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(54) **INFORMATION PROCESSING APPARATUS, PRINT CONTROL METHOD, AND RECORDING MEDIUM**

(71) Applicant: **Konica Minolta, Inc.**, Chiyoda-ku (JP)

(72) Inventor: **Akira INOUE**, Tokyo (JP)

(73) Assignee: **Konica Minolta, Inc.**, Chiyoda-ku (JP)

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(57) **ABSTRACT**

An information processing apparatus causes an image forming apparatus to print document data. The information processing apparatus includes a hardware processor. The hardware processor obtains document data to be printed, determines whether a print preview process has been performed on the obtained document data, generates data for printing corresponding to the document data based on whether the print preview process has been performed, and transmits the data for printing toward the image forming apparatus.

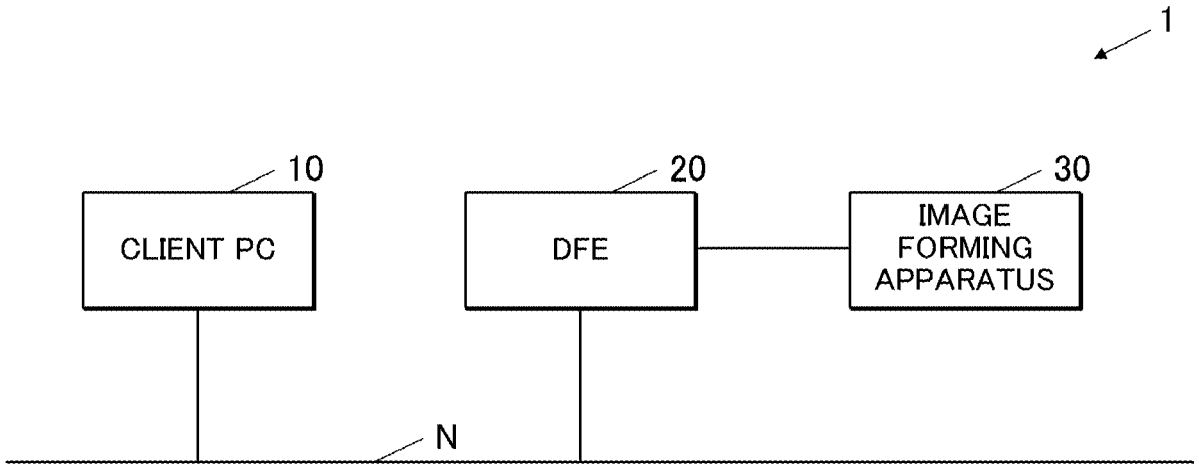


FIG.1

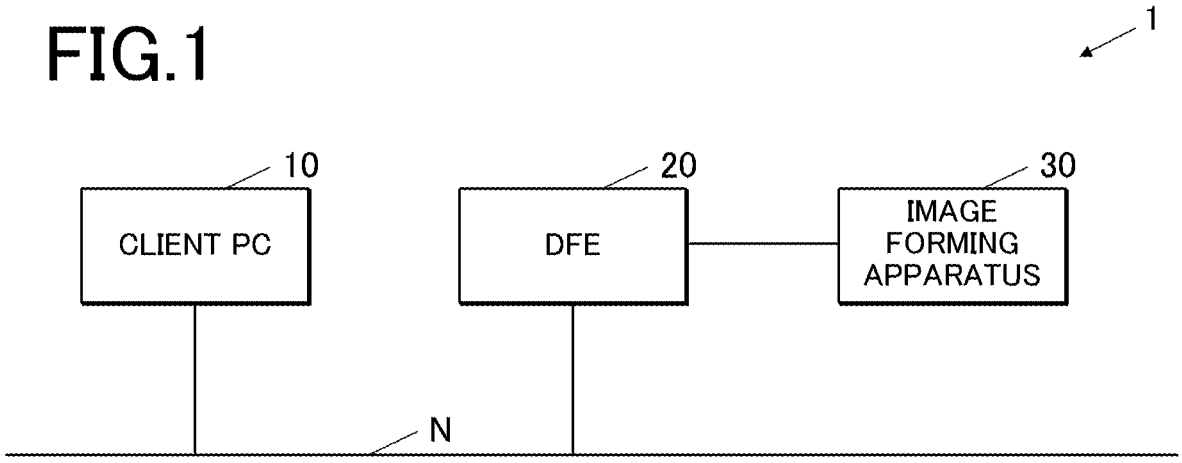

1
10
CLIENT PC
20
DFE
30
IMAGE FORMING APPARATUS
N

FIG.2

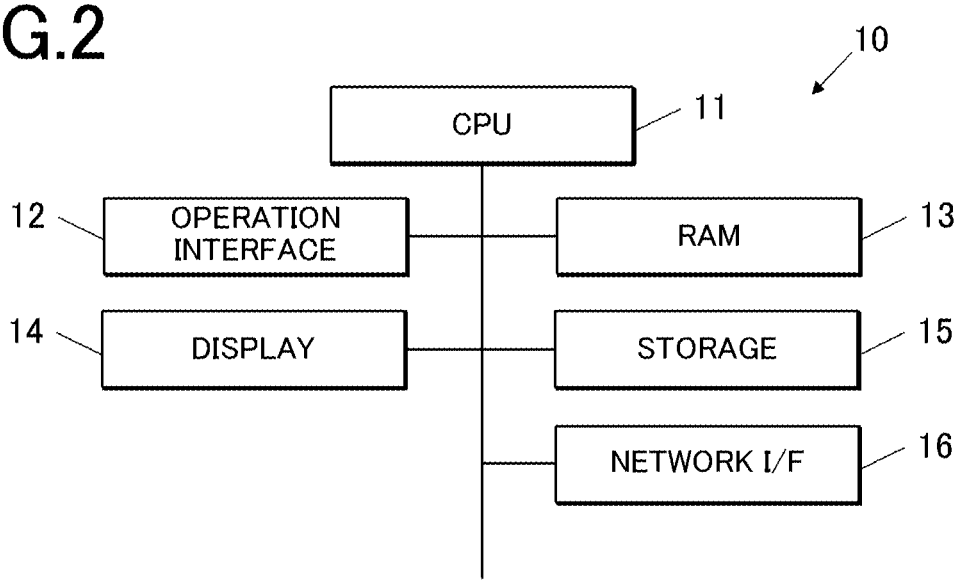

10
CPU
11
12
OPERATION INTERFACE
RAM
13
14
DISPLAY
STORAGE
15
NETWORK I/F
16

FIG.3

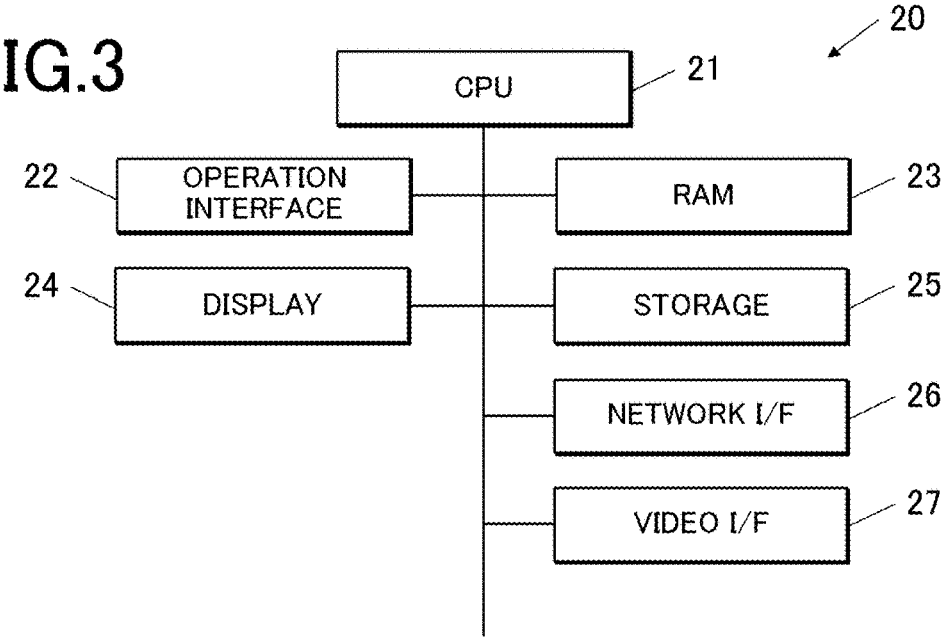


FIG.4

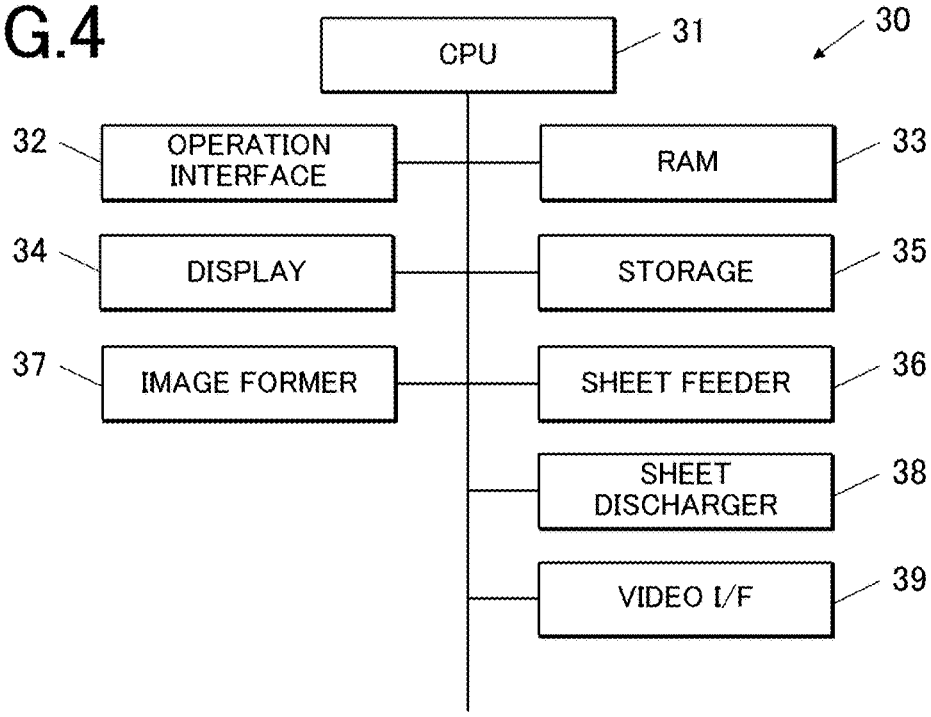


FIG.5

40

41 42

	PRINT RESOLUTION	
PREVIEW SETTING	600 DPI	1200 DPI
75 DPI	DFE	DFE
150 DPI	DFE	DFE
300 DPI	DFE	DFE
600 DPI	APP	DFE
1200 DPI	DFE	APP

FIG.6

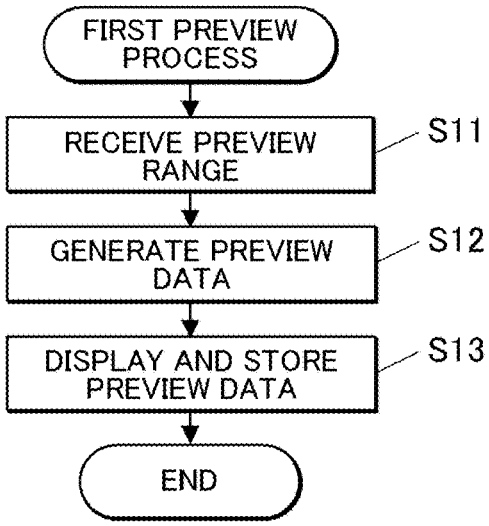

FIRST PREVIEW PROCESS
RECEIVE PREVIEW RANGE
S11
GENERATE PREVIEW DATA
S12
DISPLAY AND STORE PREVIEW DATA
S13
END

FIG.7

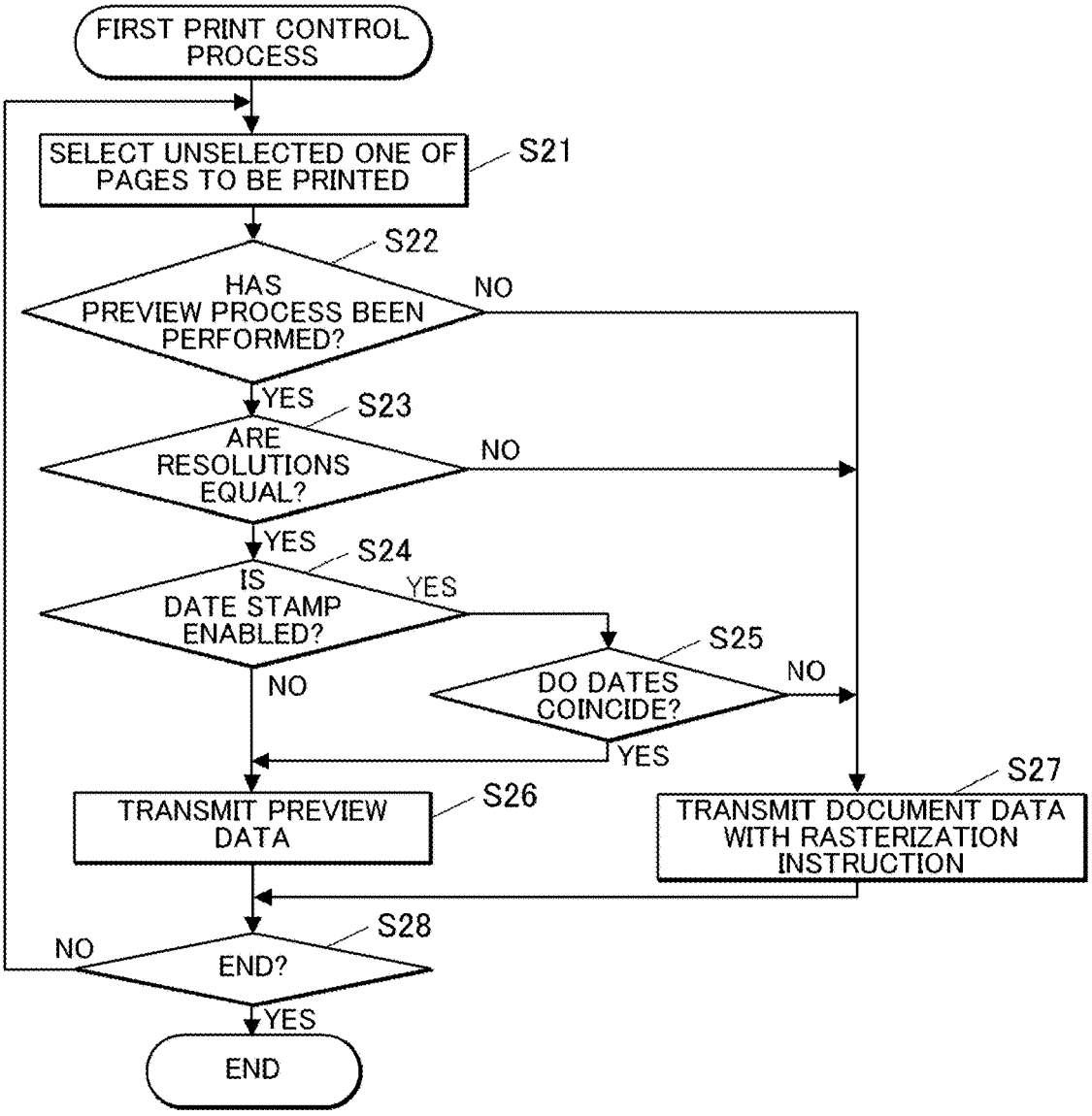

FIRST PRINT CONTROL PROCESS
SELECT UNSELECTED ONE OF PAGES TO BE PRINTED
S21
HAS PREVIEW PROCESS BEEN PERFORMED?
S22
NO
YES
ARE RESOLUTIONS EQUAL?
S23
NO
YES
IS DATE STAMP ENABLED?
S24
YES
NO
DO DATES COINCIDE?
S25
NO
YES
TRANSMIT PREVIEW DATA
S26
TRANSMIT DOCUMENT DATA WITH RASTERIZATION INSTRUCTION
S27
END?
S28
NO
YES
END

FIG.8

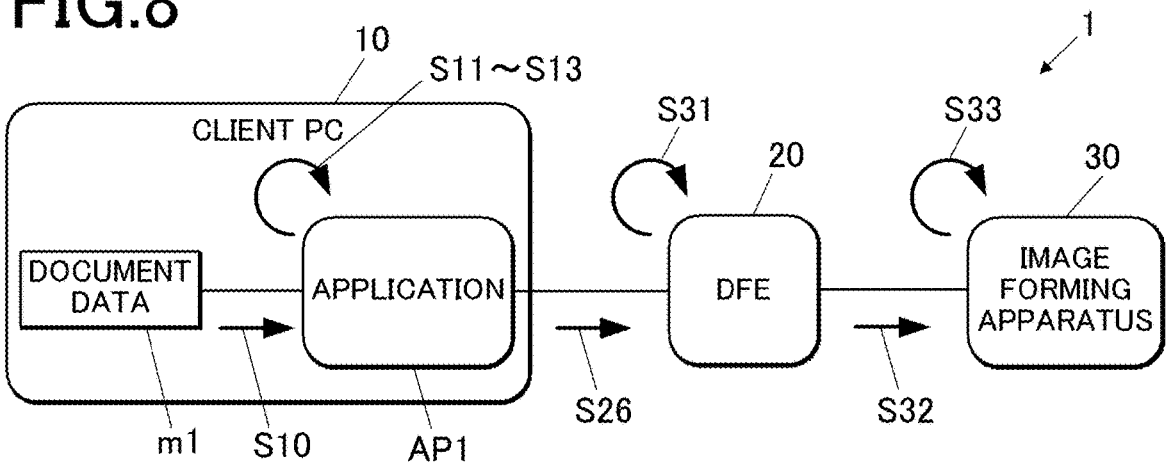

10
S11～S13
CLIENT PC
DOCUMENT DATA
APPLICATION
m1
S10
AP1
S26
S31
20
DFE
S32
S33
30
IMAGE FORMING APPARATUS
1

FIG.9

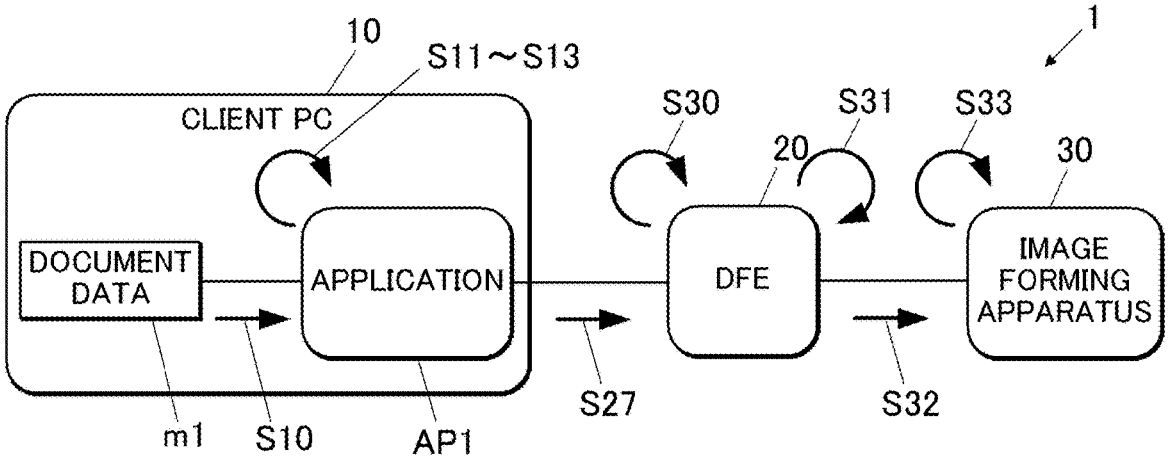

10
S11～S13
CLIENT PC
DOCUMENT DATA
APPLICATION
m1
S10
AP1
S27
S30
S31
20
DFE
S32
S33
30
IMAGE FORMING APPARATUS
1

FIG.10

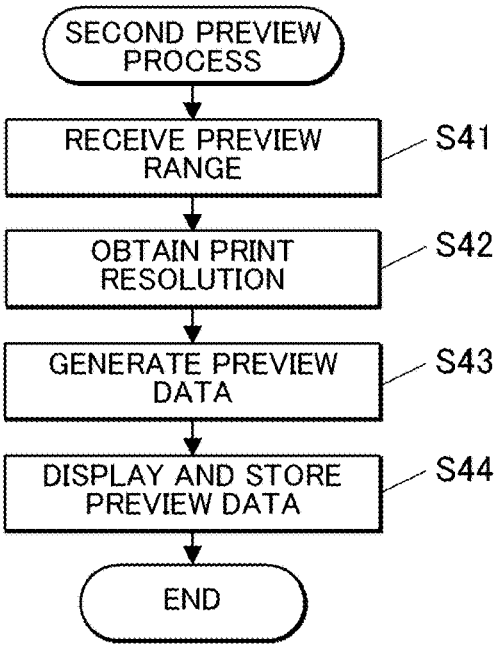

SECOND PREVIEW PROCESS
RECEIVE PREVIEW RANGE
S41
OBTAIN PRINT RESOLUTION
S42
GENERATE PREVIEW DATA
S43
DISPLAY AND STORE PREVIEW DATA
S44
END

FIG.11

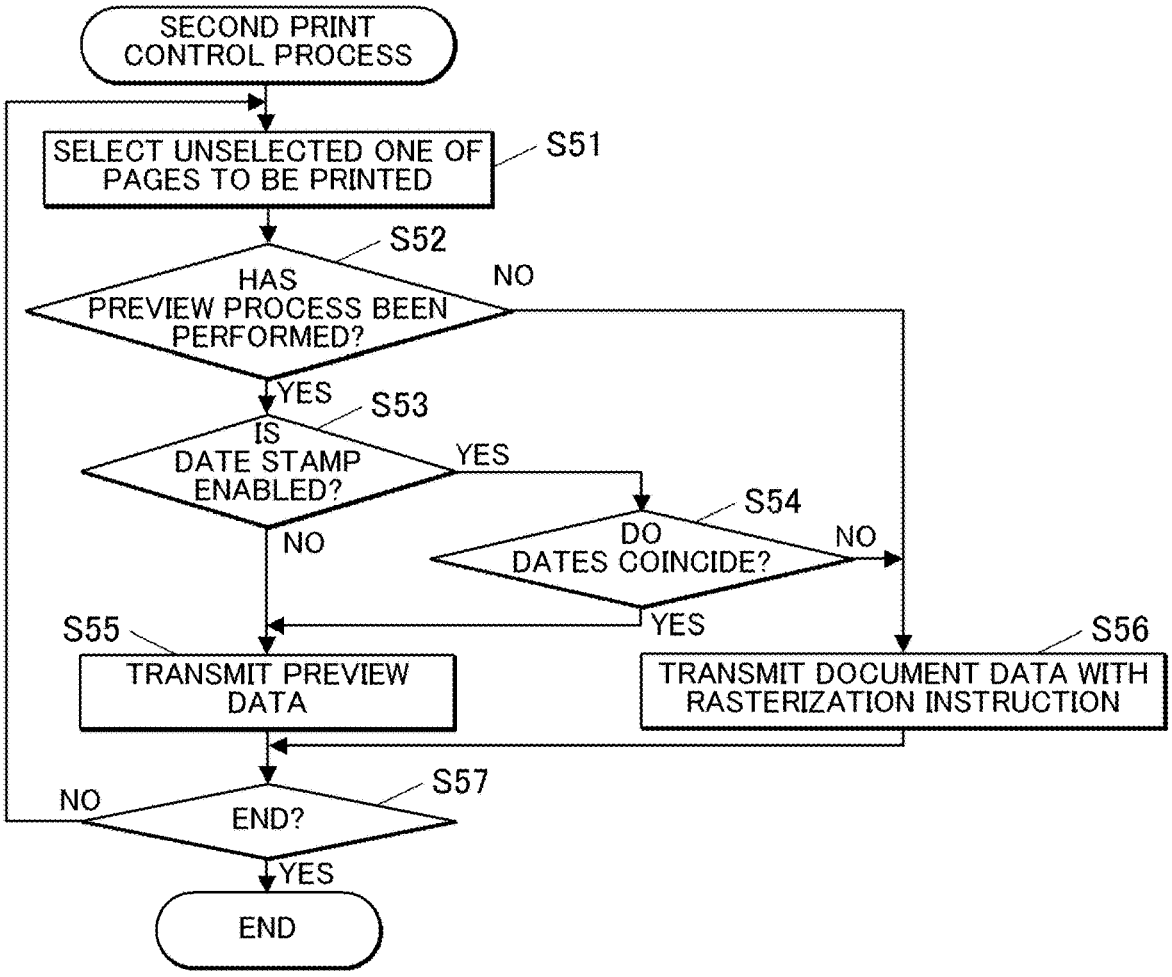

SECOND PRINT CONTROL PROCESS
SELECT UNSELECTED ONE OF PAGES TO BE PRINTED
S51
S52
HAS PREVIEW PROCESS BEEN PERFORMED?
NO
YES
S53
IS DATE STAMP ENABLED?
YES
NO
S54
DO DATES COINCIDE?
NO
YES
S55
TRANSMIT PREVIEW DATA
S56
TRANSMIT DOCUMENT DATA WITH RASTERIZATION INSTRUCTION
S57
END?
NO
YES
END

FIG.12

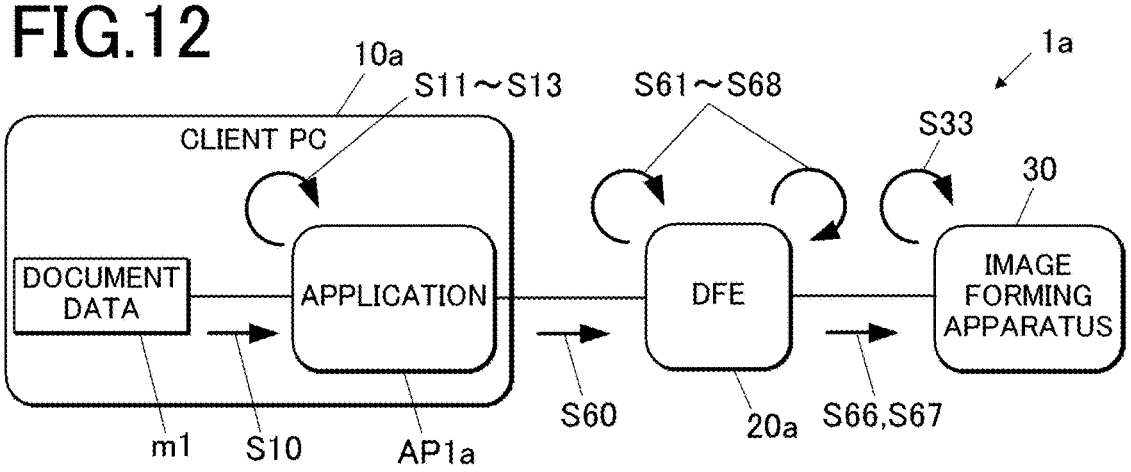

10a
S11~S13
S61~S68
1a
S33
30
CLIENT PC
DOCUMENT DATA
APPLICATION
DFE
IMAGE FORMING APPARATUS
m1
S10
AP1a
S60
20a
S66,S67

FIG.13

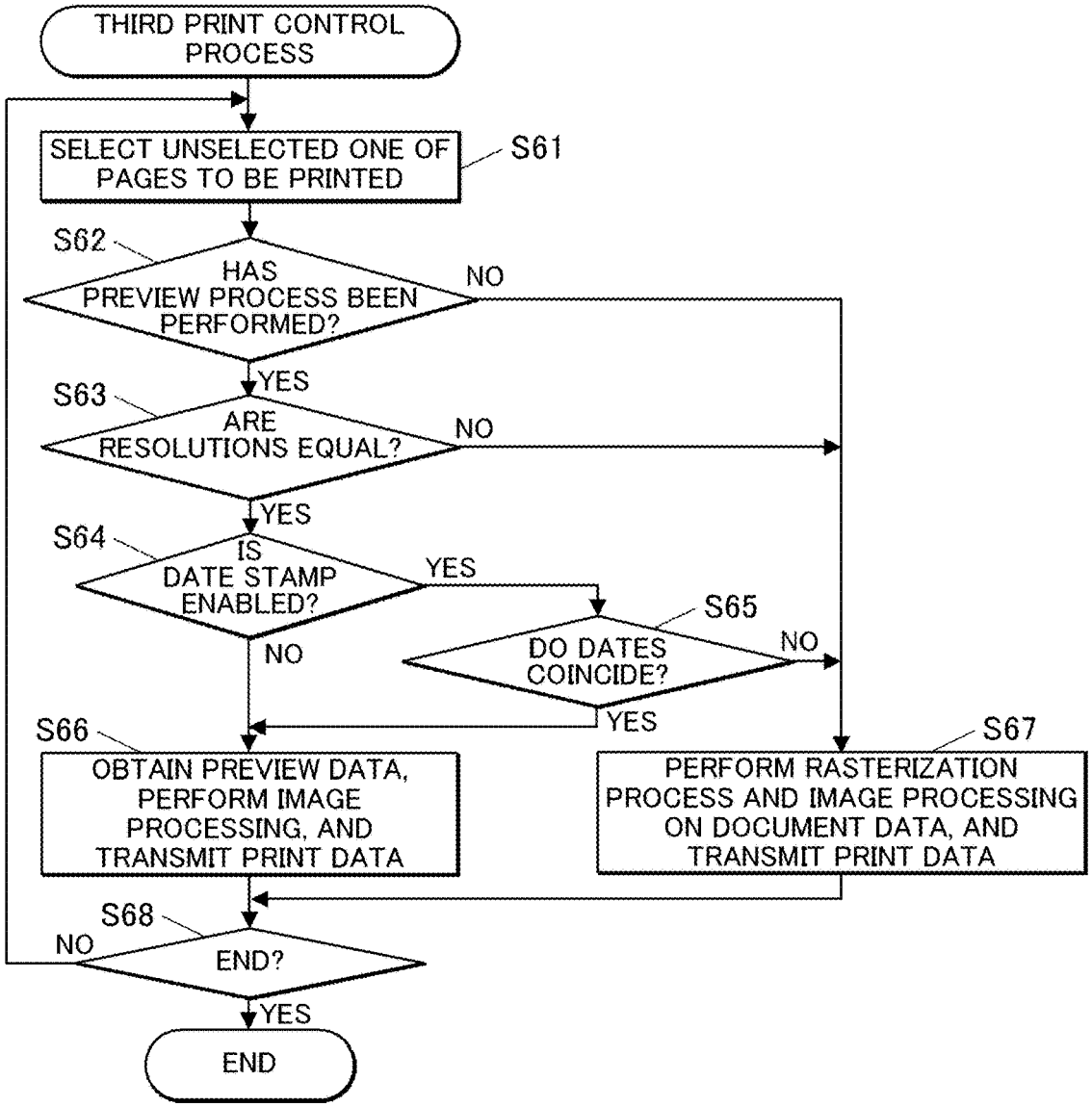

THIRD PRINT CONTROL PROCESS
SELECT UNSELECTED ONE OF PAGES TO BE PRINTED
S61
S62
HAS PREVIEW PROCESS BEEN PERFORMED?
NO
YES
S63
ARE RESOLUTIONS EQUAL?
NO
YES
S64
IS DATE STAMP ENABLED?
YES
NO
S65
DO DATES COINCIDE?
NO
YES
S66
OBTAIN PREVIEW DATA, PERFORM IMAGE PROCESSING, AND TRANSMIT PRINT DATA
S67
PERFORM RASTERIZATION PROCESS AND IMAGE PROCESSING ON DOCUMENT DATA, AND TRANSMIT PRINT DATA
S68
NO
END?
YES
END

FIG.14

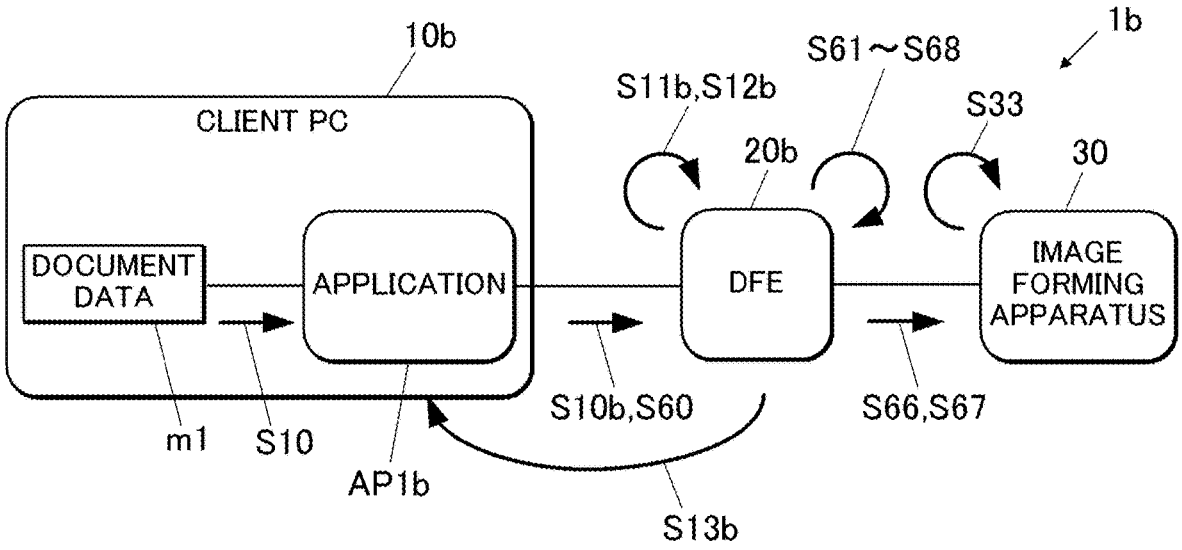
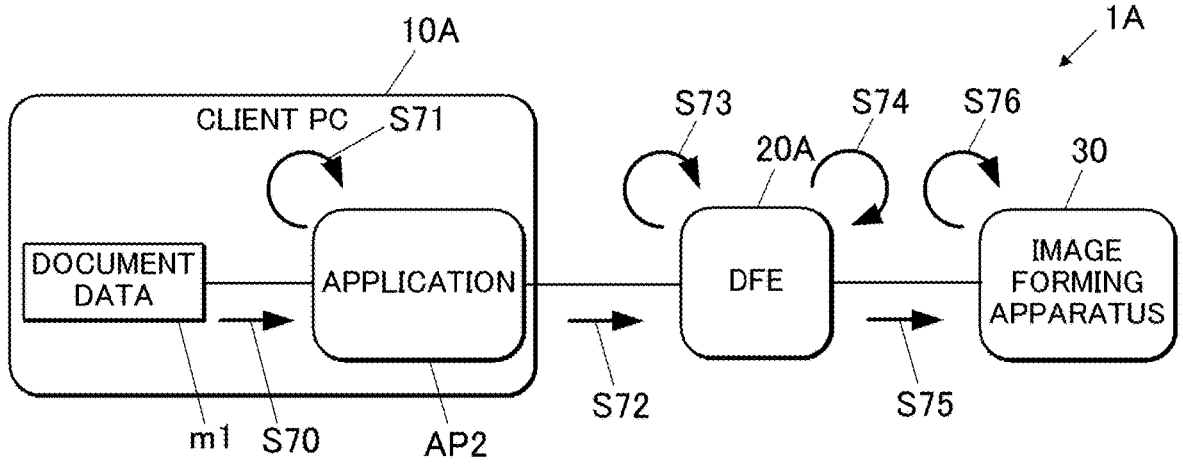

10b
CLIENT PC
DOCUMENT DATA
APPLICATION
m1
S10
AP1b
S10b,S60
S13b
S11b,S12b
S61～S68
20b
DFE
S33
30
IMAGE FORMING APPARATUS
S66,S67
1b

FIG.15


10A
CLIENT PC
S71
DOCUMENT DATA
APPLICATION
m1
S70
AP2
S72
S73
S74
S76
20A
DFE
30
IMAGE FORMING APPARATUS
S75
1A

INFORMATION PROCESSING APPARATUS, PRINT CONTROL METHOD, AND RECORDING MEDIUM

BACKGROUND

1. Field of the Invention

[0001] The present invention relates to an information processing apparatus, a print control method, and a recording medium.

2. Description of the Related Art

[0002] There is known an image forming apparatus, such as a printer, that forms an image on a sheet serving as a recording medium, using an electrophotographic recording method or the like. There is also known an image forming system in which a client personal computer (PC) transmits print data to an image forming apparatus such that the image forming apparatus forms an image.

[0003] There is also known an image forming system having a function for previewing print data. Referring now to FIG. **15**, the operation of a related-art image forming system **1**A having a preview function will be described. FIG. **15** illustrates the operation of the related-art image forming system **1**A.

[0004] As illustrated in FIG. **15**, the image forming system **1**A includes a client PC **10**A, a digital front end (DFE) **20**A connected to the client PC **10**A over a network, and an image forming apparatus **30** connected to the DFE **20**A in a peer-to-peer manner. The image forming apparatus **30** is, for example, an electrophotographic image forming apparatus, and performs printing by forming an image on a sheet using toners of cyan (C), magenta (M), yellow (Y), and black (K).

[0005] The following describes an operation performed in the image forming system **1**A to preview and print document data m**1** that is, for example, created using a word processing application program on the client PC **10**A and stored in a document file format in a storage (not illustrated). First, in the client PC **10**A, a hardware processor (hereinafter referred to as an application AP**2**) that executes a print application program reads and obtains the created document data m**1** from the storage (step S**700**). Then, the application AP**2** performs a rasterization process on the obtained document data m**1** to generate and display preview data (step S**71**). The rasterization process is a process for converting document data into image data of a bitmap image. Then, the application AP**2** transmits the document data m**1** to the DFE **20**A (step S**72**).

[0006] The DFE **20**A (specifically, its hardware processor) performs a rasterization process to convert the received document data m**1** into print data of a bitmap image in a color mode of red (R), green (G), and blue (B) (step S**73**).

[0007] Then, the DFE **20**A performs image processing to convert the print data of the RGB bitmap image into print data of a bitmap image in a color mode of CMYK (step S**74**). Then, the DFE **20**A transmits the print data of the CMYK bitmap image to the image forming apparatus **30** as a print request (step S**75**). Then, the image forming apparatus **30** (specifically, its hardware processor) forms and prints an image on a sheet, based on the received print data of the CMYK bitmap image (step S**76**).

[0008] In the image forming system **1**A, the preview data is only used for preview, and is not effectively utilized. Accordingly, there is known a system in which an image input/output controller (www server) is provided between a PC and a printer. The image input/output controller converts information to be printed, which is received from the PC, into a bitmap image for the printer, and stores the bitmap image. Upon receiving a preview instruction from the PC, the image input/output controller reads and transmits the bitmap image to the PC. Also, upon receiving a print instruction from the PC, the image input/output controller reads and transmits the bitmap image to the printer (Japanese Patent Application Publications No. 10-297057 (JP 10-297057 A)).

[0009] Depending on print data, it takes time to perform a rasterization process, so that it may take time to perform a preview process and a print process. However, in the system of JP 10-297057 A, all the rasterization processes are uniformly performed by the image input/output controller. Therefore, it is desired to more efficiently perform a rasterization process.

SUMMARY

[0010] An object of the present invention is to efficiently perform a rasterization process on document data.

[0011] In order to achieve the above object, according to an aspect of the present invention, there is provided an information processing apparatus that causes an image forming apparatus to print document data, the information processing apparatus including:

[0012] a hardware processor that obtains document data to be printed, determines whether a print preview process has been performed on the obtained document data, generates data for printing corresponding to the document data based on whether the print preview process has been performed, and transmits the data for printing toward the image forming apparatus.

[0013] According to another aspect of the present invention, there is provided a print control method that causes an image forming apparatus to print document data, the print control method including:

[0014] controlling to obtain document data to be printed, determine whether a print preview process has been performed on the obtained document data, generate data for printing corresponding to the document data based on whether the print preview process has been performed, and transmit the data for printing toward the image forming apparatus.

[0015] According to still another aspect of the present invention, there is provided a non-transitory recording medium storing a computer readable program that causes a computer of an information processing apparatus to function as a hardware processor, the information processing apparatus causing an image forming apparatus to print document data, the hardware processor being configured to:

[0016] obtain document data to be printed, determine whether a print preview process has been performed on the obtained document data, generate data for printing corresponding to the document data based on whether the print preview process has been performed, and transmit the data for printing toward the image forming apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The advantages and features provided by one or more embodiments of the invention will become more fully

understood from the detailed description given hereinbelow and the appended drawings which are given by way of illustration only, and thus are not intended as a definition of the limits of the present invention.

[0018] FIG. **1** illustrates the schematic configuration of an image forming system according to an embodiment of the present invention.

[0019] FIG. **2** is a block diagram illustrating a main functional configuration of a client PC.

[0020] FIG. **3** is a block diagram illustrating a main functional configuration of a DFE.

[0021] FIG. **4** is a block diagram illustrating a main functional configuration of an image forming apparatus.

[0022] FIG. **5** illustrates a rasterizer table.

[0023] FIG. **6** is a flowchart illustrating a first preview process.

[0024] FIG. **7** is a flowchart illustrating a first print control process.

[0025] FIG. **8** illustrates the operation of the image forming system when the client PC performs a rasterization process.

[0026] FIG. **9** illustrates the operation of the image forming system when the DFE performs a rasterization process.

[0027] FIG. **10** is a flowchart illustrating a second preview process.

[0028] FIG. **11** is a flowchart illustrating a second print control process.

[0029] FIG. **12** illustrates the operation of the image forming system when the DFE performs a print control process.

[0030] FIG. **13** is a flowchart illustrating a third print control process.

[0031] FIG. **14** illustrates the operation of the image forming system when the DFE performs a preview process and a print control process.

[0032] FIG. **15** illustrates the operation of a related-art image forming system.

DETAILED DESCRIPTION OF EMBODIMENTS

[0033] An embodiment and modifications of the present invention will be described in detail with reference to the accompanying drawings. However, the present invention is not limited to the examples illustrated in the drawings.

EMBODIMENT

[0034] An embodiment of the present invention will be described with reference to FIGS. **1** to **9**. First, the device configuration of an image forming system **1** according to the present embodiment will be described with reference to FIGS. **1** to **4**. FIG. **1** illustrates a block diagram illustrating the schematic configuration of the image forming system **1** according to the present embodiment. FIG. **2** is a block diagram illustrating a main functional configuration of a client PC **10**. FIG. **3** is a block diagram illustrating a main functional configuration of a DFE **20**. FIG. **4** is a block diagram illustrating a main functional configuration of an image forming apparatus **30**.

[0035] The image forming system **1** of the present embodiment is a print system that forms and prints an image of document data on a sheet, in response to an instruction from the user. As illustrated in FIG. **1**, the image forming system **1** includes the client PC **10**, the DFE **20**, and the image forming apparatus **30**. The client PC **10** and the DFE **20** are communicably connected to each other via a communication network N such as a local area network (LAN). The DFE **20** and the image forming apparatus **30** are communicably connected to each other in a peer-to-peer manner over a communication system such as a universal serial bus (USB).

[0036] The client PC **10** is used by the user. The client PC **10** is an information processing apparatus that receives a user input such as a print instruction with respect to the image forming apparatus **30** and a preview display instruction, generates preview data (preview image data), and transmits document data to be printed or the preview data to the DFE **20**. The client PC **10** may be, but not limited to, a desktop PC, for example. The client PC **10** may be any other information processing apparatus (information terminal) such as a notebook PC and a tablet PC.

[0037] The DFE **20** is an information processing apparatus that converts document data or preview data transmitted from the client PC into print data, and causes the image forming apparatus **30** to print the print data. The DFE **20** may be, for example, an information processing apparatus such as a PC and a server.

[0038] The image forming apparatus **30** is a printing apparatus that forms and prints an image on a sheet based on print data transmitted from the DFE **20**. The image forming apparatus **30** may be, not limited to, a color electrophotographic printer, for example. The image forming apparatus **30** may be any other image forming apparatus using a different image forming method such as an inkjet recording method, and may be any image forming apparatus of a different apparatus type such as a multifunction peripheral (MFP). Further, the image forming apparatus **30** may be an image forming apparatus that forms a monochrome image.

[0039] As illustrated in FIG. **2**, the client PC **10** includes a central processing unit (CPU) **11**, an operation interface **12**, a random access memory (RAM) **13**, a display **14**, a storage **15**, and a network interface (I/F) **16**. These components of the client PC **10** are connected to each other via a bus.

[0040] The CPU **11** reads a specified program from among system programs and application programs stored in the storage **15**, loads the program to the RAM **13**, and performs various types of processing in accordance with the program loaded in the RAM **13**.

[0041] The operation interface **12** includes a keyboard having various keys, and a pointing device such as a mouse. The operation interface **12** receives a user input via the keys and a position input, and outputs the operation information to the CPU **11**. The operation interface **12** may include a touch panel disposed on the display screen of the display **14** so as to receive a user's touch input.

[0042] The RAM **13** provides a work memory space (work area), and stores temporary data.

[0043] The display **14** includes a display panel such as a liquid crystal display (LCD) and an electroluminescence (EL) display. Under the control of the CPU **11**, the display **14** displays various types of display information.

[0044] The storage **15** includes a hard disk drive (HDD) and a solid state drive (SSD). The storage **15** is a storage that stores various programs and various types of data in a readable and writable manner. The storage **15** stores especially an application program serving as a print driver for causing the CPU **11** to function as an application AP**1** (described below).

[0045] The network I/F **16** is a communication interface such as a network card connected to a communication network N. The network I/F **16** transmits and receives information to and from apparatuses such as the DFE **20** on the communication network N.

[0046] As illustrated in FIG. **3**, the DFE **20** includes a CPU **21**, an operation interface **22**, a RAM **23**, a storage **25**, a display **24**, a network I/F **26**, and a video I/F **27**. These components of the DFE **20** are connected to each other via a bus.

[0047] The CPU **21** reads a specified program from among system programs and application programs stored in the storage **25**, loads the program to the RAM **23**, and performs various types of processing in accordance with the program loaded in the RAM **23**.

[0048] The operation interface **22** includes a keyboard having various keys, and a pointing device such as a mouse. The operation interface **22** receives a user input via the keys and a position input, and outputs the operation information to the CPU **21**. The operation interface **22** may include a touch panel disposed on the display screen of the display **24** so as to receive a user's touch input.

[0049] The RAM **23** provides a work memory space (work area), and stores temporary data.

[0050] The display **24** includes a display panel such as an LCD and an EL display. The display **24** displays various types of display information under the control of the CPU **21**.

[0051] The storage **25** includes an HDD and an SSD. The storage **25** is a storage that stores various programs and various types of data in a readable and writable manner. The storage **25** especially stores a program for executing the operation of the DFE **20** (described below).

[0052] The network I/F **26** is a communication interface such as a network card connected to a communication network N. The network I/F **26** transmits and receives information to and from apparatuses such as the client PC **10** on the communication network N.

[0053] The video I/F **27** is a communication interface connected to the image forming apparatus **30**. The video I/F **27** transmits and receives information to and from the image forming apparatus **30** through a cable.

[0054] As illustrated in FIG. **4**, the image forming apparatus **30** includes a CPU **31**, an operation interface **32**, a RAM **33**, a display **34**, a storage **35**, a sheet feeder **36**, an image former **37**, a sheet discharger **38**, and a video I/F **39**. These components of the image forming apparatus **30** are connected to each other via a bus.

[0055] The CPU **31** reads a specified program from among system programs and application programs stored in the storage **35**, loads the program to the RAM **33**, and performs various types of processing in accordance with the program loaded in the RAM **33**.

[0056] The operation interface **32** includes various keys. The operation interface **32** receives various settings entered by the user via the keys, and outputs the operation information to the CPU **31**.

[0057] The RAM **33** provides a work memory space (work area), and stores temporary data.

[0058] The display **34** includes a display panel such as an LCD and an EL display. The display **34** displays various types of display information under the control of the CPU **31**.

[0059] The storage **35** includes a flash memory. The storage **35** is a storage that stores various programs and various types of data in a readable and writable manner. The storage **35** especially stores a program for executing the operation of the image forming apparatus **30** (described below).

[0060] The sheet feeder **36** includes a sheet feed tray, a manual feed tray, and a conveyance roller. Under the control of the CPU **31**, the sheet feeder **36** picks up a sheet from the sheet feed tray or the manual feed tray, and conveys the sheet to the image former **37**.

[0061] The image former **37** includes image forming units of four colors of C, M, Y, and K, and a fixer. The image former **37** forms a toner image on a sheet conveyed from the sheet feeder **36**, based on print data, using the image forming units of four colors of C, M, Y, and K, under the control of the CPU **31**, and fixes the toner image on the sheet using the fixer.

[0062] Each of the image forming units of the respective colors of C, M, Y, and K includes a photoconductor drum, a charger, an exposure, a developer, and a cleaner. For example, in the image forming unit for color cyan, the charger charges the photoconductor drum, which is a rotating conductive cylinder. The exposer exposes the photoconductor drum in accordance with the print data of the color cyan so as to form an electrostatic latent image. Then, the developer supplies toner of the color cyan to the photoconductor drum with the electrostatic latent image formed thereon so as to transfer and develop the image onto the transfer target. The cleaner collects the residual toner on the photoconductor drum. The image forming units for the other colors have the same configuration.

[0063] In the case where electrophotographic image formation by the image former **37** is of a tandem system, the image forming units of the respective colors of C, M, Y and K are arranged in series in the sheet conveyance direction. The image forming units of the respective colors transfer toner images of the respective colors to a transfer target sheet being conveyed such that the toner images are superposed on each other.

[0064] In the case where electrophotographic image formation by the image former **37** is of a four-cycle system, the image former **37** further includes an intermediate transfer belt serving as an intermediate transfer body, and a transfer roller. The image forming units of the respective colors of C, M, Y and K transfer toner images of the respective colors to the intermediate transfer belt such that the toner images are superposed on each other. Then, the transfer roller transfers the toner images from the intermediate transfer belt to a sheet. The toner images of the four colors transferred to the sheet are heated and pressed so as to be fixed on the sheet by the fixer.

[0065] The sheet discharger **38** includes a sheet discharge tray and a conveyance roller. Under the control of the CPU **31**, the sheet discharger **38** conveys the sheet with an image formed by the image former **37** to the sheet discharge tray so as to discharge the sheet. The sheet discharger **38** may include a flipper that turns over a sheet with an image formed on one side thereof by the image former **37** and feeds again the sheet to the image former **37**. With this flipper, it is possible to form images on both sides of a sheet.

[0066] The video I/F **39** is a communication interface connected to the DFE **20**. The video I/F **39** transmits and receives information to and from the DFE **20** through a cable.

[0067] In the following, information stored in advance in the storage **15** of the client PC **10** will be described with reference to FIG. **5**. FIG. **5** illustrates a rasterizer table **40**.

[0068] The rasterizer table **40** illustrated in FIG. **5** is stored in the storage **15** in advance. The rasterizer table **40** includes the following items: a preview setting **41**, and a print resolution **42**. The preview setting **41** indicates the resolution [dots per inch (DPI)] of preview data for preview. The print resolution **42** indicates the resolution [DPI] at which printing is actually performed by the image forming apparatus **30**. In the rasterizer table **40**, DFE (DFE **20**) or APP (application AP**1** (described below)) is specified in accordance with the set value of the preview setting **41** and the set value of the print resolution **42**.

[0069] In the following, the operation of the image forming system **1** will be described with reference to FIGS. **6** and **9**. FIG. **6** is a flowchart illustrating a first preview process. FIG. **7** is a flowchart illustrating a first print control process. FIG. **8** illustrates the operation of the image forming system **1** when the client PC **10** performs a rasterization process. FIG. **9** illustrates the operation of the image forming system **1** when the DFE **20** performs a rasterization process.

[0070] In the client PC **10**, document data m**1** including a plurality of pages in a document file format is created and stored in the storage **15** in advance according to user inputs via the operation interface **12**, by execution of a word processing application program, for example. The document data m**1** may include a print stamp indicating the print date.

[0071] In the client PC **10**, for example, upon receiving an instruction entered by the user via the operation interface **12** to start a print driver for the document data m**1** the CPU **11** starts to operate as the application AP**1** according to the application program stored in the storage **15** and serving as a print driver in the present embodiment.

[0072] Then, in the client PC **10**, for example, upon receiving an instruction entered by the user via the operation interface **12** to execute a preview process for the document data, the CPU **11** (application AP**1**) executes the first preview process illustrated in FIG. **6**.

[0073] First, the CPU **11** receives a preview range of the document data entered by the user via the operation interface **12** (step S**11**). The preview range may be set to any range in units of pages to be previewed. For example, the preview range may be only a front page, all the pages, or pages of one or more page numbers.

[0074] Then, the CPU **11** performs a rasterization process for preview, on page data in the preview range of the document data entered in step S**11**, so as to generate preview data of a bitmap image (step S**12**). In step S**12**, for example, the resolution of preview data may be fixed in advance, or may be set to any resolution according to a user input via the operation interface **12**.

[0075] Then, the CPU **11** displays the preview data generated in step S**12** on the display **14**, and stores the preview data in the RAM **13** or the storage **15** (step S**13**). Thus, the first preview process is ended.

[0076] Further, in the client PC **10**, while the print driver is running, the CPU **11** (application AP**1**) sets a print resolution in the image forming apparatus **30** for the document data m**1** to be printed, according to the print resolution entered by the user via the operation interface **12**, and stores the print resolution in the RAM **13**. Then, in the client PC **10**, for example, upon receiving a print instruction entered by the user via the operation interface **12**, the CPU **11** (application AP**1**) executes the first print control process illustrated in FIG. **7**.

[0077] First, the CPU **11** selects one of unselected pages from the top of the document data m**1** to be printed (step S**21**). Then, the CPU **11** determines whether a preview process has been performed on the page selected in step S**21**, based on whether preview data corresponding to the page selected in step S**21** is present (has been generated) and is stored in the RAM **13** or the storage **15** (step S**22**). If a preview process has been performed (step S**22**; YES), the CPU **11** refers to the rasterizer table **40** stored in the storage **15**, and determines whether the resolution of the preview data corresponding to the page selected in step S**21** and the print resolution stored in the RAM **13** are equal (step S**23**).

[0078] If the resolution of the preview data and the print resolution are equal (step S**23**; YES), the CPU **11** determines whether a date stamp function is enabled on (a date stamp is included in) the preview data corresponding to the page selected in step S**21** (step S**24**). If the date stamp function is enabled (step S**24**; YES), the CPU **11** acquires a date stamp from the preview data corresponding to the page selected in step S**21**, and determines whether the date of the date stamp coincides with the current date (print date) (step S**25**).

[0079] If the date stamp function is not enabled (step S**24**; NO), or if the dates coincide (step S**25**; YES), the CPU **11** reads preview data corresponding to the page selected in step S**21** from the storage **15**, and transmits the read preview data corresponding to the page to the DFE **20** via the network I/F **16** (step S**26**).

[0080] If a preview process has not been performed (step S**22**; NO), if the resolution of the preview data and the print resolution are not equal (step S**23**; NO), or if the dates do not coincide (step S**25**; NO), the CPU **11** reads document data corresponding to the page selected in step S**21** from the storage **15**, and transmits the read document data for the page, together with an instruction to execute a rasterization process, to the DFE **20** via the network I/F **16** (step S**27**).

[0081] After step S**26** or S**27**, the CPU **11** determines whether there is no page to be selected in step S**21** and the first print control process is to be ended (step S**28**). If the process is not to be ended (step S**28**; NO), the process returns to step S**21**. If the process is to be ended (step S**28**; YES), the first print control process is ended.

[0082] Referring now to FIG. **8**, the operation of the image forming system **1** when preview data is transmitted in step S**26** will be described. As illustrated in FIG. **8**, first, in the client PC **10**A, the CPU **11** (application AP**1**) reads and obtains the created document data m**1** from the storage **15** (step S**10**). Then, the CPU **11** executes the first preview process and the first print control process.

[0083] Then, in step S**26**, the CPU **11** transmits preview data corresponding to a page of the document data m**1** to the DFE **20**. In response to step S**26**, the CPU **21** of the DFE **20** receives the preview data from the client PC **10**, via the network I/F **26**.

[0084] Then, the CPU **21** of the DFE **20** performs image processing to convert the received preview data of an RGB bitmap image into print data of a CMYK bitmap image (step S**31**). The image processing in step S**31** includes color conversion for the image forming apparatus **30**. In the image

forming apparatus **30**, the maximum toner amount of each of the CMYK colors is determined in advance, and color conversion for the image forming apparatus **30** is color conversion in accordance with the maximum toner amount of each color.

[0085] Then, the CPU **21** of the DFE **20** transmits the print data generated in step S**31** to the image forming apparatus **30**, via the video I/F **27** (step S**32**). In response to step S**32**, the CPU **31** of the image forming apparatus **30** receives the print data from the DFE **20**, via the video I/F **39**.

[0086] Then, the CPU **31** of the image forming apparatus **30** controls the sheet feeder **36**, the image former **37**, and the sheet discharger **38** to form and print an image on a sheet, based on the received print data (step S**33**).

[0087] Referring now to FIG. **9**, the operation of the image forming system **1** when document data is transmitted in step S**27** will be described. As illustrated in FIG. **9**, first, in the client PC **10**A, the CPU **11** (application AP**1**) reads and obtains the created document data m**1** from the storage **15** (step S**10**), and executes the first preview process and the first print control process.

[0088] Then, in step S**27**, the CPU **11** transmits document data corresponding to a page of the document data m**1**, together with an instruction to execute a rasterization process, to the DFE **20**. In response to step S**27**, the CPU **21** of the DFE **20** receives the document data together with the instruction to execute a rasterization process, from the client PC **10** via the network I/F **26**.

[0089] Then, the CPU **21** of the DFE **20** performs a rasterization process to convert the received document data into an RGB bitmap image data (step S**30**). Then, the CPU **21** of the DFE **20** performs image processing to convert the generated RGB bitmap image data into print data of a CMYK bitmap image (step S**31**). Steps S**32** and S**33** of FIG. **9** are the same as those of FIG. **8**.

[0090] As described above, according to the present embodiment, the client PC **10** causes the image forming apparatus **30** to print document data. The client PC **10** includes the CPU **11** that obtains document data to be printed, determines whether a preview process has been performed on the obtained document data, generates data for printing (preview data or document data) corresponding to the document data based on whether a preview process has been performed, and transmits the data for printing to the DFE **20** connected to the image forming apparatus **30**.

[0091] Therefore, the preview data that has been rasterized in the preview process is effectively utilized. This makes it possible to efficiently perform a rasterization process on document data.

[0092] If a preview process has not been performed on the obtained document data, the CPU **11** specifies the obtained document data as data for printing. Therefore, even if a preview process has not been performed, it is possible to transmit the document data as data for printing to the DFE **20** and reliably perform a rasterization process thereon.

[0093] If a preview process has been performed on the obtained document data, the CPU **11** obtains preview data generated by the preview process, and specifies the obtained preview data as data for printing. Therefore, if a preview process has been performed, the preview data that has been rasterized is effectively utilized as data for printing. This makes it possible to efficiently perform a rasterization process on document data.

[0094] If a preview process has been performed on the obtained document data, and if the preview process has been performed under a predetermined condition, the CPU **11** obtains preview data generated by the preview process, and specifies the obtained preview data as data for printing. The predetermined condition is that the resolution in the preview process is equal to the print resolution of the image forming apparatus **30**. Therefore, the resolution in the preview process is equal to the print resolution of the image forming apparatus **30**, so that printing is performed at an appropriate resolution.

[0095] The CPU **11** determines whether another predetermined condition is satisfied, that is, whether the print stamp function on the preview data is enabled. If the print stamp function is not enabled, the CPU **11** obtains the preview data, and specifies the obtained preview data as data for printing. Accordingly, if the print stamp function is enabled and the print stamp of the preview data differs from the print stamp of the document data, the preview data is prevented from being printed.

[0096] The CPU **11** determines whether another predetermined condition is satisfied, that is, whether time information (date) of the print stamp function on the preview data coincides with current time information (date). If the time information (date) of the print stamp function on the preview data coincides with the current time information (date), the CPU **11** obtains the preview data, and specifies the obtained preview data as data for printing. Accordingly, if the time information (date) of the print stamp of the preview data differs from the time information (date) of the print stamp of the document data, the preview data is prevented from being printed.

[0097] The document data includes a plurality of pages. The CPU **11** obtains the document data to be printed in units of pages, determines whether a preview process has been performed on the obtained document data, generates data for printing (preview data or document data) corresponding to the document data based on whether a preview process has been performed, and transmits the data for printing to the DFE **20** connected to the image forming apparatus **30**. Therefore, the pages of the preview data that has been rasterized in the preview process are effectively utilized. This makes it possible to more efficiently perform a rasterization process on document data in units of pages.

[0098] The preview process is performed by the client PC **10**. Therefore, the client PC **10** can easily obtain preview data, so that the processing load on the DFE **20** is reduced.

First Modification

[0099] A first modification of the above embodiment will be described with reference to FIGS. **10** and **11**. FIG. **10** is a flowchart illustrating a second preview process. FIG. **11** is a flowchart illustrating a second print control process.

[0100] In the above embodiment, if the resolution of preview data is equal to the print resolution, printing is performed using the preview data. Meanwhile, in the present modification, preview data is generated to have a resolution equal to the print resolution.

[0101] In the present modification, the image forming system **1** is used as in the above embodiment. However, the storage **15** of the client PC **10** stores application programs for executing a second preview process and a second print control process (described below).

[0102] In the following, the operation of the image forming system **1** will be described with reference to FIGS. **10** and **11**. In the client PC **10**, document data m**1** including a plurality of pages in a document file format is created and stored in the storage **15** in advance according to user inputs via the operation interface **12**, by execution of a word processing application program, for example. The document data m**1** may include a print stamp indicating the print date.

[0103] In the client PC **10**, for example, upon receiving an instruction entered by the user via the operation interface **12** to start a print driver for the document data m**1** the CPU **11** starts to operate as the application AP**1** according to the application program stored in the storage **15** and serving as a print driver in the present embodiment.

[0104] Further, in the client PC **10**, while the print driver is running, the CPU **11** (application AP**1**) sets a print resolution in the image forming apparatus **30** for the document data m**1** to be printed, according to the print resolution entered by the user via the operation interface **12**, and stores the print resolution in the RAM **13**.

[0105] Then, in the client PC **10**, for example, upon receiving an instruction entered by the user via the operation interface **12** to preview the document data m**1** the CPU **11** (application AP**1**) executes the second preview process illustrated in FIG. **10**.

[0106] First, the CPU **11** executes step S**41**. Step S**41** is the same as step S**11** of the first preview process of FIG. **6**. Then, the CPU **11** obtains the print resolution set and stored in the RAM **13** (step S**42**). Then, the CPU **11** performs a rasterization process for preview, on page data in the preview range of the document data m**1** entered in step S**41**, at a resolution equal to the print resolution obtained in step S**42**, so as to generate preview data of a bitmap image (step S**43**). Step S**44** is the same as step S**13** of the first preview process of FIG. **6**.

[0107] Then, in the client PC **10**, for example, upon receiving a print instruction entered by the user via the operation interface **12**, the CPU **11** (application AP**1**) executes the second print control process illustrated in FIG. **11**.

[0108] Steps S**51** to S**57** of the second print control process are the same as steps S**21**, S**22**, and S**24** to S**28** of the first print control process of FIG. **7**.

[0109] As described above, according to the present modification, when the preview process is performed by the client PC **10**, the preview process is performed at a resolution equal to the print resolution of the image forming apparatus **30**. Therefore, the processing load on the client PC **10** and the processing load on the DFE **20** while performing print control are reduced.

Second Modification

[0110] A second modification of the above embodiment will be described with reference to FIGS. **12** to **14**. FIG. **12** illustrates the operation of an image forming system **1***a* when a DFE **20***a* performs a print control process. FIG. **13** is a flowchart illustrating a third print control process. FIG. **14** illustrates the operation of the image forming system **1***b* when a DFE **20***b* performs a preview process and a print control process.

[0111] In the above embodiment, the client PC **10** performs a preview process and a print control process. Meanwhile, in the present modification, the DFE **20***a* performs a print control process.

[0112] Referring first to FIG. **12**, according to a first apparatus configuration of the present modification, the image forming system **1***a* is used in place of the image forming system **1** of the above embodiment. The image forming system **1***a* includes a client PC **10***a*, the DFE **20***a*, and the image forming apparatus **30**.

[0113] The client PC **10***a* has the same functional configuration as the client PC **10** of the above embodiment, and executes a first preview process. The DFE **20***a* has the same functional configuration as the DFE **20** of the above embodiment, and executes a third print control process (described below). The rasterizer table **40** and a third print control program for executing the third print control process are stored in a storage **25**.

[0114] In the following, the operation of the image forming system **1***a* will be described with reference to FIGS. **12** and **13**. First, in the client PC **10***a*, a CPU **11** starts to operate as an application AP**1***a*, according to an application program serving as a print driver, and executes the same first preview process as that of FIG. **6**.

[0115] Then, in the DFE **20***a*, upon receiving document data m**1** to be printed from the client PC **10***a* (application AP**1***a*) via a network I/F **26** and storing the document data m**1** in the storage **25** (step S**60**), the CPU **21** executes the third print control process, in association with the third print control program read from the storage **25** and appropriately loaded to the RAM **23**.

[0116] As illustrated in FIG. **13**, the CPU **21** executes steps S**61** to S**65**. Steps S**61** to S**65** correspond to steps S**21** to S**25** of FIG. **6**, but are executed by the CPU **21**. Also, in steps S**62** to S**64**, the CPU **21** refers to the rasterizer table **40** stored in the storage **25**; requests the client PC **10***a* (application AP**1***a*) for information as to whether preview data of a page to be printed is stored in the RAM **13**, the resolution, and information as to whether the date stamp function is enabled, so as to obtain these pieces of information, via a network I/F **26**; and uses the obtained pieces of information.

[0117] If the date stamp function is not enabled (step S**64**; NO), or if the dates coincide (step S**65**; YES), the CPU **21** requests the client PC **10***a* (application AP**1***a*) for preview data corresponding to the page selected in step S**61** so as to obtain the preview data via the network I/F **26**, performs image processing on the obtained preview data of the page so as to generate print data, and transmits the generated print data for the page to the image forming apparatus **30** via the video I/F **27** (step S**66**).

[0118] If a preview process has not been performed (step S**62**; NO), if the resolution of the preview data and the print resolution are not equal (step S**63**; NO), or if the dates do not coincide (step S**65**; NO), the CPU **11** reads document data corresponding to the page selected in step S**61** from the storage **25**, performs a rasterization process and image processing on the read document data corresponding to the page so as to generate print data, and transmits the generated print data to the image forming apparatus **30** via the video I/F **27** (step S**67**).

[0119] In step S**33**, the CPU **31** of the image forming apparatus **30** forms and prints an image on a sheet, based on the received print data.

[0120] Referring next to FIG. **14**, according to a second apparatus configuration of the present modification, an image forming system **1***b* is used in place of the image forming system **1** of the above embodiment. The image

forming system **1***b* includes a client PC **10***b*, the DFE **20***b*, and the image forming apparatus **30**.

[0121] The client PC **10***b* has the same functional configuration as the client PC **10** of the above embodiment. The DFE **20***b* has the same functional configuration as the DFE **20** of the above embodiment, and executes a third preview process similar to the first preview process of the above embodiment, and a third print control process. The rasterizer table **40**, a third preview program for executing the third preview process, and a third print control program for executing the third print control process are stored in a storage **25**.

[0122] In the following, the operation of the image forming system **1***b* will be described with reference to FIG. **14**. First, in the client PC **10***b*, the CPU **11** starts to operate as an application AP**1***b* according to an application program serving as a print driver, and transmits document data to be previewed to the DFE **20***b*, via the network I/F **16** (step S**10***b*).

[0123] Then, a CPU **21** of the DFE **20***b* receives the document data to be previewed from the client PC **10***b* (application AP**1***b*) via a network I/F **26**, and stores the document data in the storage **25**. Then, the CPU **21** receives the preview range of the document data m**1** entered by the user on the client PC **10***b* (application AP**1***b*), from the client PC **10***b* (application AP**1***b*) via the network I/F **26** (step S**11***b*).

[0124] Then, the CPU **21** performs a rasterization process for preview, on page data in the preview range, which is entered in step S**11***b*, of the document data m**1** stored in the storage **25**, so as to generate preview data of a bitmap image, and stores the preview data in the RAM **23** or the storage **25** (step S**12***b*). Then, the third preview process ends. A part of the RAM **23** or the storage **25** is available to the client PC **10***b* as a shared memory with the client PC **10***b*, and stores the preview data generated in step S**12***b*. Then, the CPU **11** of the client PC **10***b* reads and receives the preview data generated in step S**12***b* from the RAM **23** or the storage **25** of the client PC **10***b* (application AP**1***b*), via the network I/F **16**, and displays the preview data on the display **14** (step S**13***b*).

[0125] Then, the CPU **21** receives the document data m**1** from the client PC **10***b* (application AP**1***b*) via the network I/F **26**, stores the document data m**1** in the storage **25** (step S**60**), and executes the third print control process. Note that, in steps S**62** to S**64**, the CPU **21** obtains information as to whether preview data of a page to be printed is stored in the RAM **23** or the storage **25**, the resolution, and information as to whether the date stamp function is enabled.

[0126] As described above, according to the present modification, the DFE **20** causes the image forming apparatus **30** to print document data. The DFE **20** includes the CPU **21** that obtains document data to be printed, determines whether a preview process has been performed on the obtained document data, generates data for printing (print data) corresponding to the document data based on whether a preview process has been performed, and transmits the data for printing to the image forming apparatus **30**.

[0127] Therefore, the preview data that has been rasterized in the preview process is effectively utilized. This makes it possible to efficiently perform a rasterization process on document data.

[0128] If a preview process has not been performed on the obtained document data, the CPU **21** performs a rasterization process and image processing on the document data so as to generate data for printing (print data). Therefore, even if a preview process has not been performed, it is possible to transmit the document data subjected to the rasterization process and image processing to the image forming apparatus **30** and reliably perform printing.

[0129] Meanwhile, if a preview process has been performed on the obtained document data, the CPU **21** obtains preview data generated by the preview process, and performs image processing on the preview data so as to generate data for printing (print data). Therefore, if a preview process has been performed, the preview data that has been rasterized is effectively utilized as data for printing. This makes it possible to efficiently perform a rasterization process on document data.

[0130] If a preview process has been performed on the obtained document data, and if the preview process has been performed under a predetermined condition, the CPU **21** obtains preview data generated by the preview process, and performs image processing on the preview data so as to generate data for printing (print data). The predetermined condition is that the resolution in the preview process is equal to the print resolution of the image forming apparatus **30**. Therefore, the resolution in the preview process is equal to the print resolution of the image forming apparatus **30**, so that printing is performed at an appropriate resolution.

[0131] The CPU **21** determines whether another predetermined condition is satisfied, that is, whether the print stamp function on the preview data is enabled. If the print stamp function is not enabled, the CPU **21** obtains the preview data, and specifies the obtained preview data as data for printing (print data). Accordingly, if the print stamp function is enabled and the print stamp of the preview data differs from the print stamp of the document data, the preview data is prevented from being printed.

[0132] The CPU **21** determines whether another predetermined condition is satisfied, that is, whether time information (date) of the print stamp function on the preview data coincides with current time information (date). If the time information (date) of the print stamp function on the preview data coincides with the current time information (date), the CPU **21** obtains the preview data, and specifies the obtained preview data as data for printing. Accordingly, if the time information (date) of the print stamp of the preview data differs from the time information (date) of the print stamp of the document data, the preview data is prevented from being printed.

[0133] The document data includes a plurality of pages. The CPU **21** obtains the document data to be printed in units of pages, determines whether a preview process has been performed on the obtained document data, generates data for printing (print data) corresponding to the document data based on whether a preview process has been performed, and transmits the data for printing to the image forming apparatus **30**. Therefore, the pages of the preview data that has been rasterized in the preview process are effectively utilized. This makes it possible to more efficiently perform a rasterization process on document data in units of pages.

[0134] The preview process is performed by the client PC **10** or the DFE **20**. Therefore, the client PC **10** or the DFE **20** can easily obtain preview data, so that the processing load on the DFE **20** or the client PC **10** is reduced.

[0135] When the preview process is performed by the DFE **20**, generated preview data is stored in the RAM **23** or

the storage **25** shared with the client PC **10**. Therefore, the client PC **10** can easily obtain the preview data.

[0136] Note that the above embodiment and modifications are merely examples of an information processing apparatus, a print control method, and a program according to a preferred embodiment of the present invention, and the present invention is not limited thereto. For example, at least two of the above embodiment and the first and second modifications may be appropriately combined.

[0137] The detailed configuration and detailed operation of the components of the image forming system **1** of the above embodiment may be appropriately modified without departing from the scope of the present invention.

[0138] Although embodiments of the present invention have been described and illustrated in detail, the disclosed embodiments are made for purposes of illustration and example only and not limitation. The scope of the present invention should be interpreted by terms of the appended claims.

[0139] The entire disclosure of Japanese patent application No. 2019-156511, filed on Aug. 29, 2019, is incorporated herein by reference in its entirety.

What is claimed is:

1. An information processing apparatus that causes an image forming apparatus to print document data, the information processing apparatus comprising:

a hardware processor that obtains document data to be printed, determines whether a print preview process has been performed on the obtained document data, generates data for printing corresponding to the document data based on whether the print preview process has been performed, and transmits the data for printing toward the image forming apparatus.

2. The information processing apparatus according to claim **1**, wherein when the print preview process has not been performed on the obtained document data, the hardware processor specifies the obtained document data as the data for printing, or performs a rasterization process and image processing on the document data to generate the data for printing.

3. The information processing apparatus according to claim **1**, wherein when the print preview process has been performed on the obtained document data, the hardware processor obtains preview image data generated by the print preview process, and specifies the obtained preview image data as the data for printing, or performs image processing on the preview image data to generate the data for printing.

4. The information processing apparatus according to claim **3**, wherein when the print preview process has been performed on the obtained document data, and when the print preview process has been performed under a predetermined condition, the hardware processor obtains preview image data generated by the print preview process, and specifies the obtained preview image data as the data for printing, or performs image processing on the preview image data to generate the data for printing.

5. The information processing apparatus according to claim **4**, wherein when the hardware processor determines the predetermined condition is satisfied by determining that a resolution in the print preview process is equal to a print resolution of the image forming apparatus, the hardware processor obtains preview image data generated by the print preview process, and specifies the obtained preview image data as the data for printing, or performs image processing on the preview image data to generate the data for printing.

6. The information processing apparatus according to claim **4**, wherein the hardware processor determines whether the predetermined condition is satisfied by determining whether a print stamp function of the preview image data is enabled, and wherein when the print stamp function is not enabled, the hardware processor obtains the preview image data, and specifies the obtained preview image data as the data for printing, or performs image processing on the preview image data to generate the data for printing.

7. The information processing apparatus according to claim **4**, wherein the hardware processor determines whether the predetermined condition is satisfied by determining whether time information of the print stamp function of the preview image data and current time information coincide, and wherein when the time information of the print stamp function of the preview image data and the current time information coincide, the hardware processor obtains the preview image data, and specifies the obtained preview image data as the data for printing, or performs image processing on the preview image data to generate the data for printing.

8. The information processing apparatus according to claim **1**,

wherein the document data includes a plurality of pages; and

wherein the hardware processor obtains the document data to be printed in units of pages, determines whether a print preview process has been performed on the obtained document data, generates data for printing corresponding to the document data based on whether the print preview process has been performed, and transmits the data for printing toward the image forming apparatus.

9. The information processing apparatus according to claim **1**, wherein the print preview process is performed by the information processing apparatus, or by another information processing apparatus that has transmitted the document data to the information processing apparatus.

10. The information processing apparatus according to claim **1**, wherein when the print preview process is performed by the information processing apparatus, the print preview process is performed at a resolution equal to a print resolution of the image forming apparatus.

11. The information processing apparatus according to claim **1**, wherein when the print preview process is performed by the information processing apparatus, generated preview image data is stored in a storage shared with another information processing apparatus that has transmitted the document data.

12. A print control method that causes an image forming apparatus to print document data, the print control method comprising:

controlling to obtain document data to be printed, determine whether a print preview process has been performed on the obtained document data, generate data for printing corresponding to the document data based on whether the print preview process has been performed, and transmit the data for printing toward the image forming apparatus.

13. A non-transitory recording medium storing a computer readable program that causes a computer of an information processing apparatus to function as a hardware

processor, the information processing apparatus causing an image forming apparatus to print document data, the hardware processor being configured to:

obtain document data to be printed, determine whether a print preview process has been performed on the obtained document data, generate data for printing corresponding to the document data based on whether the print preview process has been performed, and transmit the data for printing toward the image forming apparatus.

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