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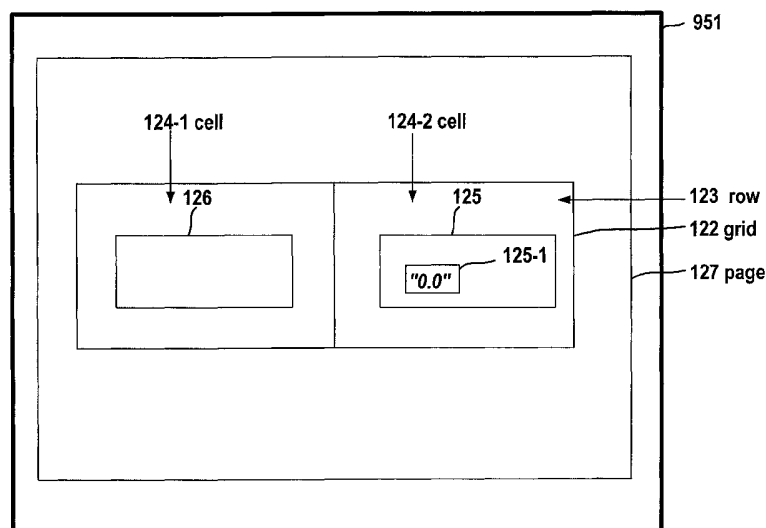
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(54) Title: METHOD AND COMPUTER SYSTEM FOR SEPARATING AND PROCESSING LAYOUT INFORMATION AND DATA OF A DOCUMENT



(57) Abstract: Computer-implemented method, computer system and computer program product for separating and processing layout information and data of a document. The computer system providing a predefined document description (120, 130). The document description (120, 130) is decomposed (420) into a layout template (140-1) and a data description (140-2). In a preferred embodiment of the invention decomposition (420) is achieved by using style sheet language transformations. Optionally, the computer system instantiates (460) a data instance (150) from the data description (140-2) and merges (470) the data instance (150) with the layout template (140-1) into an individual document description (160). The individual document description (160) can be rendered by a conventional browser.



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METHOD AND COMPUTER SYSTEM FOR SEPARATING AND
PROCESSING LAYOUT INFORMATION AND DATA OF A DOCUMENT

5 Field of the Invention

The present invention generally relates to document processing in a data processing system, and more particularly relates to a computer-implemented method and computer system to handle layout information and
10 data.

Background of the Invention

In prior art systems, documents, such as human interface descriptions, typically are described with a
15 standardized document description language (SDL). The term "human interface" as used herein after, describes any kind of application interface for a human to interact with application programs that run on a computer. Examples for human interfaces are graphical
20 user interfaces (GUI) or voice user interfaces (VUI).

Typically the SDL is an "Extensible Markup Language" (XML) based language that provides a set of layout controls, wherein a layout control comprises description instructions that describe a specific
25 layout element (LE). A transformer program, comprising transformation rules, transforms the layout element into a browser compliant description. In a SDL typical layout elements are "row", "cell", "table", "grid", etc. Such layout elements can be reused in any context
30 of any application.

A browser, as used herein after, is a computer program that "renders" a document which is written in a markup language, such as "Hyper Text Markup Language" (HTML), "Wireless Markup Language" (WML) or "Voice
35 Extensible Markup Language" (VXML), into a visual or audio presentation of this document. A browser can be device specific. For example, a browser that renders a

HTML document on a personal computer screen differs from a browser that renders a WML document on a wireless application protocol (WAP) cell phone display.

5 The browser compliant description can be rendered by a conventional browser into corresponding visual or audio layout elements on an output device of a computer.

10 In the XForms 1.0 specification (08 June 2001) of the World Wide Web Consortium (W3C), the assumption is made that data information and layout information are separated from the beginning when a new document is created. This requires the exact knowledge of the data model that is used in an application using the new document. Data model, as used herein after, corresponds
15 to a data description of data that are used (displayed, played, captured, etc.) by the document. However, there are applications where the data model of the application is not known when the document design starts. For example, when an application programmer
20 builds a survey application, typically, the information that is to be captured through a survey form (questionnaire) is defined while developing the survey document. Input fields are added to the form as they are defined during the design process. In general, no
25 data model exists that describes the corresponding data (e.g. dependencies between data, such as questions in a group of questions).

Summary of the Invention

30 Hence, the present invention provides method, computer system and computer program product to solve the technical problem of automatically separating data information from layout information on the basis of a document where layout information and data information
35 is mixed.

For convenience of explanation and without the intention of limiting the present invention, in the following description of the present invention it is

assumed that the document is a description of a graphical human interface of a computer. However, the term "layout element", as used herein after to describe a graphical layout element, also has a meaning in a voice human interface, where it corresponds to a sequence of sounds (e.g., spoken words) that follows a specific dialogue (interaction) schema.

The solution to the technical problem according to a preferred embodiment of the present invention is provided by the following characteristics: The inventive computer system

a) provides a predefined document description, wherein, preferably, the document description is a markup language description, such as a XML or a XHTML document; and

b) decomposes the document description into a layout template and a data description.

It is an advantage of the present invention that the computer system automatically creates a data model for an application that initially lacks a data model. This is the case when the application is defined through a document description that includes both, data and layout information. Examples for this kind of applications are survey forms or forms for service requests. Survey forms may comprise input or answer fields that are defined during the survey design process and where no predefined data description exists. Service requests may comprise fields for services that are not predefined because they are not offered regularly. Therefore, a predefined data description may not exist.

Further, the present invention solves the technical problem to prompt a user with an individual document that includes runtime dependent data (data that are created or modified during runtime). Runtime, as used herein after, means: occurring while a document is executing (being used interactively by a user). Design-time means: occurring while a document is designed (before being used interactively). Examples

for runtime dependent data are user name, document creation date, session ID, error messages, etc.

The solution to the technical problem according to the preferred embodiment of the present invention is provided by the following characteristics: The inventive computer system

c) instantiates a data instance from the data description; and

d) merges the data instance with the layout template into an individual document description. The individual document description can be rendered by a browser.

The advantage is the ability of the data instance to comprise runtime dependent data that can be modified by an application program during runtime processing. Therefore, the individual document description prompts the user with runtime dependent data that are dynamic when compared to then static data of the data description.

At any place in the description of the present invention where a style sheet language transformation, such as XSLT, is used to define transformation or conversion rules, alternatively, a person of skill in the art can implement these rules in any programming language, such as Java, as well.

The aspects of the invention will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims. It is to be understood that both, the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention as described.

Brief Description of the Drawings

- FIG. 1 illustrates a simplified block diagram of the inventive computer network system;
- 5 FIG. 2 illustrates a simplified flow chart of the inventive method for separating and processing layout information and data;
- FIG. 3 illustrates details one method step;
- FIG. 4 illustrates processing of documents and data according to the present invention;
- 10 and
- FIG. 5 illustrates a visual representation of an individual document description.

Detailed Descriptions

- 15 Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts. For convenience of explanation the reference number table at the end of the description lists the most important reference numbers and their
- 20 descriptions.

FIG. 1 illustrates a simplified block diagram of the inventive computer network system 999 having a plurality of computers 900, 901, 902 (or 90q, with

25 q=0...Q-1, Q any number).

Computers 900-902 are coupled via inter-computer network 990. Computer 900 comprises processor 910, memory 920, bus 930, and, optionally, input device 940 and output device 950 (I/O devices, user interface

30 960). As illustrated, the invention is present by computer program product 100 (CPP), program carrier 970 and program signal 980, collectively "program".

In respect to computer 900, computer 901/902 is sometimes referred to as "remote computer", computer

35 901/902 is, for example, a server, a router, a peer

device or other common network node, and typically comprises many or all of the elements described relative to computer 900. Hence, elements 100 and 910-980 in computer 900 collectively illustrate also
5 corresponding elements 10q and 91q-98q (shown for q=0) in computers 90q.

Computer 900 is, for example, a conventional personal computer (PC), a desktop and hand-held device, a multiprocessor computer, a pen computer, a
10 microprocessor-based or programmable consumer electronics, a minicomputer, a mainframe computer, a personal mobile computing device, a mobile phone, a portable or stationary personal computer, a palmtop computer or the like.

15 Processor 910 is, for example, a central processing unit (CPU), a micro-controller unit (MCU), digital signal processor (DSP), or the like.

Memory 920 symbolizes elements that temporarily or permanently store data and instructions. Although
20 memory 920 is conveniently illustrated as part of computer 900, memory function can also be implemented in network 990, in computers 901/902 and in processor 910 itself (e.g., cache, register), or elsewhere. Memory 920 can be a read only memory (ROM), a random
25 access memory (RAM), or a memory with other access options. Memory 920 is physically implemented by computer-readable media, such as, for example: (a) magnetic media, like a hard disk, a floppy disk, or other magnetic disk, a tape, a cassette tape; (b)
30 optical media, like optical disk (CD-ROM, digital versatile disk - DVD); (c) semiconductor media, like DRAM, SRAM, EPROM, EEPROM, memory stick, or by any other media, like paper.

Optionally, memory 920 is distributed across
35 different media. Portions of memory 920 can be removable or non-removable. For reading from media and for writing in media, computer 900 uses devices well

known in the art such as, for example, disk drives, tape drives.

Memory 920 stores support modules such as, for example, a basic input output system (BIOS), an operating system (OS), a program library, a compiler, an interpreter, and a text- processing tool. Support modules are commercially available and can be installed on computer 900 by those of skill in the art. For simplicity, these modules are not illustrated.

CPP 100 comprises program instructions and - optionally - data that cause processor 910 to execute method steps of the present invention. Method steps are explained with more detail below. In other words, CPP 100 defines the operation of computer 900 and its interaction in network system 999. For example and without the intention to be limiting, CPP 100 can be available as source code in any programming language, and as object code ("binary code") in a compiled form. Persons of skill in the art can use CPP 100 in connection with any of the above support modules (e.g., compiler, interpreter, operating system).

Although CPP 100 is illustrated as being stored in memory 920, CPP 100 can be located elsewhere. CPP 100 can also be embodied in carrier 970.

Carrier 970 is illustrated outside computer 900. For communicating CPP 100 to computer 900, carrier 970 is conveniently inserted into input device 940. Carrier 970 is implemented as any computer readable medium, such as a medium largely explained above (cf. memory 920). Generally, carrier 970 is an article of manufacture comprising a computer readable medium having computer readable program code means embodied therein for executing the method of the present invention. Further, program signal 980 can also embody computer program 100. Signal 980 travels on network 990 to computer 900.

Having described CPP 100, program carrier 970, and program signal 980 in connection with computer 900 is convenient. Optionally, program carrier 971/972 (not shown) and program signal 981/982 embody computer
5 program product (CPP) 101/102 to be executed by processor 911/912 (not shown) in computers 901/902, respectively.

Input device 940 symbolizes a device that provides data and instructions for processing by computer 900.
10 For example, device 940 is a keyboard, a pointing device (e.g., mouse, trackball, cursor direction keys), microphone, joystick, game pad, scanner. Although the examples are devices with human interaction, device 940 can also operate without human interaction, such as, a
15 wireless receiver (e.g., with satellite dish or terrestrial antenna), a sensor (e.g., a thermometer), a counter (e.g., goods counter in a factory). Input device 940 can serve to read carrier 970.

Output device 950 symbolizes a device that presents
20 instructions and data that have been processed. For example, a monitor or a display, (cathode ray tube (CRT), flat panel display, liquid crystal display (LCD), speaker, printer, plotter, vibration alert device. Similar as above, output device 950
25 communicates with the user, but it can also communicate with further computers.

Input device 940 and output device 950 can be combined to a single device; any device 940 and 950 can be provided optional.

30 Bus 930 and network 990 provide logical and physical connections by conveying instruction and data signals. While connections inside computer 900 are conveniently referred to as "bus 930", connections between computers 900-902 are referred to as "network
35 990". Optionally, network 990 comprises gateways being computers that specialize in data transmission and protocol conversion.

Devices 940 and 950 are coupled to computer 900 by bus 930 (as illustrated) or by network 990 (optional). While the signals inside computer 900 are mostly electrical signals, the signals in network are
5 electrical, magnetic, optical or wireless (radio) signals.

Networking environments (as network 990) are commonplace in offices, enterprise-wide computer networks, intranets and the internet (i.e. world wide
10 web). The physical distance between a remote computer and computer 900 is not important. Network 990 can be a wired or a wireless network. To name a few network implementations, network 990 is, for example, a local area network (LAN), a wide area network (WAN), a public
15 switched telephone network (PSTN); a Integrated Services Digital Network (ISDN), an infra-red (IR) link, a radio link, like Universal Mobile Telecommunications System (UMTS), Global System for Mobile Communication (GSM), Code Division Multiple
20 Access (CDMA), or satellite link.

Transmission protocols and data formats are known, for example, as transmission control protocol/internet protocol (TCP/IP), hyper text transfer protocol (HTTP), secure HTTP, wireless application protocol, unique
25 resource locator (URL), a unique resource identifier (URI), hyper text markup language HTML, extensible markup language (XML), extensible hyper text markup language (XHTML), wireless application markup language (WML), etc.

30 Interfaces coupled between the elements are also well known in the art. For simplicity, interfaces are not illustrated. An interface can be, for example, a serial port interface, a parallel port interface, a game port, a universal serial bus (USB) interface, an
35 internal or external modem, a video adapter, or a sound card.

Computer and program are closely related. As used hereinafter, phrases, such as "the computer provides" and "the program provides", are convenient abbreviation to express actions by a computer that is controlled by
5 a program.

It is not important for the present invention, where computer programs, files or documents are stored in computer system 999. For convenience of explanation, they are stored in memory 920 of computer 900.
10

FIG. 2 illustrates a simplified flow chart of the inventive computer-implemented method 400 for separating and processing layout information and data.

The example for document 120, 130 that is used throughout the detailed description is a survey application example. The controller of a company wants to capture financial planning data for the fiscal year 2002 from other managers in the company. For this reason, the controller creates a survey questionnaire,
15 comprising various layout elements, such as page 127, grid 122, TextOutput 126, FieldInput 125, etc. (cf. FIG. 5). Layout element TextOutput 126 includes the text "Planned travel costs 2002 :". Managers prompted with this text input their planned travel cost data
20 into layout element FieldInput 125. Hence, the resulting survey document comprises both, layout information and data.

All tables with program coding sections that are used in the description are exemplary and explanatory
30 only and not intended to provide a fully functional computer program.

Method 400 comprises the steps of:

- a) providing 410 predefined document description 120, 130; and
- 35 b) decomposing 420 document description 120, 130 into layout template 140-1 and data description 140-2.

Method 400 optionally comprises the further steps c) and d):

c) instantiating 460 data instance 150 from data description 140-2; and

5 d) merging 470 data instance 150 with layout template 140-1 into individual document description 160.

The steps are now described in detail.

In the providing step 410, computer system 999 (cf. FIG. 1) provides predefined document description 120, 130. Preferably, predefined document description 120, 130 is a markup language description document. In the survey example that is used throughout the description of the present invention the predefined document description is a XML document 120 or a XHTML document 130. Preferably, the XHTML document 130 is automatically derived from the XML document 120 (or vice versa) by a style sheet language transformation, such as XSLT.

20 Any markup language, such as XML, serves the purpose of defining layout elements 122, 123, 124-1, 124-2, 125, 126, 127 (cf. FIG. 5) in document description 120. Table 1 corresponds to a XML document that describes human interface 951 (cf. FIG. 1) by using LEs. The prefix "uicl:" in table 4 represents the namespace of the layout elements.

The following line numbers refer to table 1. LE page 127 for the "survey page" is defined in line 2 and closed in line 14. Page 127 comprises further LEs. Line 30 4 describes the LE Grid 122. Grid 122 in this example has one row and two columns. Grid 122 comprises LE Row 123. Row 123 carries a visible attribute (Line 5). Row 123 comprises cells 124-1, 124-2 (lines 9, 6). Cell 125 has a default attribute 125-1 with the value "0.0". 35 The name attribute (line 10) indicates the data path for the data of cell 125. In the example the data path is "/survey/planned_costs/travel". Hence, data and

layout information are mixed in document description 120. Lines 8 and 11-14 are closing commands of the corresponding LE.

Preferably, the data path uses XPath notification,
5 known in the art. XPath (XML Path language) is a language that describes a way to locate and process items in XML documents by using an addressing syntax based on a path through the document's logical structure or hierarchy. The XPath language is described
10 in the "XPath W3C Recommendation Version 1.0, November, 16 1999". XPath also allows the application programmer to deal with the document at a higher level of abstraction. XPath is a language that is used by and specified as part of both, XSLT and XPointer (SML
15 Pointer Language). It uses the information abstraction defined in the XML Information Set (Infoset). Since XPath does not use XML syntax itself, it could be used in contexts other than those of XML.

Line	Code
1	<?xml version="1.0" encoding="utf-8"?>
2	<uicl:page id="survey" xmlns:uicl="http://www.sap.com/sapble/page">
2	<uicl:page id="survey">
3	...
4	<uicl:Grid rows="1" cols="2" id="planned_costs">
5	<uicl:Row visible="{boolean(//survey/ planned_costs/travel)}">
6	<uicl:Cell>
7	<uicl:TextOutput text=" Planned travel costs 2002 :"/>
8	</uicl:Cell>
9	<uicl:Cell>
10	<uicl:FieldInput default="0.0" name="//survey/planned_costs/travel"/>
11	</uicl:Cell>
12	</uicl:Row>
13	</uicl:Grid>
14	</uicl:page>

Table 1: document description 120 in the survey example

Preferably, document description 120 is
 5 automatically converted into document description 130
 (or vice versa) via a style sheet language
 transformation, such as XSLT by using appropriate
 conversion rules, known in the art.

Table 2 illustrates a XHTML document example of
 10 document description 130 in the survey example that
 describes the same human interface 951 (cf. FIG. 5) as
 document description 120. The standard HTML
 instructions are not explained in detail as they are
 known to any person of skill in the art. The following
 15 line numbers refer to table 2. In the case of automated
 conversion LE page 127 (cf. FIG. 5) is converted into

lines 1-6 and 22-24, where line 6 defines an interaction method for the page 127.

LE grid 122 is converted into the table instructions of lines 9, 20 having one row 123 (lines 5 10, 19). Cell 124-1 conversion results in lines 11-13 and cell 124-2 conversion in lines 14-18. The text between the "span" tags in line 12 results from LE 126 (cf. table 1, line 7). The name attribute of the input field instruction (line 16) corresponds to the data 10 path of data of the input field instruction. The input field instruction carries the further attributes "type" and "value". The text attribute results from FieldInput LE 125 (cf. table 1, line 10) and the value attribute from its default value "0.0".

Line	Code
1	<html xmlns="http://www.w3.org/TR/xhtml1">
2	<head>
3	...
4	</head>
5	<body>
6	<form method="post" name="survey">
7	...
8	...
9	<table>
10	<tr>
11	<td>
12	Planned travel costs 2002 :
13	</td>
14	<td>
15	
16	<input name="//survey/planned_costs/travel" type="text" value="0.0"/>
17	
18	</td>
19	</tr>
20	</table>
21	...
22	</form>
23	</body>
24	</html>

Table 2: document description 130 in the survey example

Automated conversion is not required to provide
5 document description 130. Computer system 999 can
retrieve predefined document description 130, for
example, from memory 920.

In the decomposing step 420, computer system 999
extracts human interface layout template 140-1 and data

description 140-2 (cf. FIG. 3) from document description 120, 130. As discussed earlier, for some applications, such as a survey or a service request, a data description does not exist at the point in time, when the human interface 951 (cf. FIG. 5) for the application is described in document description 120, 130. Therefore, for some applications, document description 120, 130 comprises a mix of layout information and data description. Preferably, during runtime the data are separately stored from the layout information. This allows a user specific and application specific instantiation and initialization of data without storing redundant layout information with each data instance. Preferably, decomposing step 420 is performed by applying a style sheet language transformation, such as XSLT, to document description 120, 130. The details of extracting 430 layout template 140-1 and extracting 440 data description 140-2 are explained under FIG. 3.

The further optional steps c) instantiating 460 and d) merging 470 are explained in detail under FIG. 4.

FIG. 3 illustrates details of method step 420.

In the extracting layout template step 430, computer system 999 processes document description 120, 130, preferably by using a style sheet transformation, such as XSLT, to create layout template 140-1 (cf. table 5). Tables 3 and 4 show two different implementations for the style sheet language transformation. Table 3 is used in case XML document description 120 is processed, whereas table 4 is used when XHTML document description 130 is processed. For other markup language type documents a person of skill in the art can create corresponding transformation rules.

For convenience of explanation, table 3 comprises an example of a transformation rule for the layout element FieldInput 125 (cf. table 1, line 10; cf. FIG. 5), because FieldInput 125 comprises both, layout information and data. Transformation rules for other layout elements can be defined accordingly by any person skilled in the art. The following line numbers without explicit table reference refer to table 3.

Line	Code
1	<xsl:transform version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform" xmlns:uicl="http://www.sap.com/sapsurvey/ble" >
2	...
3	<xsl:template match="uicl:FieldInput">
4	<input class="InputField" name="{@name}" type="text">
5	<xsl:element name="xsl:attribute">
6	<xsl:attribute name="name">value</xsl:attribute>
7	<xsl:element name="xsl:value-of">
8	<xsl:attribute name="select"><xsl:value-of select="@name"/></xsl:attribute>
9	</xsl:element>
10	</xsl:element>
11	</input>
12	</xsl:template>
13	...
14	</xsl:transform>

Table 3: transformation rules for extracting layout template 140-1 from document description 120 in the survey example

Lines 1, 14 indicate a XSL transformation document. Lines 3, 12 enclose the transformation rule for LE FieldInput 125 . Line 4 generates line 11 of

target-table 5 when applied to line 10 of source-table 1. Target-table 5 is a preferred, XSLT-based embodiment of layout template 140-1 in the survey example. The data information in the form of the default attribute value "0.0" (cf. source-table 1, line 10) is not generated into layout template 140-1. Layout information is now separated from data. However, a placeholder allows to link to the corresponding data. Lines 5-10 generate the XSL attribute instructions in lines 12, 14 of target-table 5 for the value attribute with the "value-of" instruction (table 5, line 13). The "value-of" instruction points to the location where the value is stored (e.g. data instance 150; cf. FIG. 4) and, therefore, provides the link between the separated layout and data information.

Line	Code
1	<?xml version="1.0" encoding="utf-8"?> <xsl:transform version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
2	...
3	<xsl:template match="input">
4	<xsl:copy>
5	<xsl:copy-of select="@*[name() != 'value']" />
6	<xsl:element name="xsl:attribute">
7	<xsl:attribute name="name">value</xsl:attribute>
8	<xsl:element name="xsl:value-of">
9	<xsl:attribute name="select">/<xsl:value-of select="@name"/></xsl:attribute>
10	</xsl:element>
11	</xsl:element>
12	</xsl:copy>
13	</xsl:template>
14	...
15	</xsl:transform>

Table 4: transformation rules for extracting 430 layout template 140-1 from document description 130 in the survey example

5

Table 4 comprises transformation rules that transform document description 130 (cf. table 2) into layout template 104-1 (cf. table 5). For convenience of explanation, table 4 illustrates an example of a transformation rule for the input field instruction (cf. table 5, line 16), because the input field instruction comprises both, layout information and data. Transformation rules for other layout elements can be defined accordingly by any person skilled in the art. The following line numbers without explicit table reference refer to table 4.

Line 1 indicates the start of a XSLT document.
Lines 3, 13 indicate that the comprised coding applies
to the input field instruction in line 16 of table 2.
Lines 4, 12 copy the input field instruction of source-
5 table 2 resulting in lines 11, 15 of target-table 5.
Line 5 copies all table 2 attributes except value
attributes. Therefore, line 11 of target-table 5 has no
value attribute. Layout information is now separated
from data. However, a placeholder allows to link to the
10 corresponding data. Therefore, lines 6-11 generate XSL
instructions for the value attribute into lines 12-14
of target-table 5. Lines 6, 7, 11 generate an attribute
instruction for the value attribute (of the input
field) in lines 12, 14 of target-table 5. Lines 8-10
15 generate line 13 of target-table 5 that comprises a
"value-of" instruction to retrieve the eliminated data
from the corresponding location (e.g. data instance
150; cf. FIG. 4).

Line	Code
1	<?xml version="1.0" encoding="utf-8"?>
2	<xsl:transform version="1.0" xmlns:xsl= "http://www.w3.org/1999/XSL/Transform">
3	<xsl:template match="/">
4	...
5	<html>
6	<form method="post" name="survey">
7	<table class="Grid">
8	<xsl:if test="{boolean(//survey/planned_costs/ travel)}">
9	<tr class="row">
10	<td>Planned travel costs 2002 :</td>
11	<td><input class="InputField" name="//survey/planned_cost/ travel"> type="text"
12	<xsl:attribute name="value">
13	<xsl:value-of select= "/env:envelope/env:body/ survey/planned_costs/travel"/>
14	</xsl:attribute>
15	</input></td>
16	</tr>
17	</xsl:if>
18	</table>
19	</form>
20	</html>
21	...
22	</xsl:template>
23	</xsl:transform>

Table 5: layout template document 140-1 in the survey example

In the extracting data description step 440, computer system 999 processes document description 120, 130, preferably by using a style sheet transformation, such as XSLT, to create data description 140-2. In the survey example, an appropriate XSL transformation processes XML document description 120 in table 1 or XHTML document description 130 in table 2 by scanning the document for name attributes. Each time a name attribute having data path information is detected, corresponding tags for each data path element (<data_path_element>, </data_path_element>) of the data path information are inserted into data description document 140-2 (cf. table 6). Preferably, data description document 140-2 is written in a markup language, such as XML. The name attribute "//survey/planned_costs/travel" is detected in line 10 of table 1 and in line 16 of table 2, respectively. The resulting data description 140-2 document in the survey example is shown in table 6. The following line numbers refer to table 6. Line 1 indicates a XML document. Lines 2-4 define the data path "//survey/planned_costs/travel" of default value "0.0" (line 4). The closing tags </...> (lines 4 to 6) complete the definition of the data path.

Line	Code
1	<?xml version="1.0" encoding="utf-8"?>
2	<survey>
3	<planned_costs>
4	<travel>0.0</travel>
5	</planned_costs>
6	</survey>

Table 6: data description document 140-2 in the survey example

5

FIG. 4 illustrates processing of documents and data according to the present invention.

In a preferred embodiment of the present invention, computer system 999 (cf. FIG 1) executes the remaining, optional steps of method 400 (cf. FIG. 2) during runtime:

c) instantiating 460 data instance 150 from data description 140-2; and

d) merging 470 data instance 150 with layout template 140-1 into individual document description 160.

In the instantiating step 460, computer system 999 complements data description 140-2 by further, runtime dependent data (data that are created or modified during runtime) resulting in data instance 150. Examples for runtime dependent data are user name, document creation date, session ID, error messages, etc. Preferably, data instance 150 is a markup language document, such as an XML document. The following line numbers refer to table 7. In the survey example, table 7 illustrates an envelope (lines 2, 13) comprising the runtime dependent data user name ("USER1", line 4) in its header (lines 3, 5), whereas the data description (lines 7-11) forms its body (lines

6, 12). The prefix "env:" represents a namespace for the envelope.

Line	Code
1	<?xml version="1.0" encoding="utf-8"?>
2	<env:envelope xmlns:env="http://www.sap.com/sapsurvey/env">
3	<env:header>
4	<env:user>USER1</env:user>
5	</env:header>
6	<env:body>
7	<survey>
8	<planned_costs>
9	<travel>0.0</travel>
10	</planned_costs>
11	</survey>
12	</env:body>
13	</env:envelope>

5 Table 7: data instance document 150 in the survey example

If required, data instance 150 is modified, for example, by an application program (e.g., cf. FIG.1
 10 computer program 101 on computer 901), prior to applying layout template 140-1. This is achieved through interface 155. For example, computer system 999 (cf. FIG. 1) transfers data of data instance 150 (e.g. on computer 900) to the application program through
 15 interface 155 and data instance 150 receives modified data from the application program through interface 155. The advantage is an application specific initialization of data instance 150. For example, in the survey example a user (e.g. USER1, cf. table 11,
 20 line 4) wants to input the planned travel costs for the fiscal year 2002. The default value that is derived

from the corresponding data description 140-2 is "0.0" (cf. table 11, line 9). In the example, the application program knows the real travel cost of the user for the previous fiscal year. The application program is called through interface 155 and runs a query for the previous travel cost. The result value (e.g. "5600.0") is returned to data instance 150 through interface 155 and replaces the old default value "0.0".

In the merging step 470, layout template 140-1 is applied to data instance 150. Preferably, this corresponds to a style sheet transformation of data instance 150.

Table 8 shows individual document description 160 as result of merging step 470. Preferably, document 160 is written in a markup language, such as XHTML. The following line numbers refer to table 8. Document 160 is similar to the document 130 in table 2. In line 19 of the survey example, layout information (input of type "text") and data from data instance 150 (input value "5600.0") are merged when instruction lines 11-15 of table 5 (layout template 140-1) are applied to table 7 (data instance 150). Line 11 of table 5 generates the input field instruction in line 19 with the name attribute "//survey/planned_costs/travel" and the type attribute "text". Lines 12, 14 of table 5 define the value attribute. Line 13 of table 5 comprises an instruction to get the value of the value attribute from a location with the data path "//env:envelope/env:body/survey/planned_costs/travel". When this instruction is applied to data instance 150, the corresponding value (cf. table 7, line 9) is retrieved as the value of the value attribute of the input field instruction.

Line	Code
1	<?xml version="1.0" encoding="utf-8"?>
	<html xmlns="http://www.w3.org/TR/xhtml1">
2	<head>
3	...
4	...
5	...
6	</head>
7	<body>
8	<form method="post" name="survey">
9	...
10	...
11	...
12	<table>
13	<tr>
14	<td>
15	Planned travel costs 2002 :
16	</td>
17	<td>
18	
19	<input name="//survey/planned_costs/ travel" type="text" value="5600.0"/>
20	
21	</td>
22	</tr>
23	</table>
24	...
25	</form>
26	</body>
27	</html>

Table 8: individual document description 160 in the survey example

FIG. 5 illustrates a visual representation 951 of individual document description 160.

In the survey example, XHTML instructions (cf. table 8) of individual document description 160 correspond to layout elements page 127, grid 122, row 123, cells 124-1, 124-2, TextOutput 126, FieldInput 125 and attribute 125-1. Preferably, individual document description 160 is rendered by a conventional browser to prompt a user with visual representation 951 (human interface) for data input into FieldInput 125 on output device 950 (cf. FIG.1).

Having described the present invention as computer-implemented method 400 the invention is now described as computer system 999.

The inventive computer system 999 (cf. FIG. 1) separates and processes layout information and data of a document.

It is assumed that computer 900 (cf. FIG. 1) is the operating computer. A person of skill in the art can implement the invention also in a client-server system, where a server computer (e.g. computer 901, cf. FIG. 1) is used for data processing and a client computer (e.g. computer 900, cf. FIG. 1) serves as a front-end computer for the user.

A preferred embodiment of computer system 999 comprises the following means:

a) a means for providing 410 (cf. FIG. 2) predefined document description 120, 130 (cf. FIG. 4); and

b) a means for decomposing 420 document description 120, 130 into layout template 140-1 (cf. FIG. 4) and data description 140-2 (cf. FIG. 4).

Preferably, means a) comprises a markup language document, such as XML document description 120 (cf. table 1) or XHTML document description 130 (cf. table

2). Document description 120, 130 is preferably stored in memory 920 (cf. FIG. 1) of computer 900.

Preferably, means b) comprises two style sheet language transformation documents that are applied to document 120, 130 to extract layout template 140-1 and data description 140-2. An example for the style sheet transformation document to extract layout template 140-1 from document description 120 is given in table 3. A further example for the style sheet transformation document to extract layout template 140-1 from document description 130 is given in table 4. Preferably, the style sheet language transformations are stored in memory 920.

The style sheet language transformation document to extract data description 140-2 is described in the detailed description of FIG. 3. Preferably, processor 910 processes the corresponding style sheet language transformation documents and stores the resulting documents 140-1 and 140-2 in memory 920. In this preferred embodiment of computer system 999 a design-time memory portion of memory 920 is used because the decomposing step 450 occurs during design-time of human interface 951 (cf. FIG 5). Optionally, a runtime memory portion of memory 920 can be used.

Optionally, computer system 999 further comprises:

c) a means for instantiating 460 (cf. FIG. 2) data instance 150 (cf. FIG. 7) from data description 140-2; and

d) a means for merging 470 (cf. FIG. 2) data instance 150 with human interface layout template 140-1 into individual document description 160 (cf. FIG. 7).

Preferably, means c) comprises a computer program that reads data description 140-2 from memory 920 and creates data instance document 150 in a runtime portion of memory 920 (e.g. a RAM for storing runtime data) by adding runtime dependent data to the data of data description 140-2. Runtime dependent data are created or modified, e.g. by an application program (e.g. 101 on computer 901, cf. FIG. 1 description), during

runtime. Table 7 shows a markup language document example of data instance 150.

Preferably, means d) comprises layout template 140-1. Processor 910 reads layout template 140-1 from memory 920 and applies it to data instance 150. The result is individual document description 160 (cf. XHTML example in table 8), which is a markup language document that is stored in a runtime portion of memory 920 and can be rendered by a conventional browser on output device 950.

Having described the present invention as computer implemented method 400 and computer system 999, it is now described as a computer program product 100 (cf. FIG. 1) that can be stored on a computer readable data carrier 970 (cf. FIG. 1).

Computer program product 100 has a plurality of instructions for causing a processor (e.g. processor 910) of a computer (e.g. computer 900) to create and process a human interface description. In a preferred embodiment, computer program product 100 causes computer 900 to execute the following steps:

a) providing 410 predefined document description 120, 130; and

b) decomposing 420 document description 120, 130 into layout template 140-1 and data description 140-2.

Computer program 100 steps a) and b) are equivalent to method 400 steps a) and b), respectively (described in detail under FIGS. 2 and 3).

In the preferred embodiment, computer program product 100 causes computer 900 to execute the further, optional steps c) and d):

c) instantiating 460 data instance 150 from data description 140-2; and

d) merging 470 data instance 150 with layout template 140-1 into individual document description 160.

Computer program 100 steps a) to d) are equivalent to method 400 steps a) to d), respectively (described in detail under FIGS. 2, 3 and 4).

Computer program product 100 can be stored on a
5 computer readable data carrier (e.g. data carrier 970).

Reference	Description
100, 101, 102	Computer program products
122, 123, 124-1, 124-2, 125, 126, 127	Layout elements
120, 130	document descriptions
140-1	Layout template
140-2	Data description
150	Data instance
155	Application interface
160	Individual document description
400	Method
4xx	Method steps
999	Computer network system
900, 901, 902	Computers
910, 911, 912	Processors
920, 921, 922	Memories
930	Bus
940	Input device
950	Output device
951	Cursor
960	User interface
970	Program carrier (computer readable device)
980	Program signal

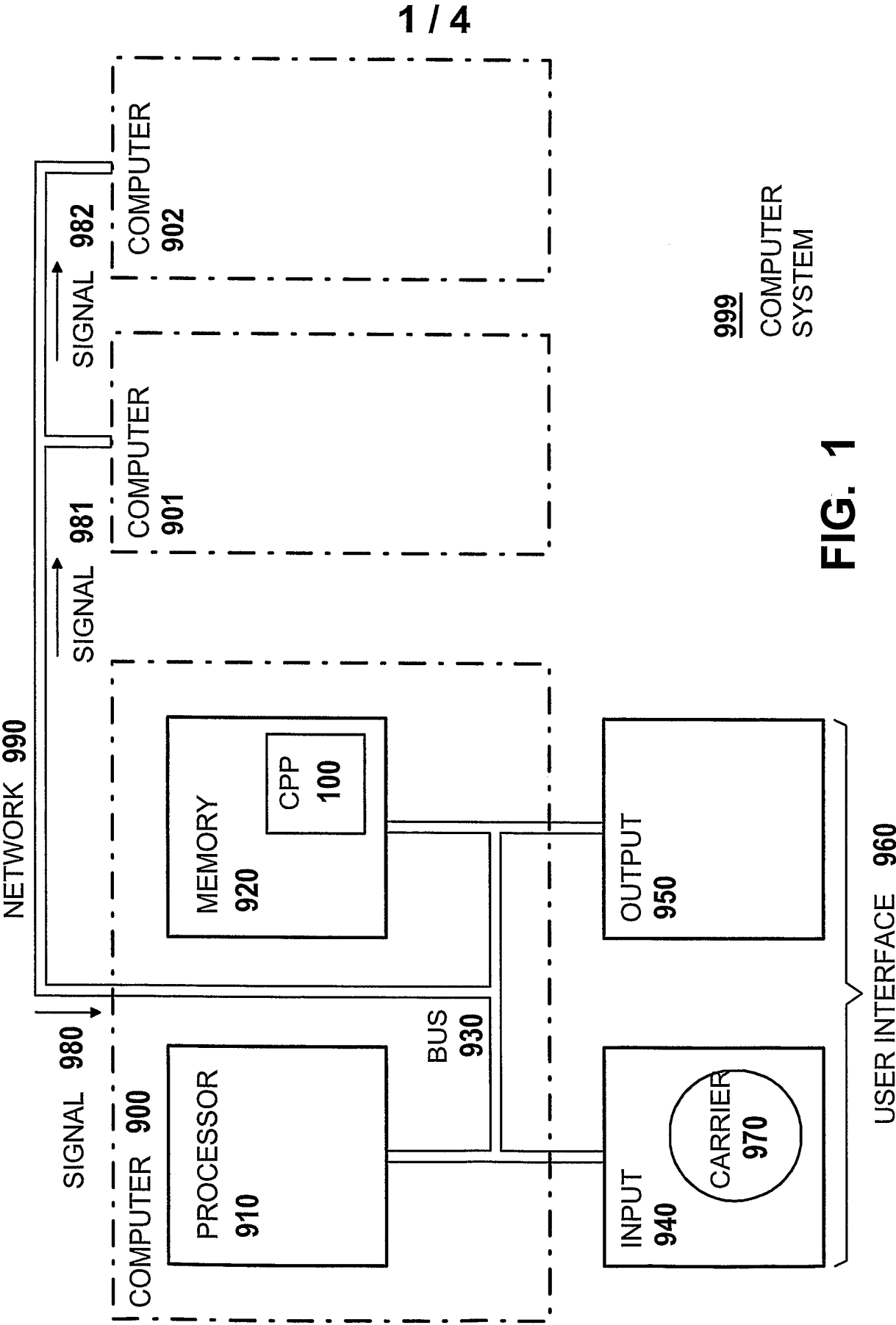
Reference number table

Patent Claims

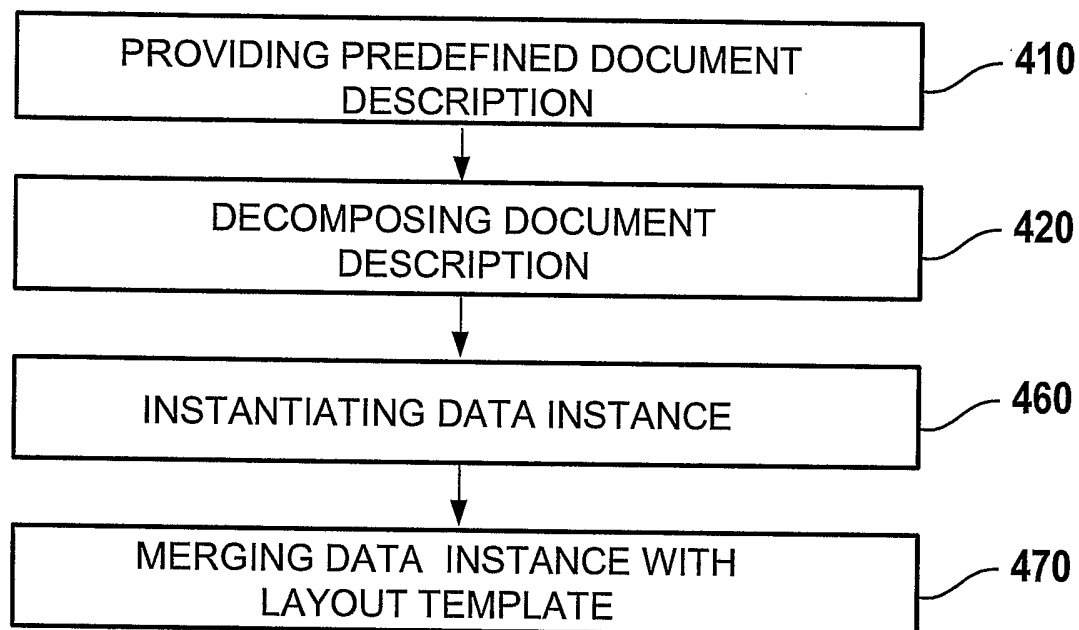
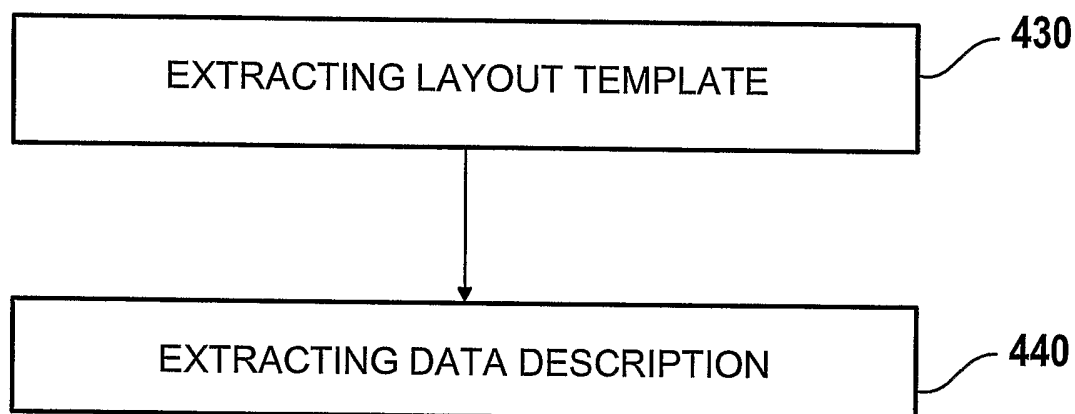
1. A computer-implemented method (400) for separating and processing layout information and data of a document; the method (400) comprising the steps of:
5 providing (410) a predefined document description (120, 130); and
decomposing (420) the document description (120, 130) into a layout template (140-1) and a data description (140-2).
10
2. The method (400) of claim 1, wherein the decomposing step (420) comprises the following steps:
extracting (430) the layout template (140-1) from
15 the document description (120, 130); and
extracting (440) the data description (140-2) from the document description (120, 130).
3. The method (400) of claim 2, wherein the extracting
20 steps (430, 440) use a transformation program in a programming language.
4. The method (400) of claim 3, wherein the
25 transformation program is a style sheet language transformation.
5. The method of claim 4, comprising the further steps:
instantiating (460) a data instance (150) from the
30 data description (140-2); and
merging (470) the data instance (150) with the layout template (140-1) into an individual document description (160).

6. The method (400) of claim 5, wherein the merging step (470) uses a transformation program in a programming language.
- 5 7. The method (400) of claim 6, wherein the transformation program is a style sheet language transformation.
8. A computer system (999) for separating and
10 processing layout information and data of a document; the computer system (999) comprising:
a means for providing (410) a predefined document description (120, 130); and
a means for decomposing (420) the document
15 description (120, 130) into a layout template (140-1) and a data description (140-2).
9. The computer system (999) of claim 8, further comprising:
20 a means for instantiating (460) a data instance (150) from the data description (140-2); and
a means for merging (470) the data instance (150) with the layout template (140-1) into an individual document description (160).
25
10. A computer program product (100) having a plurality of instructions for causing a processor (910) of a computer (900) to separate and process layout information and data of a document; the computer
30 program product (100) causing the computer (900) to execute the following steps:
providing (410) a predefined document description (120, 130); and
decomposing (420) the document description (120,
35 130) into a layout template (140-1) and a data description (140-2).

11. The computer program product (100) of claim 10,
causing the computer (900) to execute the further
steps:
instantiating (460) a data instance (150) from the
5 data description (140-2); and
merging (470) the data instance (150) with the
layout template (140-1) into an individual
document description (160).
- 10 12. A data carrier (970) readable by a computer (900);
the data carrier (970) storing a plurality of
instructions for causing a processor (910) of the
computer (900) to separate and process layout
information and data of a document; the plurality
15 of instructions causing the computer (900) to
execute the method (400) steps of claims 1 and 2.



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**FIG. 2****FIG. 3**

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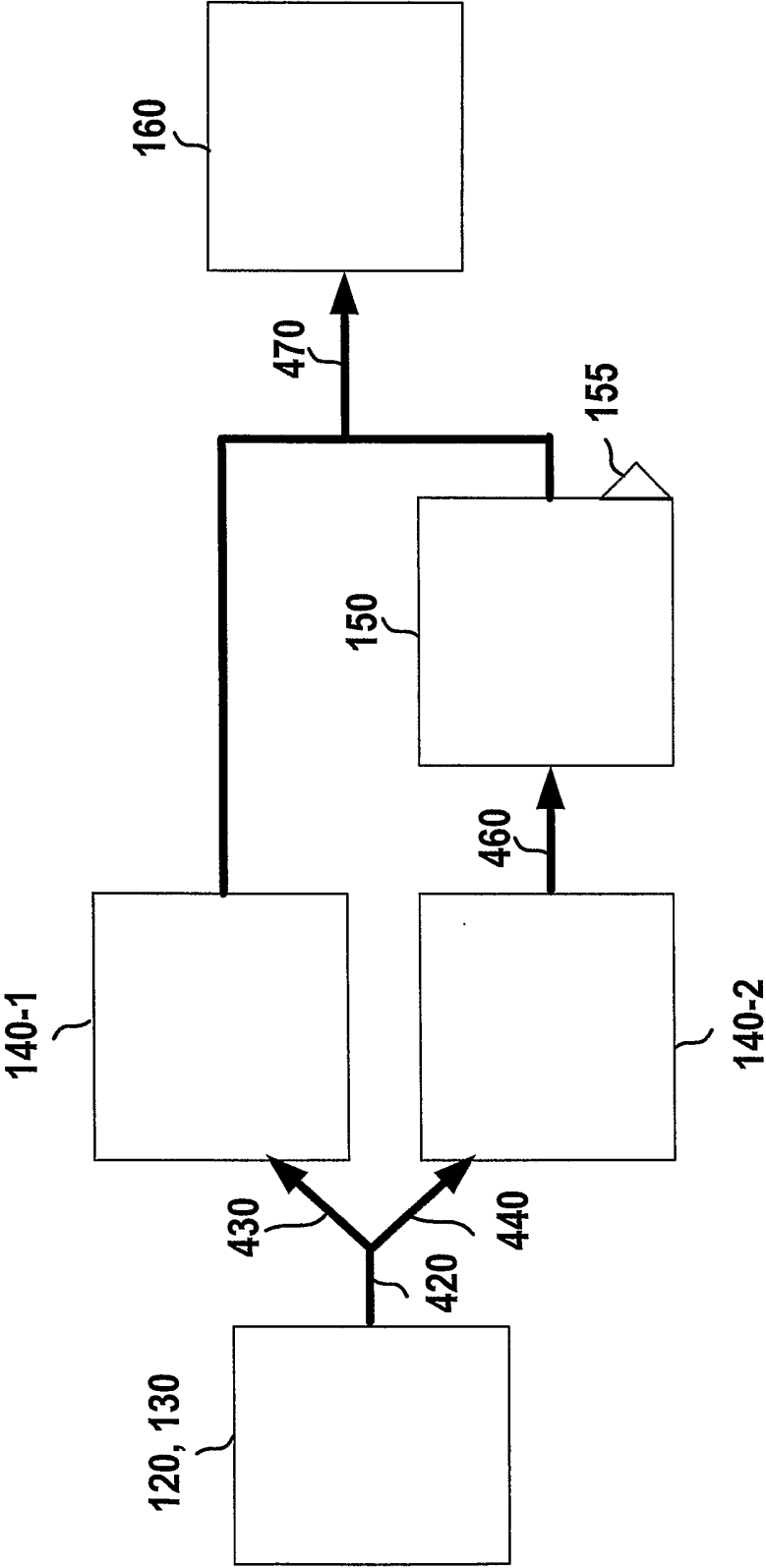


FIG. 4

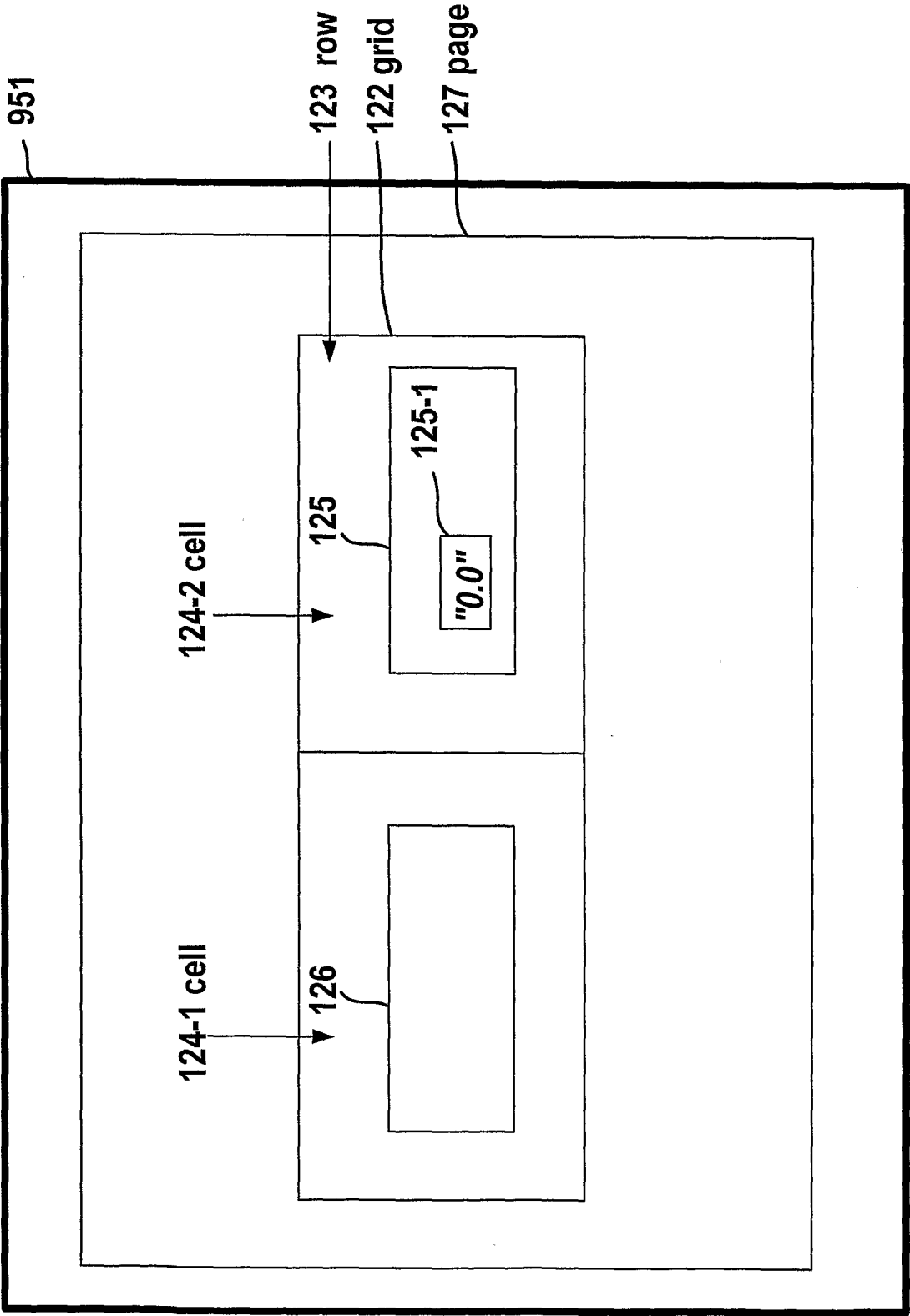


FIG. 5

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/04208

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06F9/44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01 18630 A (VANGAPALLI RAMMOHAN ;PERCUSSION SOFTWARE INC (US); HOWARD PAUL (US) 15 March 2001 (2001-03-15)	1,2,8-10
Y	page 9, line 1 -page 10, line 1	3-7,11, 12
A	WO 01 29636 A (2ROAM INC) 26 April 2001 (2001-04-26)	1-12
Y	page 24, line 1 -page 29, line 22	
Y	W3C: "XSL Transformations (XSLT)" W3C RECOMMENDATION, 'Online! 16 November 1999 (1999-11-16), XP002189938 Retrieved from the Internet: <URL:http://www.w3.org/TR/xslt> 'retrieved on 2002-02-11! paragraphs '0001!, '0002!	3-7,11, 12



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents :

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- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- * & * document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 02/04208

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
WO 0118630	A	15-03-2001	AU	7363900 A	10-04-2001
			WO	0118630 A2	15-03-2001
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			WO	0129636 A2	26-04-2001