a row in layouts table **82** of database **66**, a row is also inserted into layoutdata table **84** to represent the top split in the newly created layout.

[0094] FIG. **4**B shows the web page **406** that results when the submit button of form **402** is selected by a user. Web page **406** contains operations that can be performed on the entire layout. These operations includes delete layout operation **408**, modify layout operation **410**, and change layout name operation **412**. Inside bordered box **414** is top split **416**, along with dropdown menu **418** that contains menu options for all of the operations that can be performed on top split **416**.

[0095] FIG. **4**C shows the results of inserting split **420** into top split **416**. Split **420** is inserted in top split **416** by selecting the "insert container" option from dropdown menu **418**. There are now two dropdown menus, one for the top split **416** (menu **418**) and one for split **420** (menu **422**). Split **420** is a child of top split **416**. When split **420** was created, a new row was added to layoutdata table **84** (FIG. **2**) using the procedures described in Section 5.2, above. The parent identifier in the new row in layoutdata table **84**, corresponding to split **420**, is assigned the split_id of top split **416**.

[0096] FIG. **4**D shows the results of inserting a second split (split **424**) into top split **416**. Split **424** is inserted in top split **416** by selecting the "insert container" option from dropdown menu **418**. When split **424** was created, a new row was added to layoutdata table **84** (FIG. **2**) using the procedures described in Section 5.2, above. The parent identifier in the new row in layoutdata table **84**, corresponding to split **424**, is assigned the split_id of top split **416**. At this point the borders of each split are more readily identifiable. The border of top split **416** is directly outside of and encircles for splits **420** and **424**. Splits **420** and **424** are surrounded by their own border boxes.

[0097] FIG. **4**D provides a good illustration of the treemap algorithm that is used to create the presentations of the present invention. Splits are inserted either into top split **416** or into a split that is within top split **416** in a hierarchical manner. Each split at a given level in a branch of the hierarchy are either arranged in a row (as illustrated in FIG. **4**D by splits **420** and **424**) or they are arranged in a column. Menu options in the parent split designate whether the splits will be arranged in rows or columns. FIG. **4**E illustrates this feature. In FIG. **4**E, the user selects the dropdown option in menu **418** of the top split called "switch orientation". This changes the orientation of daughter splits **420** and **424**. This new orientation is noted by changing the value in the "type" column of layoutsdata table **84** in the rows that correspond to splits **420** and **424**. In one embodiment, the value in the "type" column of layoutsdata table **84** is defaulted to H for horizontal but can be toggled to V for vertical and back again by clicking the "switch orientation" button in the appropriate menu. The "type" parameter is referred to herein as an orientation parameter. FIG. **4**F shows the results of changing the orientation of the daughter splits of top split **416** from horizontal to vertical.

[0098] FIG. **4**G shows the results of adding splits **428** and **432** inside split **424**. As per the default, splits **428** and **432** are arranged horizontally within parent split **424**. However, this arrangement can be changed to a vertical arrangement using menu **426**.

[0099] FIG. **4**H shows the user selecting a dropdown option from menu **430** of split **428** in order to add a data split into split **428**. The insertion of a data split is referenced by the menu option "insert object" in menu **430**. Selection of the "insert object" menu option results in the creation of a row in layoutdata table **84** to record the data split in the same manner that the other splits were recorded in table **84** with one exception. The "type" field in table **84** for the newly created data split is assigned the type value of "D" for data. A type designation of "D" means that only an object can be contained inside the split, and additional splits cannot be inserted inside the split.

[0100] Users have the option to either "insert existing object" to insert previously created data into a data split or "create new object" to insert a new object into a data split. FIG. **4**I illustrates a page **440** where the user can select the type of new object to insert into the data split created by action taken in FIG. **4**H. Specifically, the user can insert an entire layout (but not a split), text, a gallery, and a blog.

[0101] FIG. **4**J is a close up of splits **428** and **432** after the user has selected to insert a new "text" object into data split **442**. Specifically, inside split **428**, there is a holder for data split **442** that displays some meta-information about the object. The creation of a new object, as illustrated by FIGS. **4**I and **4**J, causes the creation of a row in objects table **92** and a

row that corresponds to the object in views table **88** of database **66**. Every data split that has an object also has a view that is unique to that data split. At this step, the text object has been created, but no information has been entered into the object.

[0102] To enter information, the user selects the "modify text object" option from menu **444**. This will bring the user to form **446** (FIG. **4**K). The user enters information into box **448** and then hits submit button **450**. Submitting form **446** creates an action that, when executed, updates the obj_data field for the row in objects table **92** that represents the object. A text object is a simple object so all of the data for that object is contained in objects table **92**. FIG. **4**L is a close-up of data split **442** after the text entered into box **448** (FIG. **4**K) has been associated with the data split. A small preview of the text entered is displayed inside data split **442**.

[0103] FIG. **4**M illustrates the instance where the user has created a data split **450** inside split **432** in the same manner as data split **442** was created in split **428**. Further, FIG. **4**M illustrates how the user has selected to the create an object option from the menu **452** associated with data split **450**. Upon submitting the "create object" option, the user is brought to the page displayed in FIG. **4**I. At this point, the user selects the "gallery" option and hits the submit button. This submission creates an action in action table **72** that, when executed, creates a row in objects table **92**, and a row in views table **88** for the gallery. FIG. **4**N provides a close up view of splits **428** and **432**. The holder **454** for data split **450** is now seen in split **432**. Holder **454** displays meta-information about the object. However, none of the fields in the meta-information are populated at this stage because the user has not provided the information. To provide such information, the user selects the option to "upload an image" from menu **452** (menu option not shown). This action takes the user to the upload image page **460** of FIG. **4**O. Page **460** allows the user to browse their computer or, more preferably, any computer addressable by system **20**, and select an image to upload into the gallery. There is also an open text field **462** where a description of the image can be added.

[0104] A photo gallery object is a complex object meaning that multiple pieces of data make up the object. This complexity requires that a separate table, called gallerydata table **96** (FIG. **2**), store each individual picture that makes up the gallery object. Thus, there is a one to many relationship between rows in objects table **92** and rows in gallerydata table **96**. In some embodiments, uploading an image saves the image to file system **42**. In other embodiments, the image is not uploaded to file system **42**. Rather, the address of the image in system **20** is noted. Regardless of whether the image is uploaded to file system **42**, a row is written to the gallerydata table **96** upon execution of the action. The newly added row in the gallerydata table **96** contains the field "image_url" that records the path to where the image is stored in system **20**. Further, the newly added row in the gallerydata table **96** includes a lookup field entitled "object_id" to the object in object table **92** that it belongs to, and other information such as the image description (image_name, image_position).

[0105] FIG. **4**P shows gallery parameters editing page **470** that can be invoked for any gallery object. Between FIG. **4**O and FIG. **4**P, the user has uploaded three more images into the gallery in the same manner as described in screenshot FIG. **4**O. The user then selected the "edit container parameters" option of the dropdown menu **452** of data split **450** to get the gallery parameters editing page **470** of FIG. **4**P. Page **470** allows the user to change the display parameters associated with the gallery. The gallery height and gallery width options, which can be modified by the user, respectively determine the number of rows and the number of columns of images that are to be displayed in the associated gallery. Further, the thumbnail width and thumbnail height options, which can also be modified by the user, determine the thumbnail size of all images displayed in the associated gallery.

[0106] As described above, each data split has its own view that determines the style properties to associate with that data split. The object inside the data view will determine what style properties are available. Some objects, like a text object, can store all of those properties in columns in views table **88**, but some object types, like the gallery object, require an additional table to support more specific style property instructions. Setting the gallery width, gallery height, thumbnail width, and thumbnail height values as done in FIG. **4**P creates a row in galleryviews table **90**. Table **90** has one column that serves as a key to the views table (view_id), and then a column for each property value (x, y, thumb_x, and thumb_y). In other words, when the user submits page **470**, the information is stored as an action in actions table **72**. Then, when the action is executed, the x, y, thumb_x, and thumb_y fields of the row in the galleryviews table **90** that corresponds to the view for the gallery is modified with the updated values.

[0107] FIG. **4**Q a close up of **420**. The user is selecting the "insert object" option from dropdown menu **422**. This creates data split **480** within split **420**. Instead of selecting the "create new object" option that was shown previously, the user selects the "insert existing object" from the dropdown menu **482** of data split **420**. This brings the user to page **490** where the desired object can be selected from a dropdown display **490** of that user's objects (FIG. **4**R).

[0108] As illustrated in FIG. **4**R, the user selects object 00014 and hits a submit button. This creates an action in actions table **72** (FIG. **2**). When the action is executed, a row in views table **88** is created. The newly created row stores the object_id for object 00014. FIG. **4**S is a close up of split **420** after the existing object has been added to data split **480** Top split **416** now contains split **420** and split **424**. Split **420** contains data split **480** that has an object and a view of that object inside it. As illustrated in FIG. **4**G, split **424** contains split **428** and split **432**. As illustrated in FIG. **4**J, split **428** contains data split **442** that has an object and a view of that object inside it. As illustrated in FIG. **4**N, split **432** contains data split **450** that has an object and a view of that object inside it.

[0109] The user has finished creating the layout and is now ready to view it as an HTML page. The user selects the "Visitor view of layout demo_test" link **496** at the top of the main work page (FIG. **4**C). As a result, a layout collection process takes place and the layout tree is converted to HTML steps in accordance with step **302** through **316** of FIG. **3**A. The full HTML version of the newly created layout is illustrated as FIG. **4**T.

5.4. Exemplary Operation Processing

[0110] The following is an example of the steps taken when a user submits form **470** of FIG. **4**P. In this case, the operation that is being performed is operation_id=30 which is gallery view editing. Gallery view editing is a form of a complex operation. Operations table **76** stores information relating to the top level of this operation. In particular, the type column of operations table **76** indicates that operation_id=30 modifies a view and, more particularly, the subtype column of operations table **76** indicates that operation_id=30 affects a gallery. Thus, the values in the row in operations table **76** that is created upon submission of form **470** are as described in Table 2 below.

TABLE 2

values in operations table 76

operation_id	Name	text	button	type	subtype
30	EDIT_VIEW_GALLERY	Edit Gallery View Parameters		view	gallery

[0111] As seen in FIG. **4**P, operation_id=30 updates four fields. They are gallery width, gallery height, thumbnail width, and thumbnail height. Each of these fields is represented by a unique row in operationparameters table **78** (FIG. **2**) that is created upon submission of form **470**. Thus, for operation_id=30, the entries shown in Table 3 are placed in operationparameters table **78**.

TABLE 3

values in operationsparameters table 78

operation_id	name	text	Magic
19	X	Gallery Width	Tabla::DBI::View::Gallery->retrieve($id)->x(NEWDATA)
20	Y	Gallery Height	Tabla::DBI::View::Gallery->retrieve($id)->y(NEWDATA)
21	thumb_x	Thumbnail Width	Tabla::DBI::View::Gallery->retrieve($id)->thumb_x(NEWDATA)
22	thumb_y	Thumbnail Height	Tabla::DBI::View::Gallery->retrieve($id)->thumb_y(NEWDATA)

[0112] The "text" field in each of these four rows displays the corresponding field name seen in the screenshot. So, for example, the "text" field for the row in operationparameters table **78** that represents the gallery width field will be "Gallery Width", the "text" field for the row in operationparameters table **78** that represents the gallery height field will be "Gallery Height" and so forth.

[0113] A modification to gallery width is operation_id=19. The name field for the row in table **78** corresponding to operation_id=19 has a value "X" that represents how many images across a gallery view should be displayed in the presentation. The modification to gallery height is operation_id=20. The name field for the row corresponding to operation_id=20 has a value of "Y" that represents how many images down a gallery view should be displayed in a presentation. A modification to thumbnail width is operation_id=21. The name field for the row corresponding to operation_id=21 has a value of "thumb_x" that specifies the width, in pixels, of all image in the gallery object. A modification to thumbnail width is operation_id=22. The name field for the row corresponding to operation_id=22 has a value of "thumb_y" that specifies the height, in pixels, of all images in the gallery.

[0114] When a user enters information into all four fields in form **470** of FIG. **4**P and hits submit, an operation_id=30 row is created in actions table **72**:

TABLE 4

values in action table 72

action_id	operation	target	Date	session_id
1808	30	311	1061272184	adef0384be7cb2609792af6e70c9f900

The Tabla::DBI::Action module (Table 1) creates this row. The value "30" in the "operation" column specifies that the operation is editing a gallery view and the value "311" in the "target" column specifies that the gallery view that is being modified is view_id **311**. The identity of the table that the target is pointing to (galleryviews table **90**) is known because operation **30** is specific to table **90**. The date of the action and the session committing the action are also stored in the newly created operation_id=30 row in actions table **72**.

[0115] Correspondingly, four rows are created in actionparameters table **74**, one for each field in the form:

TABLE 5

values in actionparameters table 74

parameter_id	action_id	data	operation parameters
1841	1808	2	19
1842	1808	2	20
1843	1808	225	21
1844	1808	200	22

[0116] In some embodiments, edit_split_data.pl script **48** (FIG. **1**) creates the four rows in actionparameters table **74**. The "parameter_id" column is a unique value for each action parameter. The value in the "action_id" field of each of the fours rows is a link to the parent action in action table **72**. Thus the value in this field will be identical for all four action parameters. The "data" column contains the data entered into each field by the user of form **470**. The "operation_parameters" column in actionparameters table **74** (Table 5) is used to join over to the corresponding rows in operationparameters table **78** (Table 3) to identify what fields were updated in the form and what target database table is to be updated.

[0117] Now that the relevant database tables that are affected by a complex action have been outlined, a process for applying this action in order to update the target tables in database **66** will be described for one of the rows in actionparameters table **74**. This process is repeated for each row in actionparameters table **74** (Table 5). The process will be illustrated for the action with parameter_id **1843**, which changes the width of all thumbnails in the target gallery object to 225 pixels. In order to accomplish this, the "thumb_x" field for the row in galleryviews table **90** (FIG. **2**) that corresponds to the correct target view needs to be updated.

[0118] Once edit_split_data.pl module **48** has written a row for each action parameter in actionparameters table **74**, it invokes the Tabla::DBI::Action method do_action( ). Method_do_action( ) is responsible for updating the rows in database **66** based on any unprocessed actions in actions table **72**. Method do_action( ) accomplishes this by first determining the target of a subject action parameter (the action with parameter_id **1843** in Table 5). To get this information, do_action( ) relies on the "target" field for the action in action table **72** (Table 4) corresponding to the action parameter, in actions table **72**, as well as the corresponding "magic" field for the action parameter in operationparameters table **78**. The magic field in operationparameters table **78** contains a string of Perl code that invokes a module and inserts parameters that do_action( ) knows how to handle and apply. In this case, the Tabla::DBI::View::Gallery module is invoked and passed three parameters: the "target" from the actions table **72** (Table 4), which goes in "retrieve($id)", the column to be updated "thumb_x" which is specified in the magic code string, and the data from actionparameters table **74** (Table 5) to update the column. Based on that data, Tabla::DBI::View::Gallery knows to update, to the value of 225, the "thumb_x" field in the row of galleryviews table **90** representing view_id "311". This process is repeated for each of the remaining actionparameters in actionparameters table **74** (Table 5) in order to update the target gallery view in galleryviews table **90**. As a result, the target gallery view will be a two by two display with thumbnails that are 225 by 200 pixels in the presentation.

6. REFERENCES CITED

[0119] All references cited herein are incorporated herein by reference in their entirety and for all purposes to the same extent as if each individual publication or patent or patent application was specifically and individually indicated to be incorporated by reference in its entirety for all purposes.

[0120] The present invention can be implemented as a computer program product that comprises a computer program mechanism embedded in a computer readable storage medium. For instance, the computer program product could contain the program modules shown in FIG. **1**. These program modules may be stored on a CD-ROM, magnetic disk storage product, or any other computer readable data or program storage product. The software modules in the computer program product can also be distributed electronically, via the Internet or otherwise, by transmission of a computer data signal (in which the software modules are embedded) on a carrier wave.

[0121] Many modifications and variations of this invention can be made without departing from its spirit and scope, as will be apparent to those skilled in the art. The specific embodiments described herein are offered by way of example only, and the invention is to be limited only by the terms of the appended claims, along with the full scope of equivalents to which such claims are entitled.

1. A method of constructing a presentation in a platform independent manner, the method comprising:

defining a layout that includes a top split, wherein said top split includes a first orientation parameter specifying an orientation for any daughter split created within said top split;

receiving a request to create a daughter split within said top split;

generating said daughter split within said top split in accordance with said first orientation parameter, wherein said daughter split includes a second orientation parameter specifying an orientation for any child split created within said daughter split; and

converting said layout to said presentation.

2. The method of claim **1** wherein said first orientation parameter specifies that each daughter splits created within said top split is arranged either horizontally or vertically within said top split.

3. The method of claim **1** wherein said second orientation parameter specifies that each child split created within said daughter split is arranged either horizontally or vertically within said daughter split.

4. The method of claim **1** wherein said daughter split is a data split, the method further comprising:

inserting a data object in said data split; and

associating a view with said data object, wherein said view determines how said data object is presented in said data split.

5. The method of claim **4** wherein said data object is a complex object.

6. The method of claim **5** wherein said complex object is a blog or a gallery.

7. The method of claim **1** wherein said presentation is written in a target language for a target platform.

8. The method of claim **7** wherein said target language is HTML, XML, Java, ASP, PHP, or ASCII text.

9. A computer program product for use in conjunction with a computer system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism for constructing a presentation in a platform independent manner, the computer program mechanism comprising:

instructions for defining a layout that includes a top split, wherein said top split includes a first orientation parameter specifying an orientation for any daughter split created within said top split;

instructions for receiving a request to create a daughter split within said top split;

instructions for generating said daughter split within said top split in accordance with said first orientation parameter, wherein said daughter split includes a second orientation parameter specifying an orientation for any child split created within said daughter split; and

instructions for converting said layout to said presentation.

10. The computer program product of claim **9** wherein said daughter split is a data split, the computer program mechanism further comprising:

instructions for inserting a data object in said data split; and

instructions for associating a view with said data object, wherein said view determines how said data object is presented in said data split.

11. A computer system for constructing a presentation in a platform independent manner, the computer system comprising:

a central processing unit;

a memory, coupled to the central processing unit, the memory storing:

instructions for defining a layout that includes a top split, wherein said top split includes a first orientation parameter specifying an orientation for any daughter split created within said top split;

instructions for receiving a request to create a daughter split within said top split;

instructions for generating said daughter split within said top split in accordance with said first orientation parameter, wherein said daughter split includes a second orientation parameter specifying an orientation for any child split created within said daughter split; and

instructions for converting said layout to said presentation.

12. The computer system of claim **11** wherein said daughter split is a data split, the memory further storing:

instructions for inserting a data object in said data split; and

instructions for associating a view with said data object, wherein said view determines how said data object is presented in said data split.

13. A method of editing a layout, which defines a presentation in a platform independent manner, the layout comprising a split hierarchy, the method comprising:

(A) beginning at the top split in the split hierarchy, for each split encountered in the split hierarchy, building a translation of the split, wherein, when the split is a data split, the building comprises,

(i) retrieving object data in accordance with a view for the data split; and

(ii) applying a template to the data associated with the data split;

(B) associating a different menu of options with each split in the split hierarchy as well as retrieved object data;

(C) receiving a menu selection from any one of the different menus of options and,

(i) when the menu selection specifies an action that has parameters:

(1) presenting the parameters in a form;

(2) adding, in response to a submission of said form, an entry in an actions table of a database to reflect said submission; and

(3) modifying the layout in the database in accordance with said submission; and

(ii) when the menu option is associated with a parameterless action:

(1) adding, in response to said menu selection, an entry in said actions table of said database to reflect said menu selection; and

(2) modifying the layout in the database based upon said menu selection.

14. (canceled)

15. (canceled)

16. (canceled)

17. (canceled)

18. (canceled)

19. (canceled)

20. (canceled)

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