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Smart Layout For Printing

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SMART LAYOUT FOR PRINTING

ABSTRACT

A printing system that adjusts the print layout for content to be printed based on the content itself in order to improve the print results. For example, the printing system may include a printing adjustor that intelligently suggests one or more print layouts for content to be printed by changing the size of the content so that it fits on a single page, arranging the content with two columns instead of one, and/or removing unimportant parts from the content such as a lengthy disclaimer, for example. As a result, the printing system can print content in a more efficient manner by generating a printing output that better matches what the user expects.

DISCLOSURE

Printing documents may be sub-optimal for many users because the print output does not necessarily match what the user expects in many cases. In some cases, the print document almost fits on a single page, where one or two lines exist on a second page. In this case, the printing adjuster may scale the page or make the margins smaller to have all the print content contained on a single page. In another example, a user prints a document that is printed as a very narrow column and is printed onto two pages. In this case, the printing adjuster may adjust the print layout to have the document printed on a single page using two columns. In another example, a user prints a document that contains a lengthy disclaimer at the end of the document. Often times, the user does not want the disclaimer to be printed. In this case, the printing adjuster may identify the disclaimer as unimportant for printing purposes, and automatically adjust the print layout such that the disclaimer is not included as part of the printed document.

FIG. 1 is a block diagram of a system 100 having a printing adjustor 120 configured to adjust a print layout for print content 128 based on the print content 128 itself. The printing adjustor 120 may provide a set of alternative ‘smart’ printing layouts (print layouts 130) based on an input document (print content 128). For example, the printing adjustor 120 may suggest a first print layout 130-1 and a second print layout 130-2, which provide alternative printing layouts than what is originally provided by the application. For instance, the printing adjustor 120 may provide these print layouts 130 in a print user interface (e.g., a print dialog) so that the user can decide which print layout to select. Then, the user can then select one of the print layouts 130 for actual printing or decide to use the original layout. In other examples, the printing adjustor 120 automatically selects the best print layout, and uses that layout for actual printing. The print content 128 may include any type of content capable of being printed. In some examples, the print content 128 may include content generated by an application executing on a user’s computing device. In some examples, the print content 128 includes web content generated by a browser executing on the computing device.

The printing adjustor 120 may include a print layout suggestor 122 configured to implement a suggestion algorithm that creates different variations of printings layouts. For examples, the print layout suggestor 122 may evaluate the properties of the print content 128 and attributes of the printing areas (e.g., the size and shapes of the printing areas, the filled ratio of pages to print, etc.). In some examples, the print layout suggestor 122 may detect that the print content 128 is a multi-page document and that the last page is nearly empty. In this case, the print layout suggestor 122 may scale the print content 128 to achieve a printout where all pages are fully used. In some examples, the print layout suggestor 122 may use scaling if the print content 128 would be scaled down by less than or equal to a threshold amount (e.g., 5%) in order

for the content to fit on the page. For instance, if a document is scaled down by 5% or less, most users will not notice the difference between the scaled version and the original version. However, if the document would have to be scaled by more than the threshold amount, the print layout suggestor 122 may determine that scaling is not an option.

The print layout suggestor 122 may detect that the print content 128 is a multi-page document where every page (or more than one page) has large margins (e.g., margins having a size above a threshold amount). In this case, the print layout suggestor 122 may determine to scale-up one or more pages (or all of them) so that the print content 128 is larger and the pages are fully used. In other examples, the print layout suggestor 122 may determine to remove the margins and print two (or more) pages onto a single page.

The print layout suggestor 122 may learn from previous behavior of the user, e.g. if the user regularly prints a certain type of document and configures it in a certain way. For example, the print layout suggestor 112 may receive previous user behavior 126 about printing documents, and create a suggested print layout 130 that incorporates one or more of the features of the previous print job. In one example, the previous user behavior 126 may indicate that the user generally does not print the last part of a bank statement because it has a wordy legal disclaimer. In this case, the print layout suggestor 122 may propose to remove this legal disclaimer the next time the user prints his/her bank statement.

The printing adjustor 120 may include a print layout scoring unit 124 that may implement a scoring algorithm to score the determined print layouts 130. For example, the print layout scoring unit 124 may score the print layouts 130 in order to determine the best candidates. In some examples, the scoring algorithm may be used to guide the search (by the print layout

suggestor 122) for possible print layouts 130 such that not all possible alternatives need to be considered.

In some examples, the print layout scoring unit 124 may perform the scoring function using (a) a manually engineered scoring function, (b) a weighted set of scoring functions where weights may be optimized based on (semi-)automatic tuning (e.g. based on a training set), and/or (c) a machine-learning algorithm to optimize the scoring function according to a given set of training examples. The print layout scoring unit 124 may compute the scoring based on a number of scoring signals such as 1) the (font) size of the smallest and largest characters after printing, 2) the minimum and maximum line size for drawing components, 3) the amount of white space on the page overall and between text blocks or lines, 4) the number of sheets of paper needed to print, 5) the removal of any text or other layout elements, 6) the geometric arrangements of parts (fitting of neighboring components, variation in scaling factors), and/or 7) ‘interestingness’ of text or other layout components (which may be based on structure or content for images and/or text).

Also, the print layout scoring unit 124 may learn from the previous user behavior 126, e.g., when a user selects a suggested print layout 130, this layout (not necessarily including the document content) can be added to the training set for this particular user or for the algorithm in general. Additional to suggested print layouts 130, if a machine learning model is used, then the printing adjustor 120 may learn specific patterns that removed paragraphs and then automatically suggest these removals in the future (through a printing layout as described above, or a simple UI notification “Paragraph ‘...’ was removed”).

In some examples, the printing adjustor 120 may integrate its features within existing layout algorithms, where a layout function is assigned a piece of text that needs to be positioned

on the page, and this layout function obtains scoring information about each individual part of text (e.g. words) to decide to apply ad-hoc one optimization or another (e.g., print smaller, remove sequences of words, etc.).

In some examples, all of the previously described parts of the printing adjustor 120 may be user configurable. For example, for removing content, a user interface may be configured to remove parts of the print content 128 from a print preview. In some examples, the printing adjustor 120 may transform a print preview to make the print content 128 selectable in the sense that the user can manually remove certain text/objects from the print preview screen.

In some examples, the printing adjustor 120 incorporates another dimension to text printing, by incorporating a “relevancy” component in the layout algorithm. This relevancy component can come in the form of a heuristic function (e.g. decreasing the font size by 5%) or can come in the form of machine learning models that determine a score for a sub-part of the text and can remove it, print it entirely on a different page or make it smaller.

As a result, incorporation of the printing adjustor 120 into printing systems may lead to a better experience when printing documents because less paper is wasted and the print output will be of higher quality.

FIG. 2 illustrates the printing adjustor 120 within a cloud print service 202 according to an aspect. For example, the cloud print service 202 may be executed on a cloud print server 204 which provides printing capabilities over a network 206. The cloud print service 202 provides a user with a uniform printing experience which is platform-independent and which unburdens the user of the need to configure, update, or otherwise maintain or oversee printer operations of a printer 218. In FIG. 2, a device 208 is illustrated as an example of virtually any computing device from which a user may wish to execute a print job. By way of non-limiting example,

then, the device 208 may include a laptop or desktop computer, a netbook, a tablet computer, a smartphone, a camera, or any device which may store or have access to data which the user may desire to print. In the example of FIG. 2, an operating system 210 is illustrated as executing an application 212. Again, these elements are included by way of illustration and example, and may include virtually any operating system or other platform on which virtually any application may run. For example, the operating system 210 may include operating systems such as the Windows operating system, Mac OS, or Linux, and may include mobile platforms such as Android, Symbian, or iPhone OS, to name a few examples. In other examples, the operating system 210 may include a browser-based operating system, such as Chrome OS.

In some examples, the cloud print service 202 may include the printing adjustor 120 which is executing on the cloud print server 204. The printing adjustor 120 may receive the print content and/or the properties and attributes of the print layout and content, and determine the various print layouts in the manner as described above. Then, the printing adjustor 120 may provide the suggested print layouts 130 over the network 206 for display on the device 208 such that the user can select one of them via a user interface. The printing adjustor 120 receives the selection, and formats the print content according to the selected print layout. Then, the cloud print service 202 may send, over the network, 206, the print job having content to be printed according to the selected print layout to the printer 218 to be printed.

FIG. 3 illustrates the printing adjustor 120 executing on a computing device 308 according to an aspect. For example, the printing adjustor 120 may be incorporated on an operating system 310 of the device 308. In other examples, the printing adjustor 120 may be incorporated into an application 312 executing on the device 308 such as a web browser. The printing adjustor 120 may augment or supplement the application's existing print functionality.

100

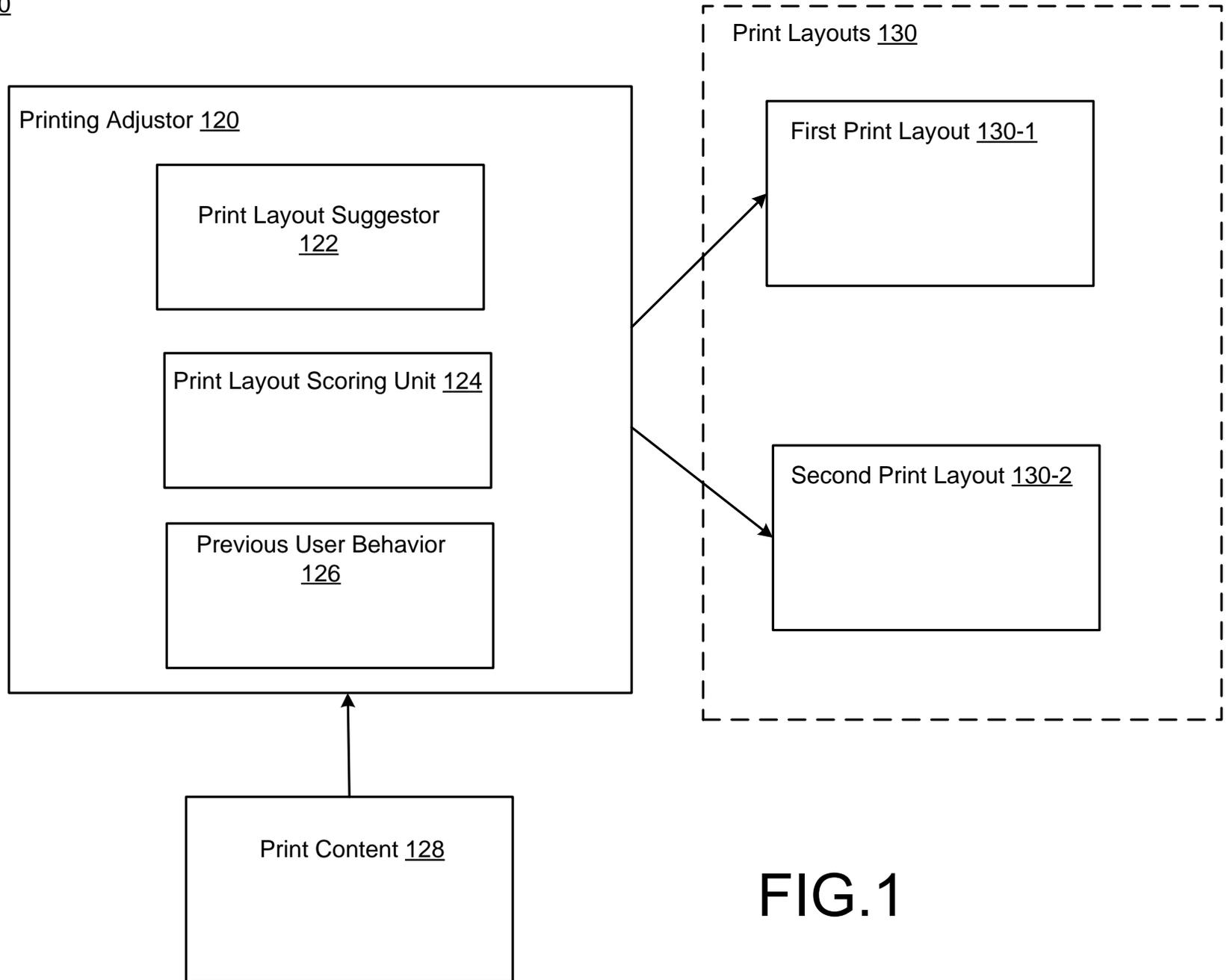


FIG.1

200

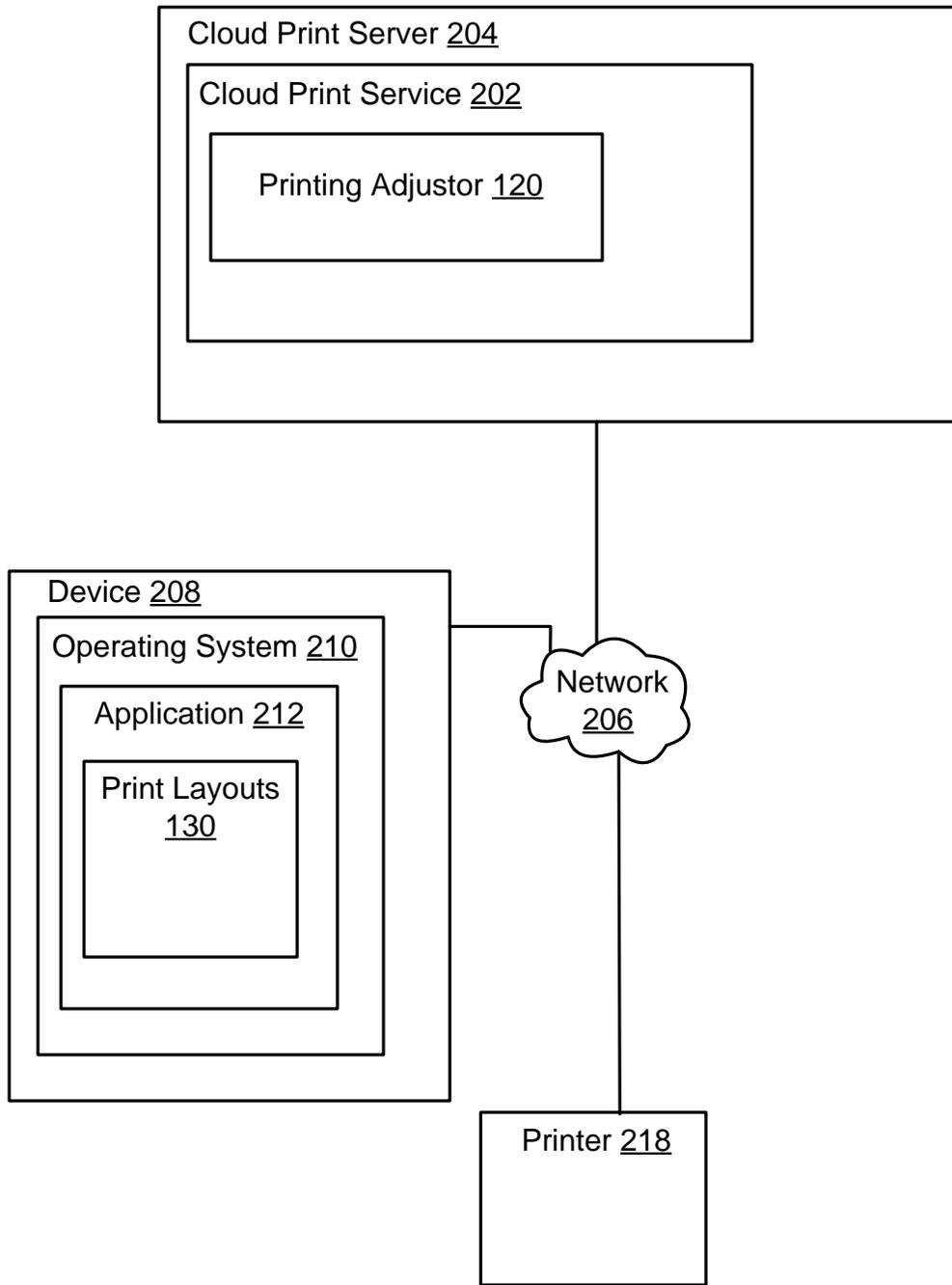


FIG. 2

300

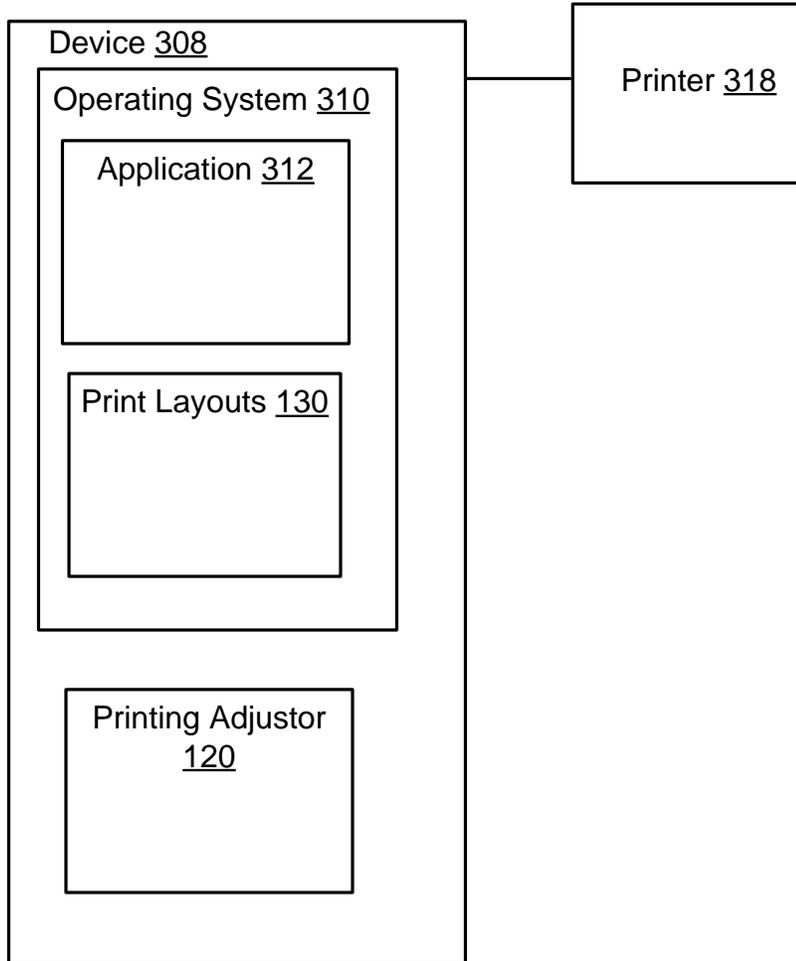


FIG. 3