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## Description

Title of the Invention

INFORMATION PROCESSING APPARATUS AND INFORMATION  
5 PROCESSING SYSTEM

Technical Field

The present invention relates to an  
information processing apparatus and an information  
10 processing system, and more particularly to an  
information processing apparatus and an information  
processing system for supporting install operations.

Background Art

15 In recent years, in embedded devices such as  
image forming apparatuses (hereinafter, simply  
referred to as "devices"), new applications can be  
installed after shipment. However, to prevent the  
cost of the device itself from increasing, the memory  
20 capacity of the device tends to be limited compared  
to general-purpose computers.

Therefore, when plural applications  
installed in the device are operated simultaneously,  
the device is more apt to run out of available memory  
25 compared to general-purpose computers.

Thus, in the conventional technology, there have been proposals for determining whether an application can be installed in an image forming apparatus based on the sum of memory amounts used by the application to be installed and the memory amounts of applications already installed in the image forming apparatus (see, for example, patent document 1).

However, the total memory amount used when plural applications are simultaneously operated does not necessarily correspond to the sum of memory amounts used when the respective applications are operated individually. For example, the memory usage of a library shared by plural applications may not be proportionate to the number of applications operated simultaneously.

When the memory usage of the library is substantially fixed but the total memory usage of the applications is obtained by a simple sum, the memory usage of the library may be redundantly added. Accordingly, the memory amount obtained by a simple sum may be greater than the actual memory usage of the applications. In this case, the image forming apparatus may reject installing an additional application even when the additional application can

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actually be installed.

Meanwhile, when the memory usage of the library exponentially increases with the number of applications that are simultaneously operated, but  
5 the total memory usage of the applications is obtained by a simple sum, the simple sum may be less than the actual memory usage of the applications. In this case, the image forming apparatus may allow an additional application to be installed even when it  
10 is inappropriate to do so.

Patent Document 1: Japanese Laid-Open Patent Application No. 2006-285871

#### Disclosure of Invention

15 The present invention has been made in view of the above-described problems, and it is an object of at least one embodiment of the present invention to provide an information processing apparatus and an information processing system capable of improving  
20 the precision in determining whether a program can be installed.

An aspect of the present invention provides an information processing apparatus including a coexistence condition storage unit configured to  
25 store combination information relevant to

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combinations of different types of first programs that can be installed in a device, the combination information including memory consumption amounts of the combinations; an install information receiving unit configured to receive an install target first program selected as an install target and device information relevant to the device selected as an install destination of the install target first program; and a validity determining unit configured to determine validity of installing the install target first program in the device by determining, by referring to the combination information in the coexistence condition storage unit, a predicted memory consumption amount corresponding to a first combination including the install target first program and an existing first program that is installed in the device and indicated in the device information, and by comparing the predicted memory consumption amount obtained as a determination result with a device memory consumption amount of the device selected as the install destination indicated in the device information.

An aspect of the present invention provides an information processing system comprising an information processing apparatus and a device,

wherein the information processing apparatus includes a coexistence condition storage unit configured to store combination information relevant to combinations of different types of first programs  
5 that can be installed in the device, the combination information including memory consumption amounts of the combinations; an install information receiving unit configured to receive an install target first program selected as an install target and device  
10 information relevant to the device selected as an install destination of the install target first program, the device information being acquired from the device selected as the install destination; and a validity determining unit configured to determine  
15 validity of installing the install target first program in the device by determining, by referring to the combination information in the coexistence condition storage unit, a predicted memory consumption amount corresponding to a first  
20 combination including the install target first program and an existing first program that is installed in the device and indicated in the device information, and by comparing the predicted memory consumption amount obtained as a determination result  
25 with a device memory consumption amount of the device

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selected as the install destination indicated in the device information.

An aspect of the present invention provides a non-transitory computer-readable storage medium  
5 with an executable program stored therein, wherein the program instructs a processor of a computer to execute a method including receiving an install target first program selected as an install target and device information relevant to a device selected  
10 as an install destination of the install target first program; and determining validity of installing the install target first program in the device, the determining of the validity including determining a predicted memory consumption amount corresponding to  
15 a first combination including the install target first program and an existing first program that is installed in the device and indicated in the device information, the predicted memory consumption amount being determined by referring to a coexistence  
20 condition storage unit storing combination information relevant to combinations of different types of first programs that can be installed in the device, the combination information including memory consumption amounts of the combinations, the  
25 determining of the validity further including

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comparing the predicted memory consumption amount  
obtained as a determination result with a device  
memory consumption amount of the device selected as  
the install destination indicated in the device  
5 information.

#### Brief Description of Drawings

FIG. 1 illustrates an example of an install  
support system according to an embodiment of the  
10 present invention;

FIG. 2 illustrates an example of a hardware  
configuration of a program management server  
according to an embodiment of the present invention;

FIG. 3 is an example of a functional block  
15 diagram of an install support system according to an  
embodiment of the present invention;

FIG. 4 is a sequence diagram for describing  
processing procedures of a process of installing a  
program in an image forming apparatus performed by  
20 the install support system;

FIG. 5 illustrates a configuration example  
of device information;

FIGS. 6A and 6B illustrate a flowchart for  
describing an example of processing procedures of an  
25 install validity determination process;

FIG. 7 illustrates a configuration example of a product key association information storage unit;

FIG. 8 illustrates configuration example of  
5 a combination information storage unit;

FIG. 9 illustrates a configuration example of a coexistence condition; and

FIG. 10 illustrates a configuration example of report information.

10

#### Best Mode for Carrying out the Invention

Embodiments of the present invention are described below with reference to the accompanying drawings. FIG. 1 illustrates an example of an  
15 install support system according to an embodiment of the present invention.

In an install support system 1, a program management server 10 and a device management apparatus 20 are connected via a network 40 such as  
20 the Internet. Furthermore, the device management apparatus 20 and one or more image forming apparatuses 30 are connected via a network 50 (wired or wireless) such as LAN (Local Area Network).

The device management apparatus 20 and the  
25 image forming apparatus 30 are located in, for

example, a user environment E1. The user environment E1 is a system environment of a user (customer) of the image forming apparatus 30.

The image forming apparatus 30 is an example of a device, such as a multifunction peripheral that implements multiple functions including printing, scanning, a copying, and fax transmission/reception in a single casing. However, the image forming apparatus 30 may not necessarily be a multifunction peripheral. The image forming apparatus 30 may be a device that implements a single function, such as a printer or a scanner. Furthermore, a device other than an image forming apparatus may be used as the image forming apparatus 30. Functions of the image forming apparatus 30 may be expanded as needed, by adding or updating programs. In the present embodiment, programs are generally divided into application programs (hereinafter, simply referred to as "applications") and platforms. An application is an example of a first program, which is an upper-level program that is directly operated by a user and that causes the image forming apparatus 30 to execute a predetermined job. A platform is an example of a second program, which is a group of lower-level program modules for implementing an execution

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environment of applications. A platform is shared by plural application programs.

The device management apparatus 20 is a computer such as a PC (Personal Computer) for  
5 controlling processes of installing programs in the image forming apparatus 30.

The program management server 10 is a computer such as a PC for managing programs that can be installed in the image forming apparatus 30 and  
10 for determining whether an application can be installed in the image forming apparatus 30 (or whether it is valid (or possible or appropriate) to install the application. The program management server 10 is located in, for example, a manufacturer  
15 environment E2. The manufacturer environment E2 is a system environment at the manufacturer of the image forming apparatus 30.

FIG. 2 illustrates an example of a hardware configuration of the program management server 10  
20 according to an embodiment of the present invention. The program management server 10 illustrated in FIG. 2 includes a drive device 100, a secondary storage device 102, a memory device 103, a CPU 104, and an interface device 105, which are interconnected by a  
25 bus B.

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Programs for implementing processes at the program management server 10 are provided by a recording medium 101 such as a CD-ROM. When the recording medium 101 having a program recorded  
5 therein is set in the drive device 100, the program is installed in the secondary storage device 102 from the recording medium 101 via the drive device 100. However, programs may not necessarily be installed from the recording medium 101; programs may be  
10 downloaded from other computers via a network. The secondary storage device 102 stores the installed programs as well as necessary files and data.

The memory device 103 reads a program from the secondary storage device 102 and stores the read  
15 program, in response to an instruction to activate the program. The CPU 104 executes functions relevant to the program management server 10 according to programs stored in the memory device 103. The interface device 105 is used for connecting to a  
20 network.

FIG. 3 is an example of a functional block diagram of an install support system according to an embodiment of the present invention.

As illustrated in FIG. 3, the device  
25 management apparatus 20 includes a request receiving

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unit 21, a device information acquiring unit 22, an  
install validity reference unit 23, and install  
control unit 24. These units are implemented as  
programs installed in the device management apparatus  
5 20, which are executed by a CPU of the device  
management apparatus 20.

The request receiving unit 21 causes a  
display device of the device management apparatus 20  
to display a screen image, and receives an  
10 instruction to install an application in the image  
forming apparatus 30 from the operator via the  
displayed screen image.

The device information acquiring unit 22  
acquires information relevant to the image forming  
15 apparatus 30 (hereinafter, "device information") from  
the image forming apparatus 30 selected as an install  
destination in the install instruction (hereinafter,  
"target device").

The install validity reference unit 23  
20 inquires (refers to) the program management server 10  
of whether it is valid to install, in the target  
device, the application (hereinafter, "target  
application") selected as an install target in the  
install instruction.

25 When the install validity reference unit 23

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determines that the installing of the target application is valid, the install control unit 24 downloads the target application from the program management server 10 and controls the process of  
5 installing the target application in the target device.

The image forming apparatus 30 includes a device information providing unit 31 and an install unit 32. In response to a request to acquire device  
10 information from the device management apparatus 20, the device information providing unit 31 collects information to be included in the device information from inside the image forming apparatus 30, and returns the device information including the  
15 collected information to the device management apparatus 20.

The install unit 32 executes the process of installing the target application, according to instructions from the install control unit 24 of the  
20 device management apparatus 20.

The program management server 10 includes a request receiving unit 11, an install validity determining unit 12, a program providing unit 13, a product key association information storage unit 14,  
25 a combination information storage unit 15, a

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coexistence condition storage unit 16, and a program storage unit 17.

The request receiving unit 11 receives requests from the device management apparatus 20.

5 Examples of the requests include a request for determining the validity to install an application and a request to download a program.

The install validity determining unit 12 determines the validity of installing an application  
10 in response to a request to determine the validity of installing an application from the device management apparatus 20.

The program providing unit 13 returns a program specified as the download target, in response  
15 to a request to download the program from the device management apparatus 20.

The product key association information storage unit 14 stores association information of product keys and product IDs, with the use of the  
20 secondary storage device 102. The product ID is an ID (identifier) given to each type of program. The product ID may be unique to each product type. For example, assuming that there is an application A and an application B, the application A and the  
25 application B have different product IDs. Meanwhile,

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a product key is an identifier that is issued (or assigned) every time an application is purchased. A product key is used as information for certifying a purchase of an application. That is to say, when an application is purchased, the entity of the application is not distributed to the purchaser, but instead, a product key is distributed to the purchaser. The product key may be unique to each purchase of an application. Therefore, plural product keys may be issued for the same product ID (application). For example, when an application is purchased, a product key assigned to the purchase is associated with the product ID of the application and recorded in the product key association information storage unit 14.

The combination information storage unit 15 stores, with the use of the secondary storage device 102, list information including combinations of applications that can coexist with each other, among the applications managed by the program management server 10 (i.e., applications that can be installed in the image forming apparatus 30). When applications can coexist, it means that the applications can be installed together in a single image forming apparatus 30. Examples of cases where

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applications are cannot coexist with each other are  
when the environments in which the applications can  
be operated (e.g., versions of platforms) are  
exclusive of each other, and when one application  
5 cannot be operated when the other application is  
operated.

The coexistence condition storage unit 16  
stores, with the use of the secondary storage device  
102, the conditions that need to be fulfilled (or  
10 that are preferably fulfilled) for applications of a  
combination to coexist with each other.

The program storage unit 17 stores the  
entity of each program (program file) in association  
with a product ID, with the use of the secondary  
15 storage device 102.

Hereinafter, a description is given of  
processing procedures of the install support system 1.  
FIG. 4 is a sequence diagram for describing  
processing procedures of a process of installing a  
20 program in the image forming apparatus 30 performed  
by the install support system 1. In FIG. 4, the  
device management apparatus 20 is the operation  
target.

In step S101, the request receiving unit 21  
25 of the device management apparatus 20 receives, from

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an operator, an instruction to install a target application, specifying a target device and a product key of the target application. For example, the target device is specified as the operator selects an  
5 install destination from a screen image including a list of image forming apparatuses 30 displayed by the request receiving unit 21. List information of the image forming apparatuses 30 may be saved in the device management apparatus 20 in advance, or  
10 searched in the network 50 according to input of the operator. As the target device is specified (selected), the IP address of the target device is identified.

For example, the product key is specified as  
15 an operator inputs a product key that is purchased in advance, in a screen image for inputting product keys displayed by the request receiving unit 21.

Plural target devices and plural product keys may be specified by the operator.

20 Next, the device information acquiring unit 22 transmits a request to acquire the device information to the target device (to the IP address of the target device) (step S102). The device information providing unit 31 of the target device  
25 collects information configuring the device

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information from inside the target device, and returns the device information including the collected information (step S103).

FIG. 5 illustrates a configuration example of device information. As illustrated in FIG. 5, device information acquired from a single image forming apparatus 30 includes a device ID, application information, platform information, and memory information.

The device ID is an identifier of the image forming apparatus 30. An IP address may be used as the device ID. The application information includes product IDs and versions of the applications installed in the image forming apparatus 30. The platform information includes module IDs and versions of the program modules configuring the platform installed in the image forming apparatus 30. A module ID is an identifier given to each type of program module. A module ID may be unique to each type of program module. The memory information is relevant to the memory capacity of the image forming apparatus 30 and includes a stack area set value, a stack area upper limit value, a heap area set value, and a heap area upper limit value. The stack area set value expresses the size of a stack area set in

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the image forming apparatus 30. The stack area upper limit value expresses the upper limit of the size of the stack area in the image forming apparatus 30. The heap area set value expresses the size of the heap area set in the image forming apparatus 30. The heap area upper limit value expresses the upper limit of the size of the heap area in the image forming apparatus 30. The set values of the stack area and the heap area may be changed within the respective upper limits. The image forming apparatus 30 executes a program within the set values.

In the device management apparatus 20, when the device information acquiring unit 22 receives device information, the install validity reference unit 23 specifies the input product key and device information of the target device, and transmits a request to determine the validity of installing the target application to the program management server 10 (step S104). The determination request is received by the request receiving unit 11 at the program management server 10.

Next, the install validity determining unit 12 of the program management server 10 determines the validity of installing the target application based on the product key and device information included in

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the determination request, the product key  
association information, the combination information  
storage unit 15, and the coexistence condition  
storage unit 16, and returns the determination result  
5 to the install validity reference unit 23 of the  
device management apparatus 20 (step S105). When it  
is determined that it is valid (or possible) to  
install the target application, at least the product  
ID of the target application is included in the  
10 determination result.

When a determination result indicating that  
it is valid to install the target application is  
returned, the install control unit 24 of the device  
management apparatus 20 specifies the product ID of  
15 the target application according to the determination  
result, and transmits a download request to the  
program management server 10 (step S106). Depending  
on the contents of the determination result, the  
module ID of a module that is part of the platform  
20 may be specified as a download target.

The program providing unit 13 of the program  
management server 10 acquires, from the program  
storage unit 17, a program corresponding to the  
product ID specified in the download request, and  
25 returns the program to the install control unit 24

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(step S107).

Next, the install control unit 24 transmits the install instruction including the returned program (target application, etc.) to the target  
5 device (step S108). The install unit 32 of the image forming apparatus 30 executes a process of installing the program received together with the install instruction, and returns a process result of the install process (information indicating whether the  
10 install process is successful) to the install control unit 24 (step S109. The install process may include a process of updating (upgrading) a program that is already installed.

The install control unit 24 that has  
15 received the process result of the install process causes the display device of the device management apparatus 20 to display a screen image according to the process result (step S110).

Next, a detailed description is given of  
20 processing procedures of an install validity determination process executed by the install validity determining unit 12 of the program management server 10, in response to the install validity determination request of step S104.

25 FIGS. 6A and 6B illustrate a flowchart for

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describing an example of processing procedures of an install validity determination process.

In step S201, the install validity determining unit 12 identifies, with the use of the product key association information storage unit 14, the product ID corresponding to the product key received from the device management apparatus 20. Identifying the product ID means identifying the target application.

FIG. 7 illustrates a configuration example of the product key association information storage unit 14. In FIG. 7, the product key association information storage unit 14 stores product keys that are issued every time the applications corresponding to product IDs are purchased. The product keys are stored in association with the corresponding product IDs.

Next, the install validity determining unit 12 identifies the product ID of an application (hereinafter, "existing application") already installed in the target device, based on application information included in the device information received from the device management apparatus 20 (step S202).

When there are no existing applications,

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i.e., when no applications are installed in the target device (NO in step S203), the install validity determining unit 12 determines that the installation is valid (step S204), and ends the process of FIGS. 5 6A and 6B. Thus, in this case, in step S105 of FIG. 4, the install validity determining unit 12 returns, to the device management apparatus 20, a determination result including an indication that installation is valid and the product ID of the 10 target application.

Next, the install validity determining unit 12 searches for combinations of the target application and existing applications in the combination information storage unit 15, to determine 15 whether the target application can coexist with existing applications (step S205).

FIG. 8 illustrates configuration example of the combination information storage unit 15. As illustrated in FIG. 8, the combination information 20 storage unit 15 stores combinations of applications that can coexist with each other among all applications managed by the program management server 10 (i.e., all applications that can be installed in the image forming apparatus 30). Specifically, the 25 combination numbers of the combinations and the

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product IDs of the applications belonging to the combinations are stored in the combination information storage unit 15. Therefore, in step S205, the install validity determining unit 12 determines  
5 whether the combination information storage unit 15 includes records corresponding to a combination of product IDs of all target applications and product IDs of all existing applications. When there is no such record, the install validity determining unit 12  
10 determines that coexistence is impossible. When there is such a record, the install validity determining unit 12 determines that coexistence is possible.

The records of the combination information storage unit 15 are registered by the developer of  
15 the applications. Specifically, the developer installs, in the image forming apparatus 30, all applications belonging to each combination, and confirms the operations of the applications. When  
20 there are no problems with any of the applications as a result of the operation confirmation, the developer determines that the applications belonging to the combination can coexist with each other and adds a record indicating the combination in the combination  
25 information storage unit 15.

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When the install validity determining unit 12 determines that coexistence is impossible (NO in step S205), the install validity determining unit 12 determines that installation is invalid (step S206).  
5 In this case, the install validity determining unit 12 returns a determination result indicating that the installation is invalid to the device management apparatus 20. The device management apparatus 20 ends the install process according to the  
10 determination result.

There are a large number of applications available in the market, and there may be an immense number of combinations of applications. Thus, it may be difficult to actually confirm the operations of  
15 all combinations. In a case where a large number of applications have been shipped, the operation confirmation may only be performed on the important applications for each combination. The combinations stored in the combination information storage unit 15  
20 ensure that the applications in the combinations can coexist with each other. When an application is not included in the combination information storage unit 15, it does not immediately mean that this application cannot be installed. The install  
25 validity determining unit 12 determines that

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installation of this application is not ensured. In this case, the install validity determining unit 12 returns, to the device management apparatus 20, a determination result including an indication that  
5 installation of the target application is not ensured and a product ID of the target application. When the determination result is received, the request receiving unit 21 of the device management apparatus 20 causes the device management apparatus 20 to  
10 display a screen image indicating that installation of the target application is not ensured, and prompts the user to select whether to continue the installation operation. When the user selects to continue the installation operation, steps S106 and  
15 onward are executed. However, in another example, when a determination result indicating that installation of the target application is not ensured, the install validity reference unit 23 may abort the install process.

20           When the install validity determining unit 12 determines that coexistence is possible (YES in step S205), the install validity determining unit 12 acquires, from the coexistence condition storage unit 16, coexistence conditions of the combination, based  
25 on the combination number of the combination

indicated in the corresponding record (step S208).

FIG. 9 illustrates a configuration example of a coexistence condition. FIG. 9 illustrates a coexistence condition for combination 1. Coexistence  
5 conditions are registered in the coexistence condition storage unit 16 for the respective combinations registered in the combination information storage unit 15.

The coexistence condition is to be satisfied  
10 when all applications belonging to the combination relevant to the coexistence condition are installed in the target device. In the present embodiment, items included in the coexistence condition include a stack area minimum value, a heap area minimum value,  
15 application versions, and platform versions.

The stack area minimum value is the minimum value of the stack area that the target device is required to have. The heap area minimum value is the minimum value of the heap area that the target device  
20 is required to have. The application versions indicate version information limiting the versions of the applications belonging to the combination. That is to say, if an application does not correspond to any of the versions recorded in the application  
25 versions, the coexistence condition is not satisfied.

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The platform versions indicate version information limiting the versions of program modules of the platforms used by the applications belonging to the combination.

5               Values of the coexistence condition are set by the developer of the applications, for example. Specifically, the developer measures the memory amounts of the stack area and heap area used when all applications belonging to the combination are  
10 simultaneously executed, during the operation confirmation executed when adding a record to the combination information storage unit 15. As for applications having plural versions, the operation confirmation is performed on the respective versions.

15               There are a large number of applications available in the market, and there may be an immense number of combinations of applications. Thus, it may be difficult to actually confirm the operations of combinations of all versions of all applications. In  
20 a case where a large number of versions have been shipped, the operation confirmation may only be performed on the important versions. The combinations stored in the combination information storage unit 15 ensure that the versions in the  
25 combinations can coexist with each other.

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Next, the install validity determining unit 12 determines whether the stack area set value included in the device information of the target device is greater than or equal to the stack area minimum value included in the acquired coexistence condition (hereinafter, "target coexistence condition") (step S209). When the stack area set value included in the device information of the target device is less than the stack area minimum value (NO in step S209), the install validity determining unit 12 determines whether the stack area upper limit value included in the device information of the target device is greater than or equal to the stack area minimum value included in the target coexistence condition (step S210). When the stack area upper limit value included in the device information of the target device is less than the stack area minimum value included in the target coexistence condition (NO in step S210), the install validity determining unit 12 determines that the installation is invalid (step S206).

When the stack area upper limit value included in the device information of the target device is greater than or equal to the stack area minimum value included in the target coexistence

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condition (YES in step S210), the install validity determining unit 12 adds the stack area minimum value included in the target coexistence condition to the report information to be returned together with the determination result. By changing the stack area set value of the target device to a value that is greater than or equal to the stack area minimum value, the installation of the target application becomes possible. This is the purpose of adding the stack area minimum value to the report information to be notified to the operator.

When the result of step S209 is YES, or after step S211, the install validity determining unit 12 executes, on the heap area, the same process as that performed on the stack area, in steps S212 through S214.

In step S215, the install validity determining unit 12 determines, for the respective existing applications, whether the version information included in the application information of the device information and the version information included in the application version of the target coexistence condition correspond to each other. The version information in the coexistence condition may be range-specified or listed. In this case, the

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determination result is affirmative if the version information in the device information is included in any of the version information items that are range-specified or listed in the coexistence condition.

5                   When there is at least one existing application where the version information included in the application information of the device information and the version information included in the target coexistence condition do not correspond to each other  
10 (NO in step S215), the install validity determining unit 12 adds the product ID and the version information included in the target coexistence condition to the report information for the corresponding existing application (step S216). By  
15 updating (upgrading) the existing application, installation of the target application becomes possible. This is the purpose of adding the product ID and the version information included in the target coexistence condition to the report information to be  
20 notified to the operator.

                  When the result of step S215 is YES, or after step S216, the install validity determining unit 12 determines whether the version information included in the device information corresponds to the  
25 version information of the respective program modules

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included in the platform information of the  
coexistence condition (step S217). In step S217, the  
install validity determining unit 12 also determines  
whether the module ID included in the platform  
5 version of the coexistence condition is included in  
the platform information of the device information.  
That is to say, the install validity determining unit  
12 determines whether the program module set in the  
coexistence condition is already installed in the  
10 target device.

When there is at least one program module  
where the version information included in the  
platform information of the device information and  
the version information included in the platform  
15 version in the target coexistence condition do not  
correspond to each other (NO in step S217), the  
install validity determining unit 12 adds the module  
ID and the version information included in the target  
coexistence condition to the report information for  
20 the corresponding program module (step S218). By  
updating (upgrading) the program module, installation  
of the target application becomes possible. This is  
the purpose of adding the module ID and the version  
information included in the target coexistence  
25 condition to the report information to be notified to

the operator.

When at least one module ID included in the platform version of the coexistence condition is not included in the platform information of the device  
5 information, the corresponding module ID and version information are acquired from the coexistence condition and are added to the report information.

For example, the report information is generated in a format as illustrated in FIG. 10. FIG.  
10 10 illustrates a configuration example of the report information. As illustrated in FIG. 10, the report information includes items of application versions, platform versions, a stack area set value, and a heap area set value. The record of the application  
15 version (product ID and version information) is added in step S216. The record of the platform version (module ID and version information) is added in step S218. The record of the stack area set value is added in step S211. The record of the heap area set  
20 value is added in step S214.

When the result of step S217 is YES, or after step S218, the install validity determining unit 12 determines whether at least one record is added to the report information (step S219). That is  
25 to say, the install validity determining unit 12

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determines whether there is an item (condition) that is not satisfied in the target coexistence condition.

When there are no records added to the report information (NO in step S219), the install  
5 validity determining unit 12 determines that the installation is valid (step S220). Accordingly, in this case, in step S105 (FIG. 4), a determination result indicating that the installation is valid and the product ID of the target application are returned.

10 Meanwhile, when there is at least one record included in the report information (YES in step S219), the install validity determining unit 12 determines that the installation is invalid (step S221). However, in this case, by changing the status of the  
15 target device so that the contents (conditions) specified in the report information are satisfied, the installation becomes valid. Therefore, in order to notify this to the operator, in step S105 (FIG. 4), the determination result indicating that installation  
20 is invalid, the product ID of the target application, and the report information are returned.

When the report information is received, the install validity reference unit 23 of the device management apparatus 20 causes the display device to  
25 display the report information. When a record

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relevant to the application version or the platform version is included in the report information, the install validity reference unit 23 causes the display device to display a screen image for prompting the operator to select whether to execute the process of updating an existing application or program module together with the process of installing the target application. When the operator selects to execute the process of updating an existing application or program module in this screen image, in step S106, the install control unit 24 of the device management apparatus 20 specifies the product ID of the existing application or the module ID of the program module and the product ID of the target application, and transmits a download request to the program management server 10. The install control unit 24 installs, in the target device, the target application, the existing application, or the program module returned from the program management server 10 in response to the download request.

Furthermore, when the report includes a record relevant to the stack area set value or the heap area set value, the operator operates the target device to change the stack area set value or the heap area set value, and subsequently, the process of

installing the target application is to be executed. Alternatively, when the stack area set value or heap area set value of the target device can be changed by network communications, the install control unit 24  
5 changes the stack area set value or heap area set value of the target device to the value included in the report information by network communications, and subsequently, the target application may be downloaded and installed in the target device.

10           The device management apparatus 20 does not necessarily need to be provided. Functions of the device management apparatus 20 may be included in the image forming apparatus 30 or the program management server 10. In this case, the operator operates the  
15 operation panel of the target device to give install instructions.

          In another example, all functions of the program management server 10 may be installed in the device management apparatus 20. If it is redundant  
20 to install the product key association information storage unit 14, the combination information storage unit 15, the coexistence condition storage unit 16, and the program storage unit 17 in the device management apparatus 20 in the respective user  
25 environments E1, these storage units may be uniformly

managed in the program management server 10.

As described above, according to the present embodiment, the memory usage (consumption amount) when programs belonging to the same combination are  
5 simultaneously operated is managed for the respective combinations of programs (applications in the present embodiment) that are install targets. Accordingly, compared to the case of simply adding together the memory usage amounts of the programs, it is possible  
10 to improve the precision in predicting the memory usage and to improve the precision in determining the validity of installing programs.

Generally, programs are managed in terms of versions. In the present embodiment, the validity of  
15 combinations of versions is also managed in coexistence conditions. In this respect also, it is possible to improve the precision in determining the validity of installing programs.

According to an embodiment of the present  
20 invention, the precision in determining whether a program can be installed can be improved.

The present invention is not limited to the specific embodiments described herein, and variations and modifications may be made without departing from  
25 the scope of the present invention.

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The present application is based on Japanese  
Priority Application No. 2010-183671 filed on August  
19, 2010 with the Japan Patent Office, the entire  
contents of which are hereby incorporated by  
5 reference.

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## Claims

Claim 1. An information processing apparatus comprising:

- 5           a coexistence condition storage unit  
configured to store combination information relevant  
to combinations of different types of first programs  
that can be installed in a device, the combination  
information including memory consumption amounts of  
10 the combinations;
- an install information receiving unit  
configured to receive an install target first program  
selected as an install target and device information  
relevant to the device selected as an install  
15 destination of the install target first program; and
- a validity determining unit configured to  
determine validity of installing the install target  
first program in the device by determining, by  
referring to the combination information in the  
20 coexistence condition storage unit, a predicted  
memory consumption amount corresponding to a first  
combination including the install target first  
program and an existing first program that is  
installed in the device and indicated in the device  
25 information, and by comparing the predicted memory

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consumption amount obtained as a determination result with a device memory consumption amount of the device selected as the install destination indicated in the device information.

5

Claim 2. The information processing apparatus according to claim 1, wherein

the coexistence condition storage unit stores, for the respective combinations, version  
10 information of the respective different types of the first programs in the combinations indicated in the combination information,

the device information includes version information of the existing first programs that are  
15 installed in the device, and

the validity determining unit determines, for the respective existing first programs that are installed in the device, whether the version information included in the device information  
20 corresponds to the version information stored in the coexistence condition storage unit relevant to the install target first program in the first combination, and when the validity determining unit determines that the version information of the existing first  
25 program does not correspond to the version

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information of the install target first program, the validity determining unit generates update report information for reporting that the existing first program needs to be updated.

5

Claim 3. The information processing apparatus according to claim 1 or 2, wherein

the coexistence condition storage unit stores, for the respective combinations, a list of  
10 different types of second programs that are used by the respective different types of the first programs in the combinations indicated in the combination information,

the device information indicates an existing  
15 second program that is installed in the device, and

the validity determining unit determines, by referring to the coexistence condition storage unit, a target second program that is to be used by the install target first program included in the first  
20 combination, and when the validity determining unit determines that the target second program is not included in the device information as the existing second program, the validity determining unit generates install report information for reporting  
25 that the target second program needs to be installed

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in the device.

Claim 4. The information processing apparatus according to claim 3, wherein

5           the coexistence condition storage unit stores, for the respective combinations, the different types of the second programs that are used by the respective different types of the first programs in the combinations as well as version  
10 information of the respective different types of the second programs, and  
          the validity determining unit determines, by referring to the coexistence condition storage unit, the target second program that is to be used by the  
15 install target first program included in the first combination as well as target version information of the target second program, and when the validity determining unit determines that the target second program corresponding to the target version  
20 information is not included in the device information as the existing second program, the validity determining unit generates the install report information for reporting that the target second program corresponding to the target version  
25 information needs to be installed in the device.

Claim 5. An information processing system comprising an information processing apparatus and a device, wherein

5           the information processing apparatus includes

          a coexistence condition storage unit configured to store combination information relevant to combinations of different types of first programs  
10   that can be installed in the device, the combination information including memory consumption amounts of the combinations;

          an install information receiving unit configured to receive an install target first program  
15   selected as an install target and device information relevant to the device selected as an install destination of the install target first program, the device information being acquired from the device selected as the install destination; and

20           a validity determining unit configured to determine validity of installing the install target first program in the device by determining, by referring to the combination information in the coexistence condition storage unit, a predicted  
25   memory consumption amount corresponding to a first

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combination including the install target first  
program and an existing first program that is  
installed in the device and indicated in the device  
information, and by comparing the predicted memory  
5 consumption amount obtained as a determination result  
with a device memory consumption amount of the device  
selected as the install destination indicated in the  
device information.

10                    Claim 6. The information processing system  
according to claim 5, wherein

                    the coexistence condition storage unit  
stores, for the respective combinations, version  
information of the respective different types of the  
15 first programs in the combinations indicated in the  
combination information,

                    the device information includes version  
information of the existing first programs that are  
installed in the device, and

20                    the validity determining unit determines,  
for the respective existing first programs that are  
installed in the device, whether the version  
information included in the device information  
corresponds to the version information stored in the  
25 coexistence condition storage unit relevant to the

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install target first program in the first combination,  
and when the validity determining unit determines  
that the version information of the existing first  
program does not correspond to the version

5 information of the install target first program, the  
validity determining unit generates update report  
information for reporting that the existing first  
program needs to be updated.

10 Claim 7. The information processing system  
according to claim 5 or 6, wherein

the coexistence condition storage unit  
stores, for the respective combinations, a list of  
different types of second programs that are used by  
15 the respective different types of the first programs  
in the combinations indicated in the combination  
information,

the device information indicates an existing  
second program that is installed in the device, and

20 the validity determining unit determines, by  
referring to the coexistence condition storage unit,  
a target second program that is to be used by the  
install target first program included in the first  
combination, and when the validity determining unit  
25 determines that the target second program is not

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included in the device information as the existing  
second program, the validity determining unit  
generates install report information for reporting  
that the target second program needs to be installed  
5 in the device.

Claim 8. The information processing system  
according to claim 7, wherein  
the coexistence condition storage unit  
10 stores, for the respective combinations, the  
different types of the second programs that are used  
by the respective different types of the first  
programs in the combinations as well as version  
information of the respective different types of the  
15 second programs, and  
the validity determining unit determines, by  
referring to the coexistence condition storage unit,  
the target second program that is to be used by the  
install target first program included in the first  
20 combination as well as target version information of  
the target second program, and when the validity  
determining unit determines that the target second  
program corresponding to the target version  
information is not included in the device information  
25 as the existing second program, the validity

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determining unit generates the install report information for reporting that the target second program corresponding to the target version information needs to be installed in the device.

5

Claim 9. A non-transitory computer-readable storage medium with an executable program stored therein, wherein the program instructs a processor of a computer to execute a method comprising:

10 receiving an install target first program selected as an install target and device information relevant to a device selected as an install destination of the install target first program; and

determining validity of installing the  
15 install target first program in the device, the determining of the validity including

determining a predicted memory consumption amount corresponding to a first combination including the install target first  
20 program and an existing first program that is installed in the device and indicated in the device information, the predicted memory consumption amount being determined by referring to a coexistence condition storage unit storing combination  
25 information relevant to combinations of different

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types of first programs that can be installed in the device, the combination information including memory consumption amounts of the combinations, the determining of the validity further including

5                   comparing the predicted memory consumption amount obtained as a determination result with a device memory consumption amount of the device selected as the install destination indicated in the device information.

10

Claim 10. The non-transitory computer-readable storage medium according to claim 9, wherein

the receiving includes receiving the device information that includes version information of the existing first programs that are installed in the device,

the determining of the validity includes referring to the coexistence condition storage unit that stores, for the respective combinations, version information of the respective different types of the first programs in the combinations indicated in the combination information, and

the determining of the validity includes determining, for the respective existing first programs that are installed in the device, whether

25

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the version information included in the device  
information corresponds to the version information  
stored in the coexistence condition storage unit  
relevant to the install target first program in the  
5 first combination, the determining of the validity  
further including generating update report  
information for reporting that the existing first  
program needs to be updated when the version  
information of the existing first program is  
10 determined as not corresponding to the version  
information of the install target first program.

Claim 11. The non-transitory computer-  
readable storage medium according to claim 9 or 10,  
15 wherein

the receiving includes receiving the device  
information that indicates an existing second program  
that is installed in the device,

the determining of the validity includes  
20 referring to the coexistence condition storage unit  
that stores, for the respective combinations, a list  
of different types of second programs that are used  
by the respective different types of the first  
programs in the combinations indicated in the  
25 combination information, and

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the determining of the validity includes determining, by referring to the coexistence condition storage unit, a target second program that is to be used by the install target first program

5 included in the first combination, the determining of the validity further including generating install report information for reporting that the target second program needs to be installed in the device when the target second program is determined as not

10 being included in the device information as the existing second program.

Claim 12. The non-transitory computer-readable storage medium according to claim 11,

15 wherein

the determining of the validity includes referring to the coexistence condition storage unit that stores, for the respective combinations, the different types of the second programs that are used

20 by the respective different types of the first programs in the combinations as well as version information of the respective different types of the second programs, and

the determining of the validity includes

25 determining, by referring to the coexistence

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condition storage unit, the target second program  
that is to be used by the install target first  
program included in the first combination as well as  
target version information of the target second  
5 program, the determining of the validity further  
including generating the install report information  
for reporting that the target second program  
corresponding to the target version information needs  
to be installed in the device when the target second  
10 program corresponding to the target version  
information is determined as not being included in  
the device information as the existing second program.