US 20210250240A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2021/0250240 A1**

OHTSU (43) **Pub. Date: Aug. 12, 2021**

(54) **CONFIGURATION SETTING SUPPORT SYSTEM AND METHOD**

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(21) Appl. No.: **17/022,196**

(22) Filed: **Sep. 16, 2020**

(30) **Foreign Application Priority Data**

Feb. 6, 2020 (JP) 2020-018777

Publication Classification

(51) **Int. Cl.**
H04L 12/24 (2006.01)

(52) **U.S. Cl.**
CPC ***H04L 41/0879*** (2013.01); ***H04L 41/0806*** (2013.01); ***H04L 41/0853*** (2013.01)

(57) **ABSTRACT**

A configuration setting support system that supports setting of configuration information in an information processing apparatus includes: an information acquirer configured to acquire configuration information set in a plurality of information processing apparatuses under management; and a candidate extractor configured to select at least one of the plurality of information processing apparatuses under management on the basis of a configuration of a target information processing apparatus and the configuration information of the plurality of information processing apparatuses under management and uses the selected at least one information processing apparatus under management as a recommended candidate recommended to be used for creating the configuration information of the target information processing apparatus.

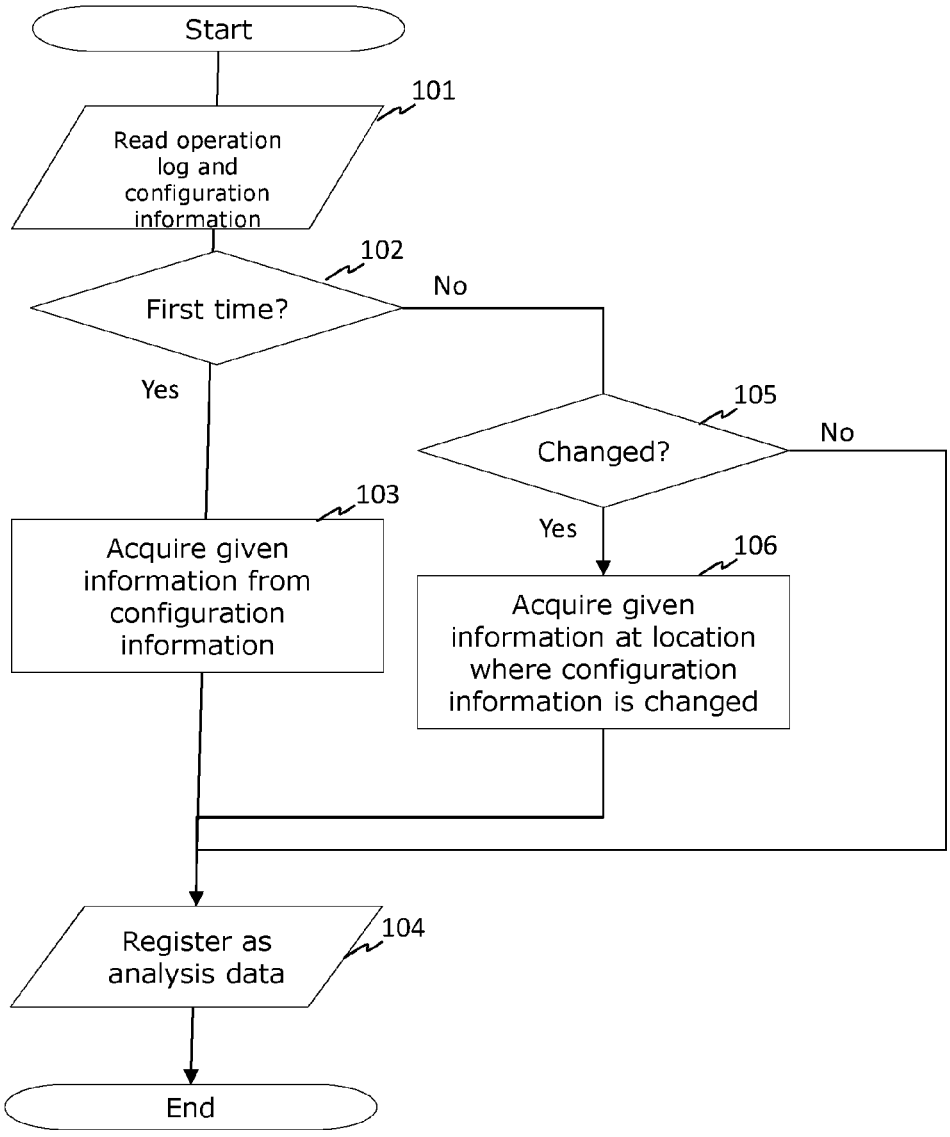


FIG. 1

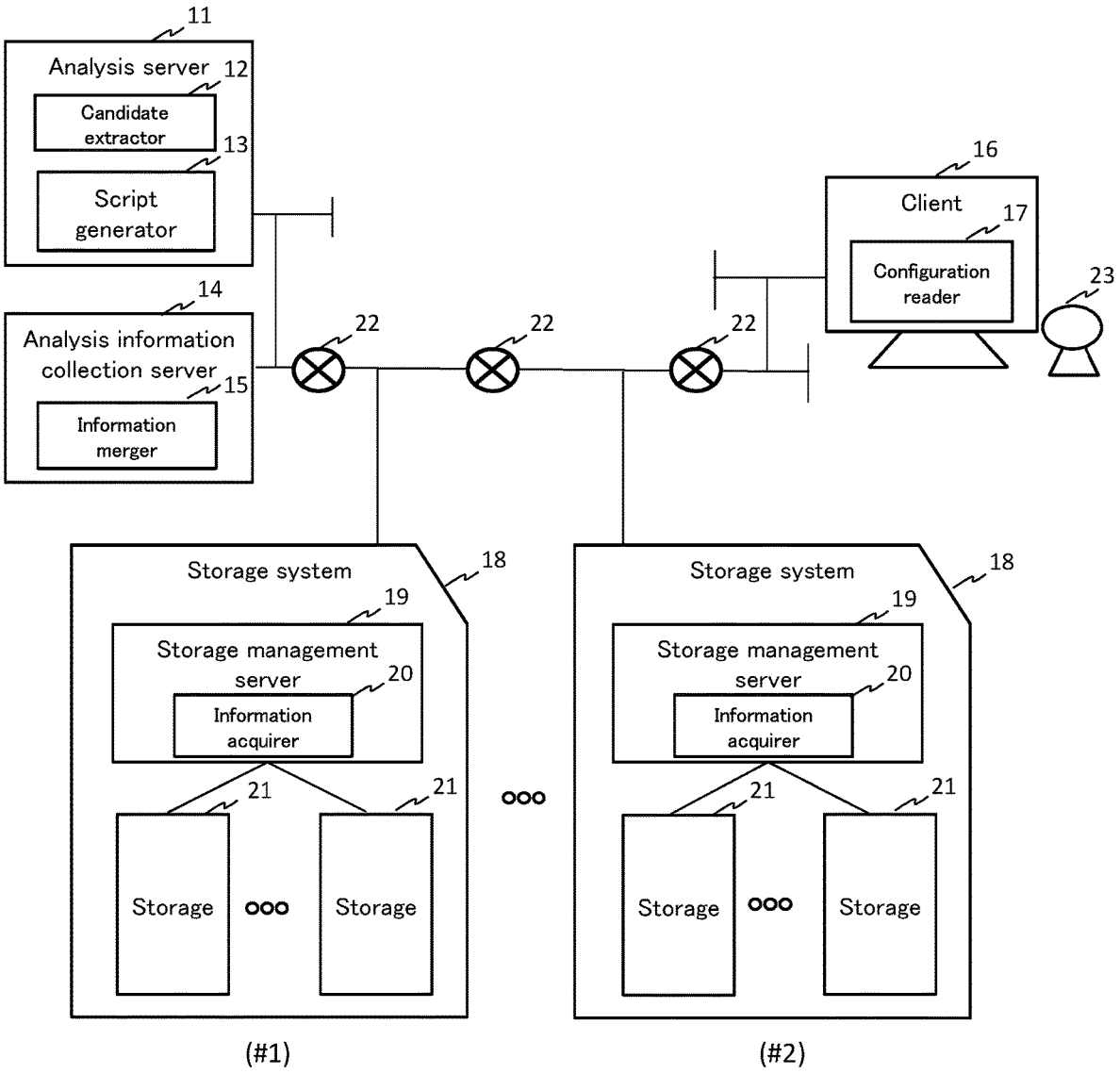

11
Analysis server
12
Candidate extractor
13
Script generator
14
Analysis information collection server
15
Information merger
16
Client
17
Configuration reader
23
22
22
22
Storage system
18
19
Storage management server
20
Information acquirer
21
21
Storage
Storage
Storage system
18
19
Storage management server
20
Information acquirer
21
21
Storage
Storage
(#1)
(#2)

FIG. 2

Object attribute (Format)	Examples
PG information (PG Type, PG ID)	2D2D, 1-1 3D1P, 2-1
LDEV information (LDEV Type, LDEV ID, LDEV Size)	BASIC, 00:00:00, 10GB VVOL, 00:00:01, 1TB
Pool information (Pool ID, Pool Size)	0, 2TB 1, 100GB
Port information (Port ID, HG ID, LU ID)	CL3-A, 0, 0 CL3-A, 0, 1 CL5-A, 5, 7

FIG. 3

Format	Examples
Apparatus ID, Operation date (YYYY/MM/DD), Operation time (HH:MM:SS:xxx), Time zone (UTC±HH:MM), Operation name, Parameter, Operation result	400001, 2018/08/01 13:00:00 UTC+09:00, Create Ldev, {00:00:01, 10GB}, Normal End 400010, 2018/08/02 15:30:00 UTC+09:00, Delete Ldev, {00:00:10, 10GB}, Normal End

FIG. 4

Format	Examples
Apparatus ID, Drive number, PG number, POOL number, LDEV number, LU number, Time point	500001, 8, 2, 2, 100, 10, 2019/07/09 15:00 500001, 8, 2, 2, 100, 15, 2019/07/09 15:10 500002, 24, 3, 0, 3, 3, 2019/07/09 15:00 . . .

FIG. 5

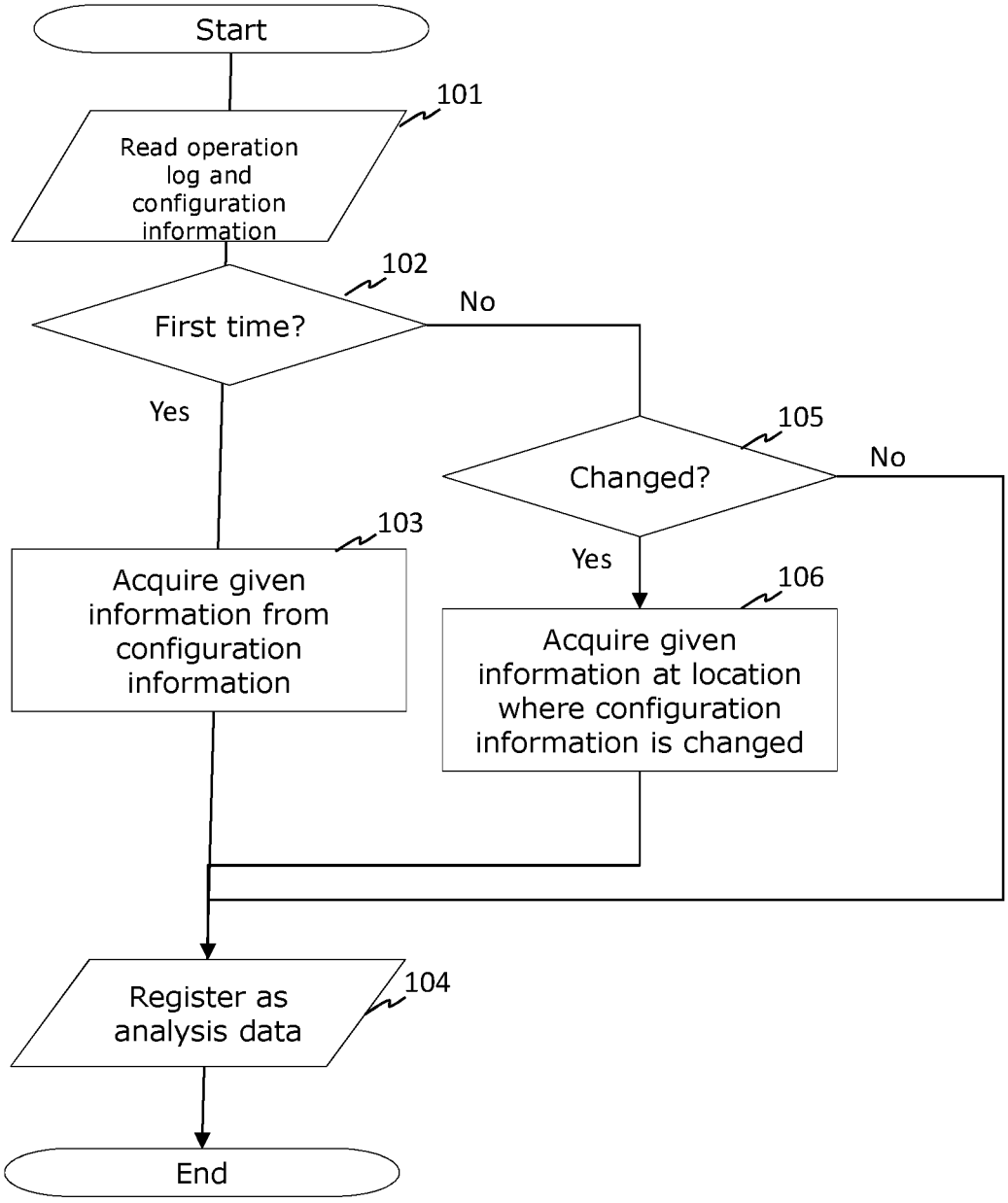

Start
101
Read operation log and configuration information
102
First time?
No
Yes
105
Changed?
No
Yes
103
Acquire given information from configuration information
106
Acquire given information at location where configuration information is changed
Register as analysis data
104
End

FIG. 6

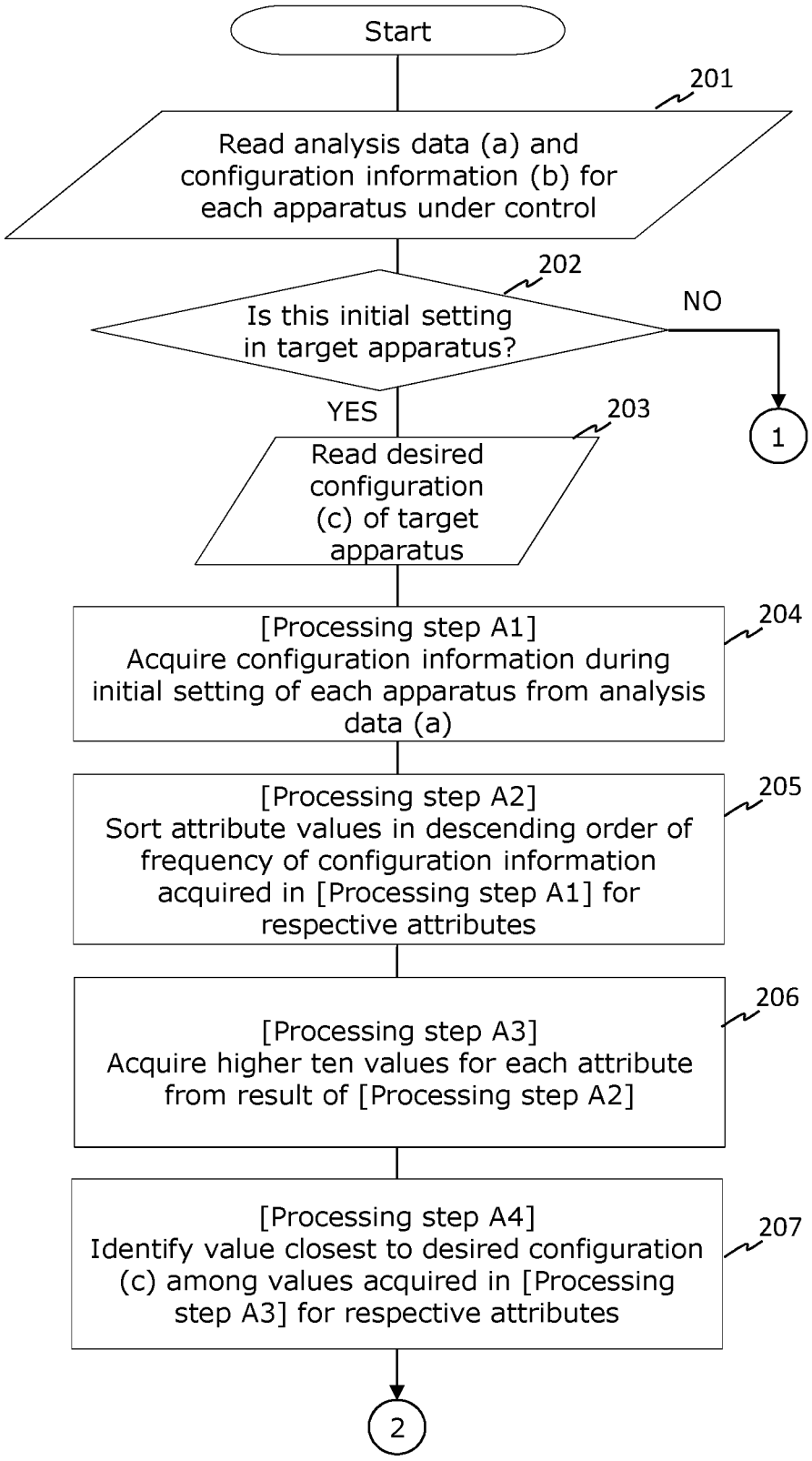

Start
201
Read analysis data (a) and configuration information (b) for each apparatus under control
202
Is this initial setting in target apparatus?
NO
1
YES
203
Read desired configuration (c) of target apparatus
[Processing step A1]
Acquire configuration information during initial setting of each apparatus from analysis data (a)
204
[Processing step A2]
Sort attribute values in descending order of frequency of configuration information acquired in [Processing step A1] for respective attributes
205
[Processing step A3]
Acquire higher ten values for each attribute from result of [Processing step A2]
206
[Processing step A4]
Identify value closest to desired configuration (c) among values acquired in [Processing step A3] for respective attributes
207
2

FIG. 7

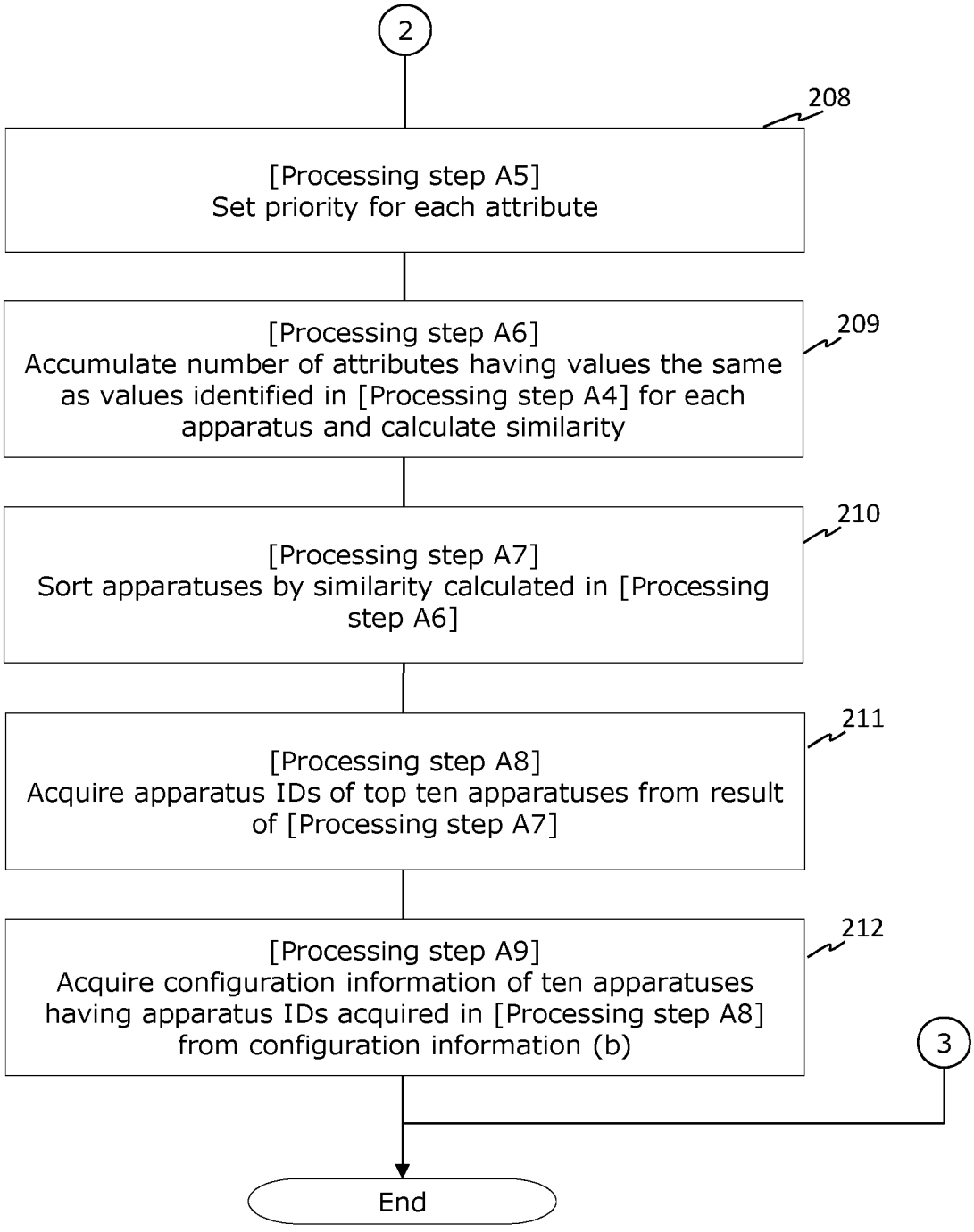

2
208
[Processing step A5]
Set priority for each attribute
209
[Processing step A6]
Accumulate number of attributes having values the same as values identified in [Processing step A4] for each apparatus and calculate similarity
210
[Processing step A7]
Sort apparatuses by similarity calculated in [Processing step A6]
211
[Processing step A8]
Acquire apparatus IDs of top ten apparatuses from result of [Processing step A7]
212
[Processing step A9]
Acquire configuration information of ten apparatuses having apparatus IDs acquired in [Processing step A8] from configuration information (b)
3
End

FIG. 8

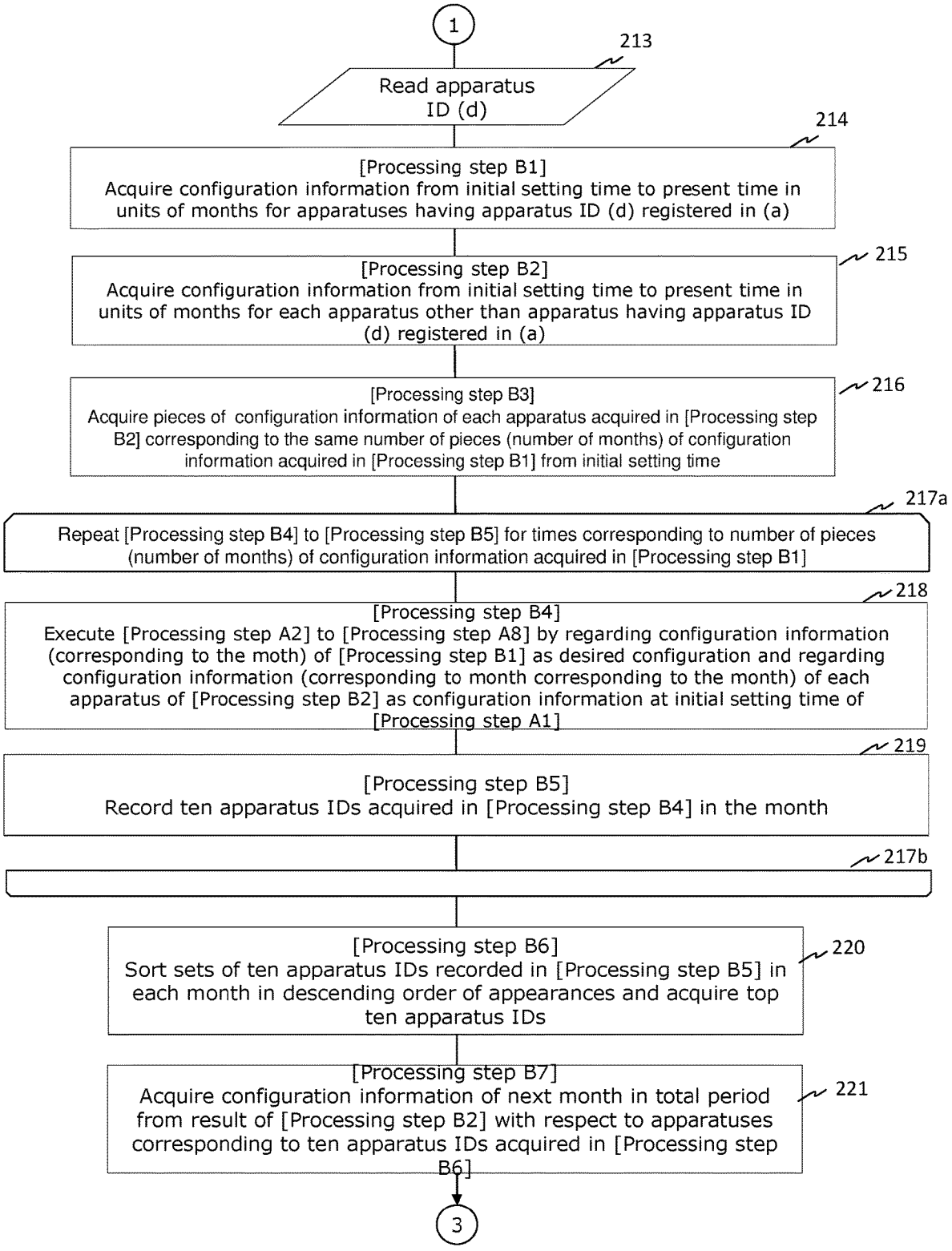

1
213
Read apparatus ID (d)
214
[Processing step B1]
Acquire configuration information from initial setting time to present time in units of months for apparatuses having apparatus ID (d) registered in (a)
215
[Processing step B2]
Acquire configuration information from initial setting time to present time in units of months for each apparatus other than apparatus having apparatus ID (d) registered in (a)
216
[Processing step B3]
Acquire pieces of configuration information of each apparatus acquired in [Processing step B2] corresponding to the same number of pieces (number of months) of configuration information acquired in [Processing step B1] from initial setting time
217a
Repeat [Processing step B4] to [Processing step B5] for times corresponding to number of pieces (number of months) of configuration information acquired in [Processing step B1]
218
[Processing step B4]
Execute [Processing step A2] to [Processing step A8] by regarding configuration information (corresponding to the moth) of [Processing step B1] as desired configuration and regarding configuration information (corresponding to month corresponding to the month) of each apparatus of [Processing step B2] as configuration information at initial setting time of [Processing step A1]
219
[Processing step B5]
Record ten apparatus IDs acquired in [Processing step B4] in the month
217b
[Processing step B6]
Sort sets of ten apparatus IDs recorded in [Processing step B5] in each month in descending order of appearances and acquire top ten apparatus IDs
220
[Processing step B7]
Acquire configuration information of next month in total period from result of [Processing step B2] with respect to apparatuses corresponding to ten apparatus IDs acquired in [Processing step B6]
221
3

FIG. 9

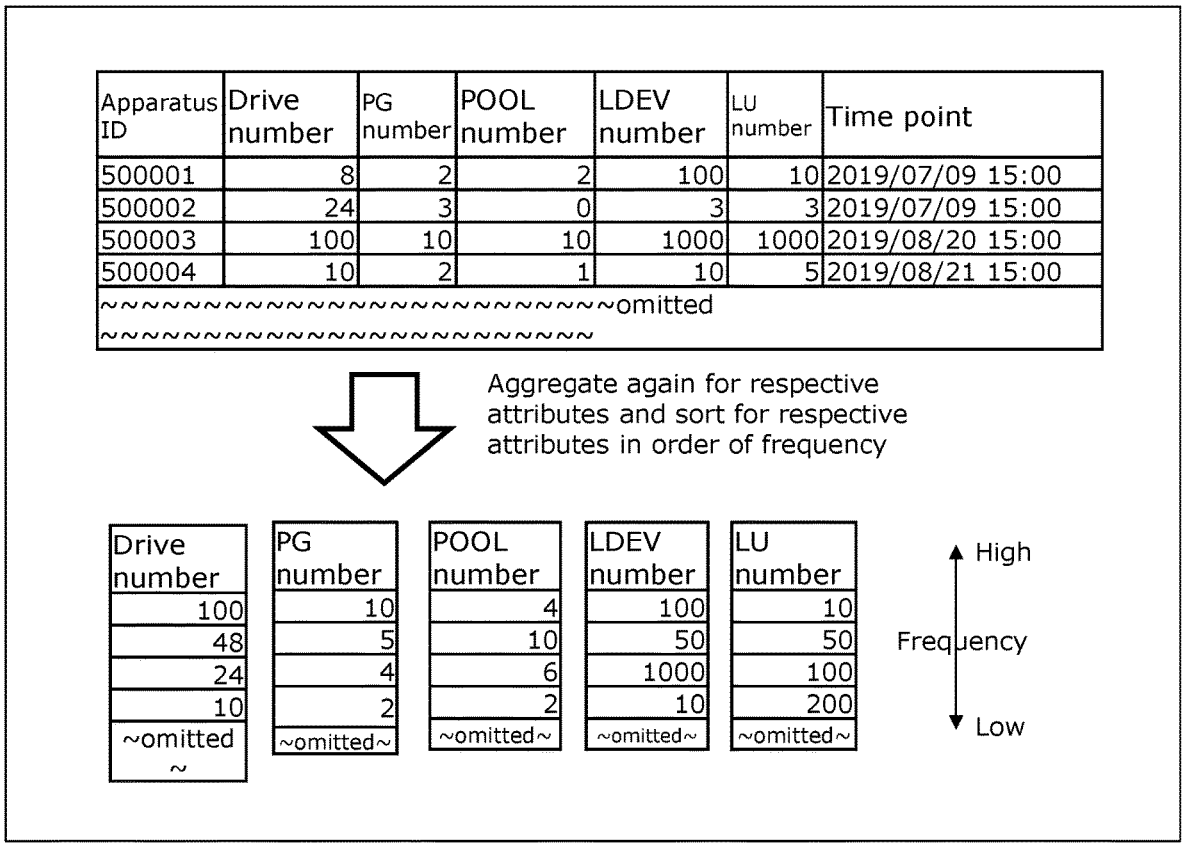

Apparatus ID
Drive number
PG number
POOL number
LDEV number
LU number
Time point
500001 8 2 2 100 10 2019/07/09 15:00
500002 24 3 0 3 3 2019/07/09 15:00
500003 100 10 10 1000 1000 2019/08/20 15:00
500004 10 2 1 10 5 2019/08/21 15:00
~~~~~~~~~~~~~~~~~~~~~~~~~~omitted~~~~~~~~~~~~~~~~~~~~~~~~~~
Aggregate again for respective attributes and sort for respective attributes in order of frequency
Drive number
100
48
24
10
~omitted~
PG number
10
5
4
2
~omitted~
POOL number
4
10
6
2
~omitted~
LDEV number
100
50
1000
10
~omitted~
LU number
10
50
100
200
~omitted~
High
Frequency
Low
~~~~~~~~~~~~~~~~~~~~~~~~~~

FIG. 10

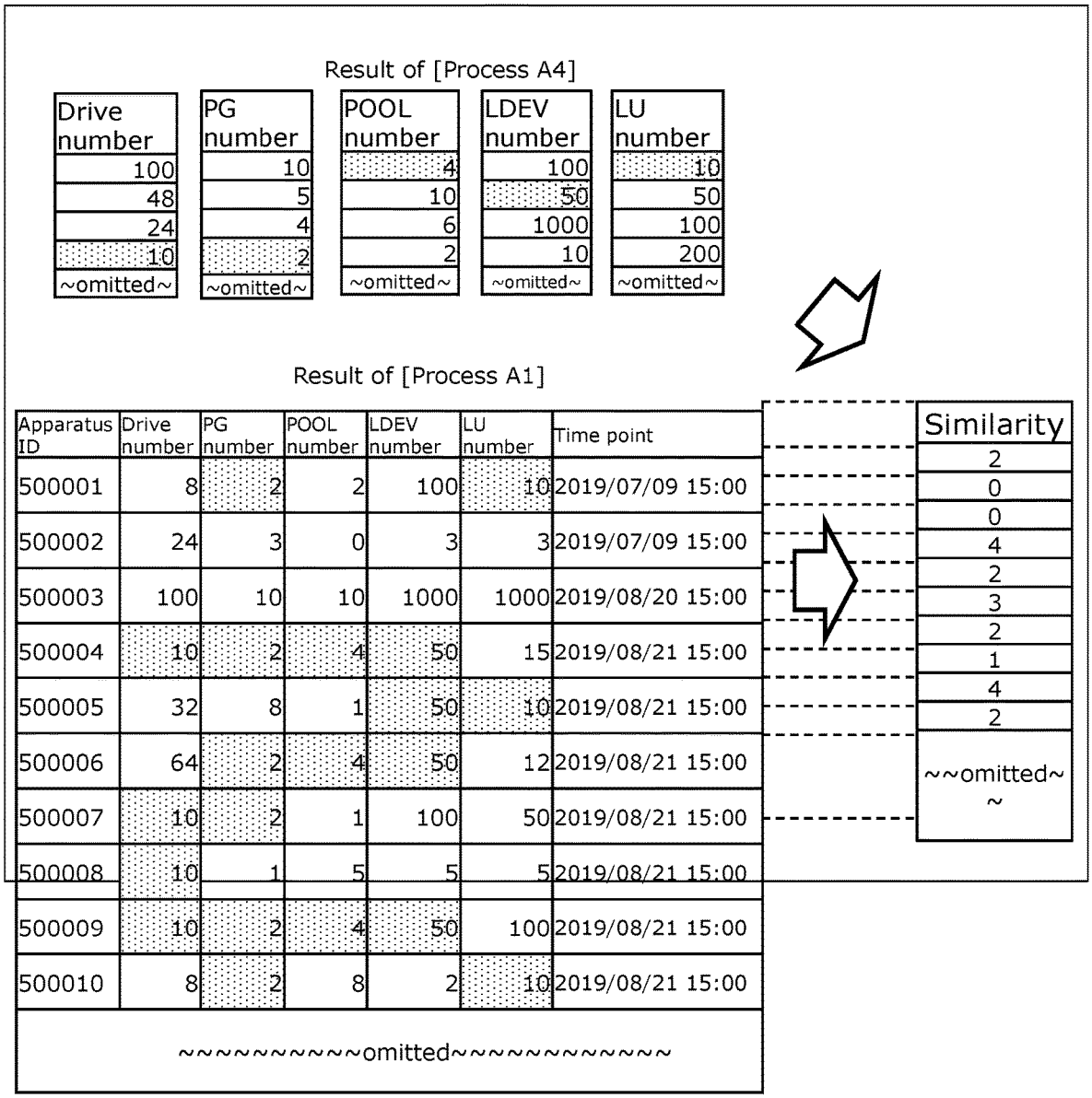

Result of [Process A4]
Drive number
100
48
24
10
~omitted~
PG number
10
5
4
2
~omitted~
POOL number
4
10
6
2
~omitted~
LDEV number
100
50
1000
10
~omitted~
LU number
10
50
100
200
~omitted~
Result of [Process A1]
Apparatus ID
Drive number
PG number
POOL number
LDEV number
LU number
Time point
500001 8 2 2 100 10 2019/07/09 15:00
500002 24 3 0 3 3 2019/07/09 15:00
500003 100 10 10 1000 1000 2019/08/20 15:00
500004 10 2 4 50 15 2019/08/21 15:00
500005 32 8 1 50 10 2019/08/21 15:00
500006 64 2 4 50 12 2019/08/21 15:00
500007 10 2 1 100 50 2019/08/21 15:00
500008 10 1 5 5 5 2019/08/21 15:00
500009 10 2 4 50 100 2019/08/21 15:00
500010 8 2 8 2 10 2019/08/21 15:00
~~~~~~~~~~omitted~~~~~~~~~~~~
Similarity
2
0
0
4
2
3
2
1
4
2
~~omitted~~
~~~~~~~~~~

FIG. 11

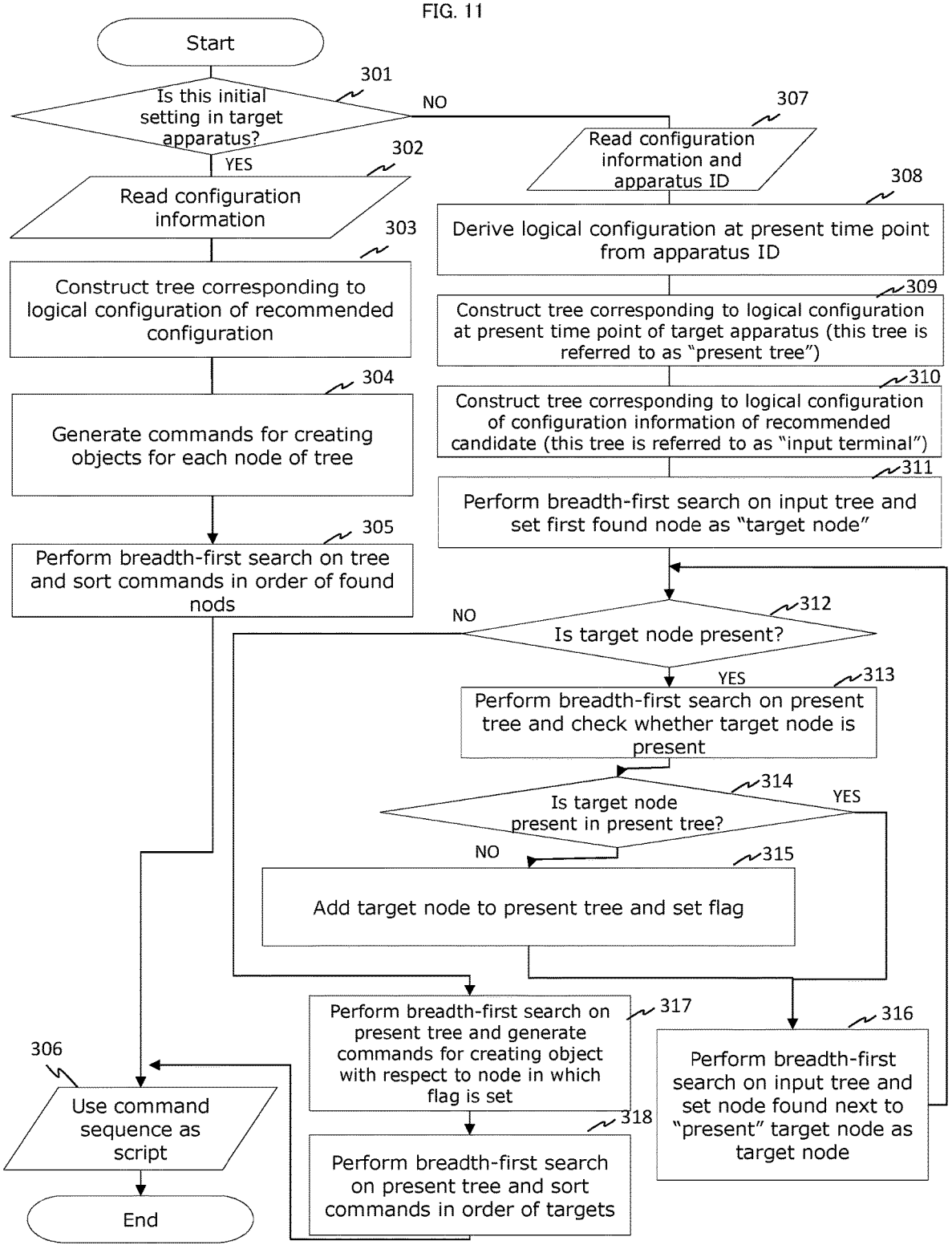

Start
301
Is this initial setting in target apparatus?
NO
YES
302
Read configuration information
303
Construct tree corresponding to logical configuration of recommended configuration
304
Generate commands for creating objects for each node of tree
305
Perform breadth-first search on tree and sort commands in order of found nods
307
Read configuration information and apparatus ID
308
Derive logical configuration at present time point from apparatus ID
309
Construct tree corresponding to logical configuration at present time point of target apparatus (this tree is referred to as "present tree")
310
Construct tree corresponding to logical configuration of configuration information of recommended candidate (this tree is referred to as "input terminal")
311
Perform breadth-first search on input tree and set first found node as "target node"
312
Is target node present?
NO
YES
313
Perform breadth-first search on present tree and check whether target node is present
314
Is target node present in present tree?
YES
NO
315
Add target node to present tree and set flag
316
Perform breadth-first search on input tree and set node found next to "present" target node as target node
317
Perform breadth-first search on present tree and generate commands for creating object with respect to node in which flag is set
318
Perform breadth-first search on present tree and sort commands in order of targets
306
Use command sequence as script
End

FIG. 12

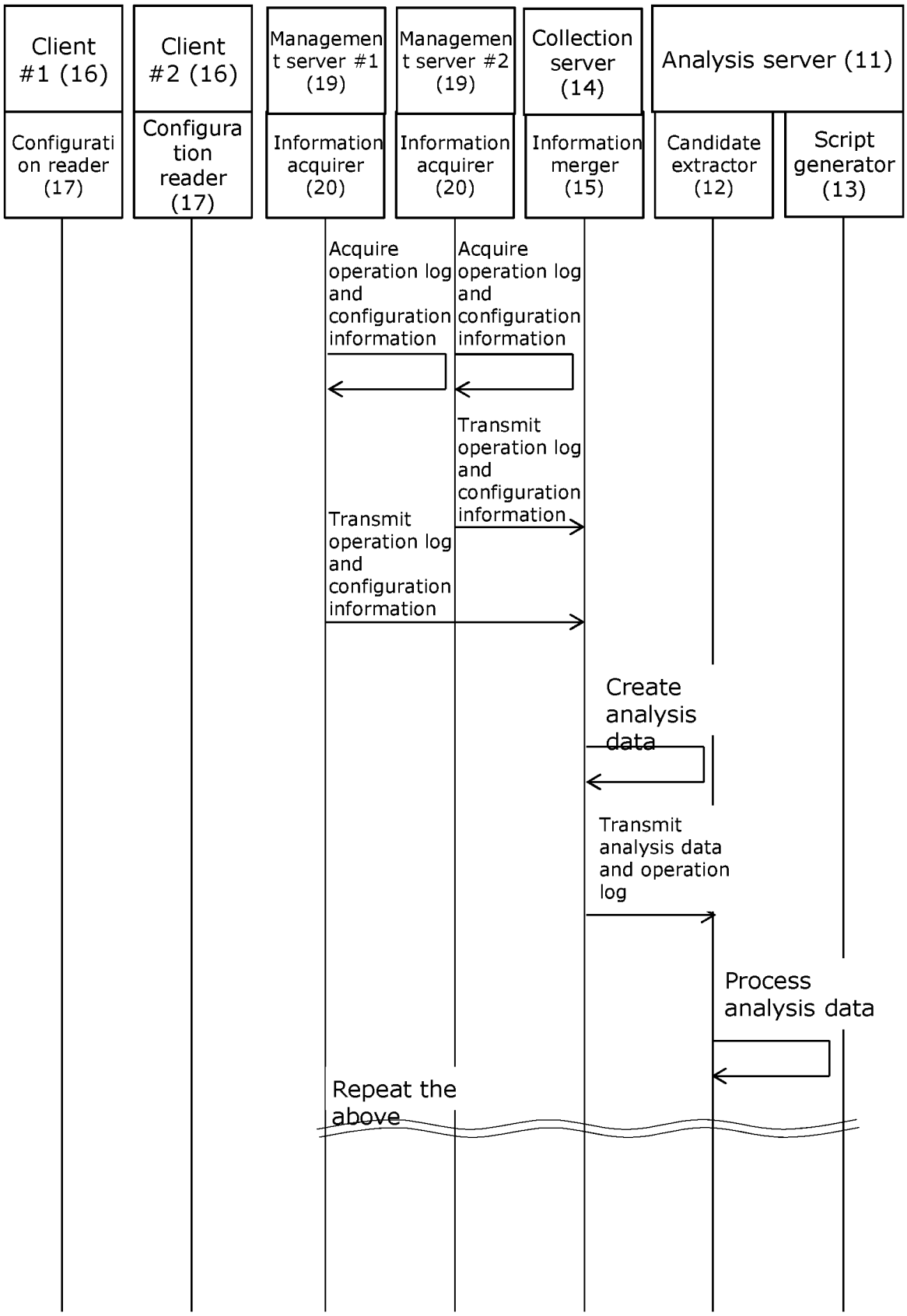

Client #1 (16)
Client #2 (16)
Management server #1 (19)
Management server #2 (19)
Collection server (14)
Analysis server (11)
Configuration reader (17)
Configuration reader (17)
Information acquirer (20)
Information acquirer (20)
Information merger (15)
Candidate extractor (12)
Script generator (13)
Acquire operation log and configuration information
Acquire operation log and configuration information
Transmit operation log and configuration information
Transmit operation log and configuration information
Create analysis data
Transmit analysis data and operation log
Process analysis data
Repeat the above

FIG. 13

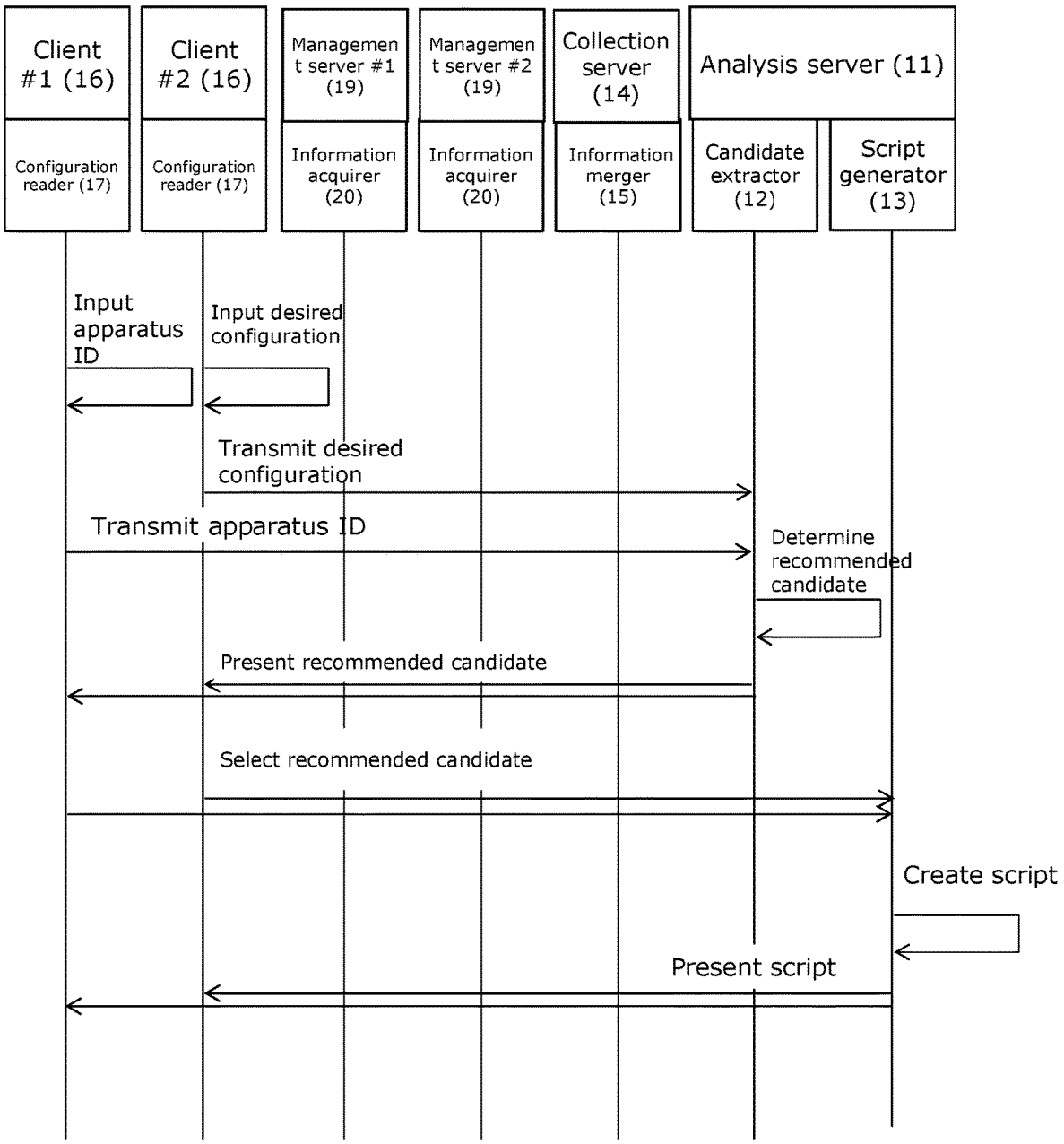

Client #1 (16)
Client #2 (16)
Managemen t server #1 (19)
Managemen t server #2 (19)
Collection server (14)
Analysis server (11)
Configuration reader (17)
Configuration reader (17)
Information acquirer (20)
Information acquirer (20)
Information merger (15)
Candidate extractor (12)
Script generator (13)
Input apparatus ID
Input desired configuration
Transmit desired configuration
Transmit apparatus ID
Determine recommended candidate
Present recommended candidate
Select recommended candidate
Create script
Present script

FIG. 14

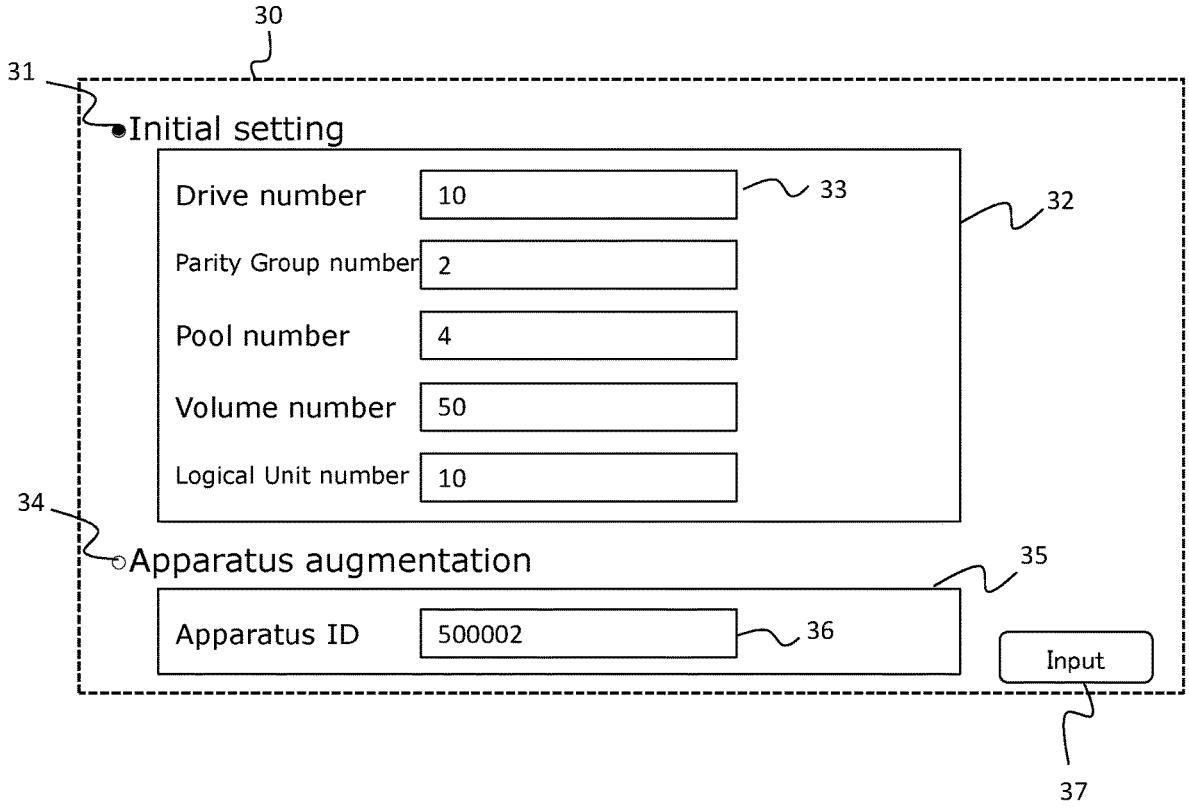
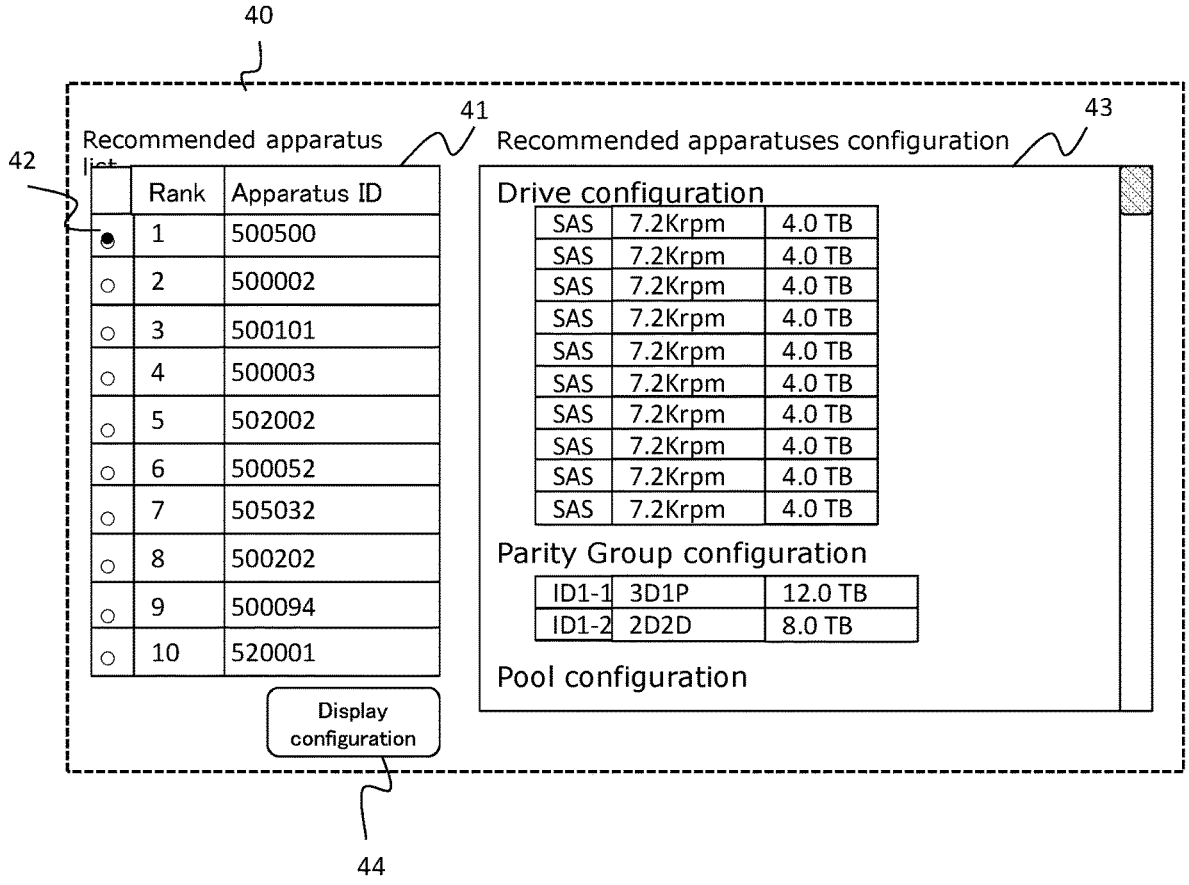

30
31
Initial setting
Drive number
10
33
32
Parity Group number
2
Pool number
4
Volume number
50
Logical Unit number
10
34
Apparatus augmentation
35
Apparatus ID
500002
36
Input
37

FIG. 15


40
41
43
42
Recommended apparatus list
Recommended apparatuses configuration
Rank
Apparatus ID
1 500500
2 500002
3 500101
4 500003
5 502002
6 500052
7 505032
8 500202
9 500094
10 520001
Drive configuration
SAS 7.2Krpm 4.0 TB
Parity Group configuration
ID1-1 3D1P 12.0 TB
ID1-2 2D2D 8.0 TB
Pool configuration
Display configuration
44

CONFIGURATION SETTING SUPPORT SYSTEM AND METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2020-018777 filed in Japan Patent Office on Feb. 6, 2020, the contents of which are hereby incorporated by reference.

BACKGROUND

[0002] The present disclosure relates to a technique of supporting setting the configuration of an information processing system.

[0003] Japanese Patent Application Publication No. 2010-282486 discloses a management computer which enables a system administrator to efficiently perform operations associated with construction of an information processing system.

[0004] The management computer disclosed in Japanese Patent Application Publication No. 2010-282486 includes a statistic information analyzer that acquires environment information of components of resources of the information processing system serving as a management target, an automation incompatibility calculator that generates history information of processing of the system administrator constructing the environment of the resources and applies weighting to automated processing and manual processing on the resources, and a script creator that controls construction of the environment of the resources.

[0005] The automation incompatibility calculator applies weighting to processing requested from the system administrator on the basis of the history information and controls automated and manual processing by digging down from a processing target device and resource to the parameters constituting the device and resource.

SUMMARY

[0006] In recent years, an information processing system such as a storage system has been sophisticated, and initial settings at the time of initial introduction and setting changes at the time of changing the configuration have become complex. Although the use of the management computer of Japanese Patent Application Publication No. 2010-282486 makes the operation of a system administrator made efficient, manual processing involves many complex operations. The workload of the system administrator may be alleviated if appropriate configuration settings are suggested.

[0007] An object of the present disclosure is to provide a technique which enables appropriate configuration settings of an information processing system to be suggested.

[0008] A configuration setting support system according to an aspect of the present disclosure is a configuration setting support system that supports setting of configuration information in an information processing apparatus, the configuration setting support system including: an information acquirer configured to acquire configuration information set in a plurality of information processing apparatuses under management; and a candidate extractor configured to select at least one of the plurality of information processing apparatuses under management on a basis of a configuration of a target information processing apparatus and the configuration information of the plurality of information processing apparatuses under management and uses the selected at least one information processing apparatus under management as a recommended candidate recommended to be used for creating the configuration information of the target information processing apparatus.

[0009] According to an aspect of the present disclosure, since the recommended candidate is selected from information processing apparatuses under management, it is possible to support setting of configuration information in the target information processing apparatus on the basis of the configuration information having records.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. **1** is a block diagram of an entire system including a storage system and a configuration setting support system;

[0011] FIG. **2** is a diagram illustrating an example of configuration information;

[0012] FIG. **3** is a diagram illustrating an example of an operation log;

[0013] FIG. **4** is a diagram illustrating an example of analysis data;

[0014] FIG. **5** is a flowchart of merging processing;

[0015] FIG. **6** is a flowchart of recommended candidate selection processing;

[0016] FIG. **7** is a flowchart of recommended candidate selection processing;

[0017] FIG. **8** is a flowchart of recommended candidate selection processing;

[0018] FIG. **9** is a conceptual diagram for describing processing step A**2**;

[0019] FIG. **10** is a conceptual diagram for describing processing step A**6**;

[0020] FIG. **11** is a flowchart of script creation processing;

[0021] FIG. **12** is a sequence diagram between apparatuses associated with the merging process;

[0022] FIG. **13** is a sequence diagram between apparatuses associated with the recommended candidate selection process and the script creation process;

[0023] FIG. **14** is a diagram illustrating an input screen for receiving the user's input of a script creation instruction; and

[0024] FIG. **15** is a diagram illustrating an output screen for presenting a recommended candidate to a user.

DETAILED DESCRIPTION OF THE EMBODIMENT

[0025] Hereinafter, an embodiment will be described with reference to the drawings.

[0026] In the present embodiment, a storage apparatus is the target in which the configuration information is set, and a configuration setting support system that supports setting of the configuration information in the storage apparatus is illustrated. The configuration setting support system places a plurality of storage apparatuses under management and can acquire the configuration information and the operation log from the storage apparatuses. The configuration setting support system selects a recommended candidate on the basis of the information acquired from the storage apparatuses under control and generates scripts which are the support information for setting the configuration information in a target storage apparatus on the basis of the configuration information of the recommended candidate.

Although the target in which the configuration information is set is a storage apparatus in this example, there is no limitation thereto. The target in which the configuration information is set may be an information processing apparatus other than the storage apparatus. Moreover, the target information processing apparatus may be a physical information processing apparatus and may be a virtual information processing apparatus.

[0027] FIG. **1** is a block diagram of an entire system including a storage system and a configuration setting support system.

[0028] Referring to FIG. **1**, the entire system includes an analysis server **11**, an analysis information collection server **14**, a client **16**, and a plurality of storage systems **18**. The configuration of the configuration setting support system is not particularly limited. In the present embodiment, as an example, the configuration setting support system is distributed to the analysis server **11**, the analysis information collection server **14**, the client **16**, and the storage system **18** and a part thereof coexists with the storage system **18**. The analysis server **11**, the analysis information collection server **14**, the client **16**, and the storage system **18** are communicably connected via a network **22**. The network **22** is configured as a communication network such as a LAN (Local Area Network) and/or a WAN (Wide Area Network), which enables cable and/or wireless communication.

[0029] The storage system **18** is an information processing system that stores data. The storage system **18** includes a storage management server **19** and a plurality of storages **21**. The storage **21** is a storage apparatus in which a logical configuration defined in configuration information is constructed.

[0030] FIG. **2** is a diagram illustrating an example of configuration information. Information related to objects of each attribute of a logical configuration of the storage **21** is recorded in the configuration information in correlation with an apparatus ID of the storage **21** and an acquisition time point. In the present embodiment, PG, LDEV, Pool, and Port are used as the object attribute.

[0031] The PG is a parity group (that is, a RAID group). Information on the PG includes a PG Type and a PG ID. The PG Type indicates a RAID type of the RAID group. A PG Type of 2D2D indicates a RAID type in which two pieces of data are prepared for two types of data. 3D1P indicates a RAID type in which one parity is prepared for three pieces of data. The PG ID is an identifier for identifying the RAID group.

[0032] The LDEV is a logical device. Information on the LDEV includes an LDEV Type, an LDEV ID, and an LDEV Size. The LDEV Type indicates the type of the LDEV. An LDEV Type of BASIC indicates an internal volume. VVOL indicates a virtual volume. The LDEV ID is an identifier for identifying the LDEV. The LDEV Size indicates the size of the LDEV.

[0033] The Pool is a pool having a storage capacity. The information on the Pool includes a Pool ID and a Pool Size. The Pool ID is an identifier for identifying the Pool. The Pool Size is the size of the storage capacity of the Pool.

[0034] The Port is a port. The information on the Port includes a Port ID, a HG ID, and a LU ID.

[0035] The Port ID is an identifier for identifying the Port. The HG ID is an identifier of a host group of the Port. The LU ID is an identifier of a logical unit of the Port.

[0036] The storage management server **19** is a server that manages the plurality of storages **21** and includes an information acquirer **20**. The information acquirer **20** acquires information including the configuration information and the operation log of each storage **21** by communicating with a GUM (Gateway for United Management) (not illustrated) that provides a management function for managing the storages **21**.

[0037] FIG. **3** is a diagram illustrating an example of the operation log. The operation log is history information related to operations executed for the storage **21**. In the present embodiment, the operation log has a format including "apparatus ID, operation date (YYYY/MM/DD), operation time (HH:MM:SS:xxx), time zone (UTC±HH:MM), operation name, parameter, and operation result". The apparatus ID is an identifier of the storage **21** on which an operation was executed. The operation date is the date when an operation was executed. The operation time is a time point at which an operation was executed. The time zone is a time zone of the operation date and the operation time. The operation name is the name of an executed operation. An operation name of Create Ldev indicates an operation of generating an LDEV. Delete Ldev indicates an operation of deleting an LDEV. The parameter is a parameter used for the operation. The operation result is the execution result of the operation. An operation result of Normal End indicates a normal end of the operation.

[0038] The storages **21** may include a storage apparatus serving as a target in which configuration information is set with the support of the configuration setting support system as well as a storage apparatus which is under control of the configuration setting support system and of which the configuration information or the like can be acquired by the configuration setting support system. The target storage apparatus has basically the same configuration as the storage **21** under control.

[0039] The analysis information collection server **14** is a server that collects configuration information of the storages **21** from the storage management server **19** of each storage system **18** and includes an information merger **15**. The information merger **15** collects the configuration information of each storage **21** acquired by the information acquirer **20** of the storage management server **19** of each storage system **18**, extracts information used for constructing a logical configuration of the storage apparatus, merges the extracted pieces of information to generate analysis data, and provides the same to the analysis server **11**. The analysis data in the present embodiment includes information on predetermined minimum objects necessary for the logical configuration of the storage apparatus and information on the time point at which the information was acquired. Processing of merging the extracted pieces of information to generate the analysis data is referred to as merging processing, and the details thereof will be described later.

[0040] FIG. **4** is a diagram illustrating an example of the analysis data. The schema of the analysis data includes an apparatus ID of the storage apparatus, a Drive number, a PG number, a POOL number, an LDEV number, an LU number, and a time point. The Drive number is the number of drives. The PG number is the number of PGs. The POOL number is the number of Pools. The LDEV number is the number of LDEVs. The LU number is the number of LUs.

[0041] When an operation related to an object included in the schema is performed, the information on the object may

change. Therefore, for example, the analysis information collection server **14** may add a new record to the analysis data on the basis of the configuration information when an operation related to the object included in the schema was performed by referring to the operation log.

[0042] The analysis server **11** selects one or more storages **21** serving as recommended candidates on the basis of the analysis data provided from the analysis information collection server **14** and generates a script for setting the configuration information in a target storage apparatus on the basis of the configuration information of the recommended candidates. The analysis server **11** includes a candidate extractor **12** and a script generator **13**.

[0043] The candidate extractor **12** selects recommended candidates among the storages **21** under control. For example, a storage **21** in which the configuration information close to a predetermined desired configuration is set may be selected as the recommended candidate preferentially. Moreover, for example, a priority may be assigned in advance to an attribute of the object that constitutes the logical configuration, and the recommended candidate may be selected by taking the priority into consideration. Moreover, the recommended candidate may be selected from the storages **21** having the configuration information having a record value in a predetermined number or more of storages **21** under control. The processing of selecting the recommended candidate is referred to as recommended candidate selection processing and the details thereof will be described later.

[0044] The script generator **13** creates a script for setting configuration information in a target storage apparatus in which configuration information is set on the basis of the configuration information of the recommended candidate storages **21**. The script is a file including a series of commands for realizing a configuration indicated by the configuration information of the recommended candidate in the target storage apparatus. For example, when a new target storage apparatus is constructed, a script for performing initial setting according to the configuration information may be created. Moreover, when the target storage apparatus is an existing apparatus, a script for updating the setting of the present configuration applied to the target storage apparatus according to the configuration information of the recommended candidate may be created. The process of creating the script is referred to as script creation processing, and the details thereof will be described later.

[0045] The client **16** is an apparatus that provides a user interface of the configuration setting support system and includes a configuration reader **17**, and the configuration reader **17** operates the configuration setting support system according to an operation of a user **23**. Moreover, the client **16** provides an operation result of the configuration setting support system to the user **23** by displaying the same on a screen and/or outputting the same as a file.

[0046] FIG. **5** is a flowchart of merging processing.

[0047] The information merger **15** collects the operation log and the configuration information from each storage management server **19** (step **101**). Subsequently, the information merger **15** determines whether this is the first registration of analysis data (step **102**). If this is the first registration, the information merger **15** extracts given information used for constructing the logical configuration of the storage apparatus from the configuration information (step **103**). In the present embodiment, from the information explicitly or implicitly illustrated in the configuration information of FIG. **2**, an apparatus ID, a Drive number, a PG number, a POOL number, an LDEV number, an LU number, and a time point serving as the records of the analysis data illustrated in FIG. **4** are acquired. Subsequently, the information merger **15** registers the information acquired from the configuration information as analysis data (step **104**).

[0048] When this is not the first registration in step **102**, the information merger **15** determines whether the value of an attribute to be recorded as analysis data, in the configuration information is changed (step **105**). If the attribute value is not changed, the information merger **15** registers information up to the latest records acquired in the past as the analysis data (step **104**). If the attribute value is changed in step **105**, the information merger **15** identifies a location where the configuration information is changed on the basis of the operation log, acquires given information used for constructing the logical configuration of the storage apparatus from the location, and adds the same as a new record after the latest records acquired in the past (step **106**). Subsequently, the information merger **15** registers information up to the newly added record as the analysis data (step **104**).

[0049] FIGS. **6** to **8** are flowcharts of the recommended candidate selection process.

[0050] First, the candidate extractor **12** reads analysis data (hereinafter referred to (a)) and configuration information (hereinafter referred to as (b)) for each storage **21** which is an apparatus under control (step **201**). Subsequently, the candidate extractor **12** determines whether this is the first setting (initial setting) of the configuration information in the storage which is the target apparatus (step **202**).

[0051] If this is the first setting, the candidate extractor **12** reads the configuration information (hereinafter referred to as (c)) of the target apparatus (step **203**) and executes processing steps A**1** to A**9** (steps **204** to **212**). The content of processing steps A**1** to A**9** will be described later. On the other hand, if this is not the first setting, the candidate extractor **12** reads an apparatus ID (hereinafter referred to as (d)) of the target apparatus (step **213**) and executes processing steps B**1** to B**7** (steps **214** to **221**).

[0052] Hereinafter, processing steps A**1** to A**9** will be described.

[0053] In processing step A**1**, the candidate extractor **12** acquires the configuration information during the initial setting of each apparatus under control from the analysis data (a) (step **204**) and proceeds to processing step A**2**.

[0054] FIG. **9** is a conceptual diagram for describing processing step A**2**. As illustrated in FIG. **9**, in processing step A**2**, the candidate extractor **12** aggregates attribute values for each apparatus, which are the result of processing step A**1** for respective attributes again and sorts the attribute values in descending order of frequencies. The frequency of values indicates how many apparatuses are using the value (step **205**).

[0055] In processing step A**3**, the candidate extractor **12** acquires a predetermined number of (for example top ten) values having the higher frequencies for the attribute of each object from the result of processing step A**2** (step **206**). An attribute value having a higher frequency means that the use record in the apparatus under control is high. By using a predetermined number or smaller of values having the higher frequencies, it is possible to use values having a use record to some extent.

[0056] In processing step A**4**, the candidate extractor **12** identifies a value closest to the value of the desired configuration for each attribute from the result of processing step A**3** (step **207**).

[0057] In processing step A**5**, the candidate extractor **12** sets a priority to each attribute (step **208**). This priority determines which attribute value of an object will be preferentially used for constructing the configuration information. In the present embodiment, an attribute located closer to the root side (the lower layer side) in the dependency of the objects of a storage is prioritized. Specifically, the priority increases in order of Drive number, PG number, POOL number, LDEV number, and LU number.

[0058] FIG. **10** is a conceptual diagram for describing processing step A**6**. As illustrated in FIG. **10**, in processing step A**6**, the candidate extractor **12** calculates a similarity between the configuration information and the desired configuration for each apparatus under control by accumulating the number of attributes having values the same as or closest to the values identified in processing step A**4** for each apparatus under control (step **209**). In FIG. **10**, since the values of attributes having values the same as or closest to the values identified in processing step A**4** are shaded, the number of shaded portions may be counted for each apparatus under control.

[0059] In processing step A**7**, the candidate extractor **12** sorts the apparatuses under control in descending order of the similarities calculated in processing step A**6** (step **210**). If attributes have the same similarity, an attribute (the shaded attribute in FIG. **10**) having a value the same as or closest to the value identified in processing step A**4** among attributes having higher priorities is on the higher rank.

[0060] In processing step A**8**, the candidate extractor **12** acquires the apparatus IDs of a predetermined number of (in the present embodiment, ten as an example) higher-rank apparatuses from the result of processing step A**7** (step **211**). The apparatuses of which the apparatus IDs are acquired herein are the recommended candidates.

[0061] In processing step A**9**, the candidate extractor **12** extracts the configuration information of each of the ten apparatuses having the apparatus IDs acquired in processing step A**8** from the configuration information (b) acquired in step **202** (step **212**).

[0062] Hereinafter, processing steps B**1** to B**7** will be described.

[0063] In processing step B**1**, the candidate extractor **12** acquires the configuration information of all periods from the initial setting time to the present time in units of months for the apparatuses having the apparatus ID (d) registered in the analysis data (a), that is, target apparatuses (step **214**).

[0064] In processing step B**2**, the candidate extractor **12** acquires the configuration information from the initial setting time to the present time in units of months for each apparatus other than the apparatus having the apparatus ID (d) registered in the analysis data (a) among the apparatus under control (step **215**).

[0065] In processing step B**3**, the candidate extractor **12** extracts a number of pieces of configuration information corresponding to the same number of pieces (number of months) as that of the configuration information acquired in processing step B**1** from the initial setting time from the pieces of configuration information of each apparatus acquired in processing step B**2** (step **216**). A period corresponding to the number of months extracted herein from the initial setting time is referred to as a total period.

[0066] Furthermore, the candidate extractor **12** executes processing steps B**4** and B**5** illustrated below with respect to each month of configuration information corresponding to the number of pieces (number of months) of the configuration information acquired in processing step B**1** (steps **217***a* to **217***b*).

[0067] In processing step B**4**, the candidate extractor **12** executes processing steps A**2** to A**8** by regarding the configuration information of the target apparatus in the month acquired in processing step B**1** as the configuration information (c) of processing step A**1** and regarding the configuration information of a month corresponding to the month as counted from the initial setting time of each apparatus acquired in processing step B**2** as the configuration information at the initial setting time of processing step A**1** (step **218**).

[0068] In processing step B**5**, the candidate extractor **12** records a predetermined number of (in the present embodiment, ten as an example) apparatus IDs acquired in processing step B**4** for the month (step **219**).

[0069] In processing step B**6**, the candidate extractor **12** sorts sets of ten apparatus IDs recorded in processing step B**6** in the total period up to a month corresponding to the present month, of the target apparatus from the initial setting time in descending order of appearances and acquires a predetermined number of (in the present embodiment, ten as an example) higher apparatus IDs (step **220**). The apparatuses of which the apparatus IDs are acquired herein are the recommended candidates.

[0070] In processing step B**7**, the candidate extractor **12** acquires the configuration information of the next month in the total period from the result of processing step B**2** with respect to the apparatuses corresponding to the ten apparatus IDs acquired in processing step B**6** (step **221**).

[0071] FIG. **11** is a flowchart of the script creation process.

[0072] The script generator **13** determines whether this is the first setting (initial setting) of the configuration information in the storage which is a target apparatus (step **301**).

[0073] If this is the first setting, the script generator **13** reads the configuration information of the storage **21** which is a recommended candidate (step **302**). As a logical configuration, the configuration information includes dependency that objects of the storage **21** which is a recommended candidate have a plurality of layers. The script generator **13** constructs a tree corresponding to the logical configuration of the read configuration information (step **303**). That is, a tree of objects in which a lower layer of the logical configuration is closer to the root side is constructed. For example, a tree is constructed in such a way that the system is a root and nodes arranged in the order of Drive, PG, POOL, LDEV, and LU are connected from the root until reaching leaves. Subsequently, the script generator **13** generates commands for creating objects corresponding to the nods of the constructed tree (step **304**). Furthermore, the script generator **13** performs breadth-first search on the tree and sorts the commands corresponding to the nodes in order of nodes found in the search (step **305**). The script generator **13** uses the sorted command sequence as a script (step **306**).

[0074] If this is not the first setting in step **301**, the script generator **13** reads the configuration information of the storage **21** which is a recommended candidate and the apparatus ID of the storage **21** which is a target apparatus

(step **307**). Subsequently, the script generator **13** derives the logical configuration of the configuration information of the storage **21** which is the target apparatus from the apparatus ID (step **308**). Subsequently, the script generator **13** constructs a tree corresponding to the logical configuration of the target apparatus, that is, a tree of objects in which the lower layer of the logical configuration is on the root side (step **309**). Hereinafter, this tree is referred to as a "present tree". Subsequently, the script generator **13** constructs a tree corresponding to the logical configuration of the configuration information of the recommended candidate, that is, a tree of objects in which the lower layer of the logical configuration is on the root side (step **310**). Hereinafter, this tree is referred to as an "input tree".

[0075] Subsequently, the script generator **13** performs breadth-first search on the input tree and sets the first found node as the target of the following processing (step **311**). Hereinafter, this node is referred to as a target node.

[0076] Subsequently, the script generator **13** determines whether a target node is present in the input tree (step **312**). If the target node is present in the input tree, the script generator **13** performs breadth-first search on the present tree to check whether a node corresponding to the target node in the input tree is present in the present tree (step **313**) and determines whether a node corresponding to the target node is present in the present tree (step **314**).

[0077] If a node corresponding to the target node is not present in the present tree, the script generator **13** adds a node corresponding to the target node to the present tree and sets a flag to the node indicating that the node is newly added (step **315**). In this case, the position in the present tree to which the new node is added is the same position of the same layer as the layer on which the target node is present in the input tree.

[0078] When the node corresponding to the target node is present in the present tree in step **314** or after step **315** is executed, the script generator **13** performs breadth-first search on the input tree and sets a node found next to the present target node as a new target node (step **316**) and returns to step **312**.

[0079] If the target node is not present in the input tree in step **312**, the script generator **13** performs breadth-first search on the present tree, and when a node in which a flag is set is found, generates commands for creating an object corresponding to the node (step **317**). Subsequently, the script generator **13** performs breadth-first search on the present tree and sorts commands corresponding to the node in which a flag is set in order of nodes found in the search (step **318**). The script generator **13** uses the sorted command sequence as a script (step **306**).

[0080] FIG. **12** is a sequence diagram between apparatuses associated with the merging process.

[0081] In this example, as a configuration example, it is assumed that two storage systems **18** are provided, and each includes the storage management server **19**. Moreover, it is assumed that two clients **16** are provided.

[0082] First, the information acquirers **20** of the storage management servers #**1** and #**2** (**19**) acquire the operation log and the configuration information of the storages **21** under control thereof and transmit the same to the information merger **15** of the analysis information collection server **14**. The information merger **15** merges the configuration information received from the information acquirers **20** to create analysis data and transmits the analysis data and the operation log to the candidate extractor **12** of the analysis server **11**. The candidate extractor **12** processes the received analysis data.

[0083] FIG. **13** is a sequence diagram between apparatuses associated with the recommended candidate selection process and the script creation process.

[0084] In this example, similarly to the configuration example of FIG. **12**, it is assumed that two storage systems **18** are provided and each includes the storage management server **19**. Moreover, it is assumed that two clients **16** are provided. In this example, it is assumed that the user of the client #**1** (**16**) wants to augment the storage in operation (apparatus augmentation). It is assumed that the user of the client #**2** (**16**) wants to perform initial setting of the configuration information in a new storage.

[0085] First, the configuration reader **17** of the client #**1** (**16**) receives an apparatus ID of a storage which is a target apparatus in which configuration information is to be set, the apparatus ID being input by the user. Moreover, the configuration reader **17** of the client #**2** (**16**) receives a desired configuration which is a configuration desired by the user as an initial setting in the target apparatus, the desired configuration being input by the user. The configuration reader **17** of the client #**1** (**16**) transmits the received apparatus ID to the candidate extractor **12** of the analysis server **11**. The configuration reader **17** of the client #**2** (**16**) transmits the received desired configuration to the candidate extractor **12** of the analysis server **11**.

[0086] The candidate extractor **12** determines the storage **21** which uses the configuration information close to the desired configuration from the client #**2** at the initial setting time as the recommended candidate using the analysis data and the operation log acquired in the sequence illustrated in FIG. **12**. A plurality of recommended candidates may be determined. The candidate extractor **12** presents the determined recommended candidate to the configuration reader **17** of the client #**2** (**16**).

[0087] The candidate extractor **12** determines the storage **21** having the progress of update of the configuration information close to the progress of update so far of the configuration information of the target apparatus indicated by the apparatus ID from the client #**1** as the recommended candidate using the analysis data and the operation log acquired in the sequence illustrated in FIG. **12**. A plurality of recommended candidates may be determined. The candidate extractor **12** presents the determined recommended candidate to the configuration reader **17** of the client #**1** (**16**).

[0088] The configuration reader **17** of each of the clients #**1**, #**2** (**16**) selects one of the recommended candidates presented from the candidate extractor **12** according to the user's operation and notifies the script generator **13** of the analysis server **11** of the selected recommended candidate. The script generator **13** creates a script for setting the configuration information in the target apparatus on the basis of the configuration information of the selected recommended candidate and presents the same to the configuration readers **17** of the clients #**1**, #**2** (**16**). The script for the initial setting is a script for setting desired configuration information newly. A script for configuration augmentation is a script for updating the present configuration information with desired configuration information.

[0089] FIG. **14** is a diagram illustrating an input screen for receiving the user's input of a script creation instruction.

[0090] An input screen **30** includes radio buttons **31** and **34** for selecting initial setting or apparatus augmentation, input areas **32** and **35** for initial setting and apparatus augmentation, and an input button **37** for confirming the input content and issuing a script creation instruction. The user can select whether initial setting or apparatus augmentation will be performed using the radio buttons **31** and **34**. When the radio button **31** for initial setting is pressed, the input area **32** for initial setting is activated and a state in which text can be input in a text box **33** is created. In this case, the input area **35** for apparatus augmentation is deactivated and a state in which text cannot be input in a text box **36** is created. When the input button **37** is pressed, creation of a script with the input content set in the activated input area starts.

[0091] FIG. **15** is a diagram illustrating an output screen for presenting a recommended candidate to a user.

[0092] An output screen **40** includes an output area **41** for displaying a list of recommended candidates, an output area **43** for displaying an apparatus configuration of the recommended candidate, and a configuration display button **44**. The output area **41** includes a list of apparatus IDs of storages which are recommended candidates and a radio button **42** correlated with each apparatus ID. When the radio button **42** corresponding to one of apparatus IDs is pressed, a state in which a storage having the apparatus ID is selected is created. When the configuration display button **44** is pressed in a state where a certain storage is selected, an apparatus configuration of the selected storage is displayed in the output area **43**. Objects on each layer of the storage and information on the objects are displayed in the output area **43**.

[0093] The present embodiment described hereinabove includes the following items. However, the items included in the present embodiment are not limited to the following.

[0094] Item 1

[0095] A configuration setting support system is a configuration setting support system that supports setting of configuration information in an information processing apparatus, the configuration setting support system including: an information acquirer configured to acquire configuration information set in a plurality of information processing apparatuses under management; and a candidate extractor configured to select at least one of the plurality of information processing apparatuses under management on the basis of a configuration of a target information processing apparatus and the configuration information of the plurality of information processing apparatuses under management and uses the selected at least one information processing apparatus under management as a recommended candidate recommended to be used for creating the configuration information of the target information processing apparatus. In this way, since the recommended candidate is selected from the information processing apparatuses under management, it is possible to support setting of configuration information in the target information processing apparatus on the basis of the configuration information having records.

[0096] Item 2

[0097] The configuration setting support system according to Item 1 further includes a user interface unit configured to receive an input for designating the target information processing apparatus. In this way, since a designation of the target information processing apparatus is received and the recommended candidate for the designated target information processing apparatus is determined, it is possible to support setting of suitable configuration information in a desired target information processing apparatus.

[0098] Item 3

[0099] In the configuration setting support system according to Item 2, the user interface unit is configured to receive an input of a desired configuration that is desirable to be set in the target information processing apparatus, and the candidate extractor is configured to select at least one of the plurality of information processing apparatuses under management on the basis of the desired configuration and the configuration information of the information processing apparatuses under management. In this way, since the desired configuration is received and the recommended candidate is selected according to the desired configuration, it is possible to support setting of desired configuration information in the target information processing apparatus.

[0100] Item 4

[0101] The configuration setting support system according to Item 1 further includes a support information creator configured to create support information for setting configuration information in the target information processing apparatus on the basis of configuration information of the recommended candidate information processing apparatus under management. In this way, since the support information based on the configuration of the recommended candidate is generated, it is possible to facilitate setting of configuration information in the target information processing apparatus.

[0102] Item 5

[0103] In the configuration setting support system according to Item 4, the support information creator is configured to create support information for updating the configuration information of the target information processing apparatus with the configuration information of the recommended candidate information processing apparatus under management on the basis of a difference between existing configuration information set in the target information processing apparatus and the configuration information of the recommended candidate information processing apparatus under management. In this way, since the support information for updating the configuration information is generated on the basis of a difference between the existing configuration information of the target information processing apparatus and the configuration information of the recommended candidate information processing apparatus under management, it is possible to easily update the configuration information set in advance in the target information processing apparatus.

[0104] Item 6

[0105] In the configuration setting support system according to Item 3, the configuration information of the information processing apparatus under management includes a logical configuration made up of a plurality of attributes of objects, and the candidate extractor select at least one of the plurality of information processing apparatuses under management on the basis of the number of objects of each of the plurality of attributes in the desired configuration and the number of objects of each of the plurality of attributes in the configuration information of the information processing apparatuses under management. In this way, since the recommended candidate is selected on the basis of the priority of each object attribute, an information processing apparatus

under management closer to the configuration information of the object having a high priority can be recommended as the recommended candidate.

[0106] Item 7

[0107] In the configuration setting support system according to Item 3, the configuration information of the information processing apparatuses under management includes a logical configuration made up of a plurality of attributes of objects, a priority is set to each of the attributes, and the candidate extractor is configured to select at least one of the plurality of information processing apparatuses under management on the basis of the desired configuration, the configuration information of the information processing apparatuses under management, and the priority. In this way, since the recommended candidate is selected on the basis of the priority of each object attribute, the information processing apparatus under management closer to the configuration information of the object having a high priority can be recommended as the recommended candidate.

[0108] Item 8

[0109] In the configuration setting support system according to Item 7, the configuration information of the information processing apparatuses under management includes a logical configuration made up of a plurality of layers of objects, and the layers are the attributes. In this way, since the recommended candidate is selected on the basis of the priority of each object layer, the information processing apparatus under management closer to the configuration information of the object layer having a high priority can be recommended as the recommended candidate.

[0110] Item 9

[0111] In the configuration setting support system according to Item 2, the candidate extractor is configured to select at least one of the plurality of information processing apparatuses under management as the recommended candidate on the basis of change in the configuration information from initial setting of the target information processing apparatus and change in the configuration information from initial setting of the information processing apparatuses under management. In this way, since the information processing apparatus under management in which change in configuration information is close to change up to the present time point of the configuration information of the target information processing apparatus is recommended as the recommended candidate, it is possible to support setting of configuration information in the information processing apparatus in operation by taking changes into consideration.

[0112] Item 10

[0113] The configuration setting support system according to Item 9 further includes a support information creator configured to create support information for setting the configuration information in the target information processing apparatus on the basis of configuration information at a next time point of configuration information of the information processing apparatus under management selected as the recommended candidate, corresponding to the configuration information at a present time point of the target information processing apparatus. In this way, since support information is generated using the configuration information of the information processing apparatus under management in which change in configuration information is close to change up to the present time point of the configuration information of the target information processing apparatus, it is possible to facilitate setting of configuration information in the information processing apparatus in operation.

[0114] The above-described embodiment is an example for describing the present disclosure and the present disclosure is not limited by the embodiment. The present invention can be embodied in a variety of other aspects by those skilled in the art without departing from the scope of the present disclosure.

What is claimed is:

1. A configuration setting support system that supports setting of configuration information in an information processing apparatus, the configuration setting support system comprising:

an information acquirer configured to acquire configuration information set in a plurality of information processing apparatuses under management; and

a candidate extractor configured to select at least one of the plurality of information processing apparatuses under management on a basis of a configuration of a target information processing apparatus and the configuration information of the plurality of information processing apparatuses under management and uses the selected at least one information processing apparatus under management as a recommended candidate recommended to be used for creating the configuration information of the target information processing apparatus.

2. The configuration setting support system according to claim **1**, further comprising

a user interface unit configured to receive an input for designating the target information processing apparatus.

3. The configuration setting support system according to claim **2**, wherein

the user interface unit is configured to receive an input of a desired configuration that is desirable to be set in the target information processing apparatus, and

the candidate extractor is configured to select at least one of the plurality of information processing apparatuses under management on a basis of the desired configuration and the configuration information of the information processing apparatuses under management.

4. The configuration setting support system according to claim **1**, further comprising

a support information creator configured to create support information for setting configuration information in the target information processing apparatus on a basis of configuration information of the recommended candidate information processing apparatus under management.

5. The configuration setting support system according to claim **4**, wherein

the support information creator is configured to create support information for updating the configuration information of the target information processing apparatus with the configuration information of the recommended candidate information processing apparatus under management on a basis of a difference between existing configuration information set in the target information processing apparatus and the configuration information of the recommended candidate information processing apparatus under management.

6. The configuration setting support system according to claim **3**, wherein

the configuration information of the information processing apparatuses under management includes a logical configuration made up of a plurality of attributes of objects, and

the candidate extractor is configured to select at least one of the plurality of information processing apparatuses under management on a basis of a number of objects of each of the plurality of attributes in the desired configuration and a number of objects of each of the plurality of attributes in the configuration information of the information processing apparatuses under management.

7. The configuration setting support system according to claim **3**, wherein

the configuration information of the information processing apparatuses under management includes a logical configuration made up of a plurality of attributes of objects,

a priority is set to each of the attributes, and

the candidate extractor is configured to select at least one of the plurality of information processing apparatuses under management on a basis of the desired configuration, the configuration information of the information processing apparatuses under management, and the priority.

8. The configuration setting support system according to claim **7**, wherein

the configuration information of the information processing apparatuses under management includes a logical configuration made up of a plurality of layers of objects, and

the layers are the attributes.

9. The configuration setting support system according to claim **2**, wherein

the candidate extractor is configured to select at least one of the plurality of information processing apparatuses under management as the recommended candidate on a basis of change in the configuration information from initial setting of the target information processing apparatus and change in the configuration information from initial setting of the information processing apparatuses under management.

10. The configuration setting support system according to claim **9**, further comprising

a support information creator configured to create support information for setting the configuration information in the target information processing apparatus on a basis of configuration information at a next time point of configuration information of the information processing apparatus under management selected as the recommended candidate, corresponding to the configuration information at a present time point of the target information processing apparatus.

11. A configuration setting support method for supporting setting of configuration information in an information processing apparatus, the configuration setting support method comprising causing a computer to execute:

acquiring configuration information set in a plurality of information processing apparatuses under management; and

selecting at least one of the plurality of information processing apparatuses under management on a basis of a configuration of a target information processing apparatus and the configuration information of the plurality of information processing apparatuses under management and using the selected at least one information processing apparatus under management as a recommended candidate recommended to be used for creating the configuration information of the target information processing apparatus.

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