US 20250265523A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2025/0265523 A1**

WATANABE (43) **Pub. Date: Aug. 21, 2025**

(54) **WORKFLOW CREATION SUPPORT DEVICE AND METHOD**

(71) Applicant: **Hitachi, Ltd.**, Tokyo (JP)

(72) Inventor: **Tomohiro WATANABE**, Tokyo (JP)

(21) Appl. No.: **18/816,077**

(22) Filed: **Aug. 27, 2024**

(30) **Foreign Application Priority Data**

Feb. 21, 2024 (JP) 2024-024678

Publication Classification

(51) **Int. Cl.**
G06Q 10/0631 (2023.01)

(52) **U.S. Cl.**
CPC ***G06Q 10/06316*** (2013.01)

(57) **ABSTRACT**

A workflow creation support device and method capable of reducing labor and time required for creating a workflow are proposed. In a workflow creation support method executed by a workflow creation support device that supports creation of a workflow including a plurality of tasks and a workflow creation support method executed by the workflow creation support device, definition contents of a workflow created in the past are managed, and a task candidate of a step to be targeted in the workflow being created is extracted and recommended on the basis of definition contents of a predetermined number of steps of previous and/or subsequent tasks already defined in the workflow being created and definition contents of the existing workflow being managed.

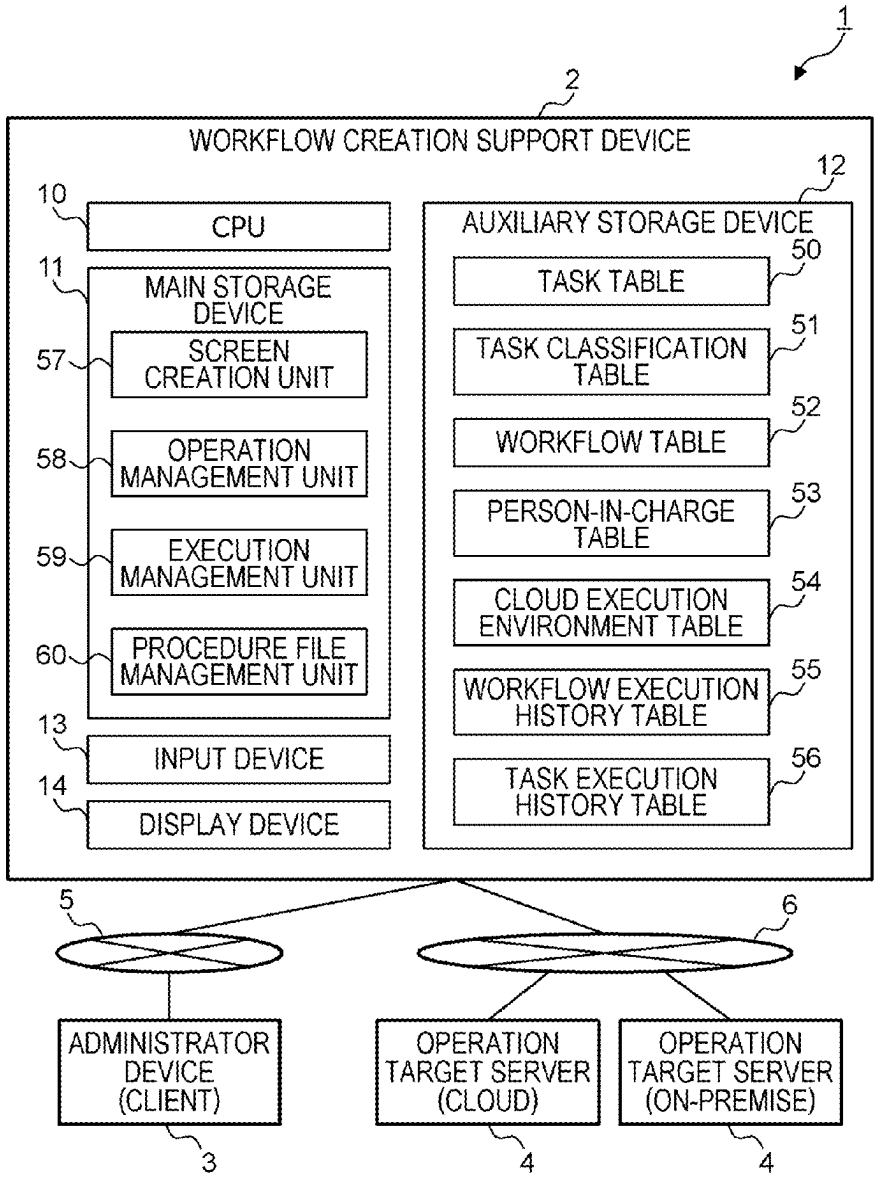


FIG. 1

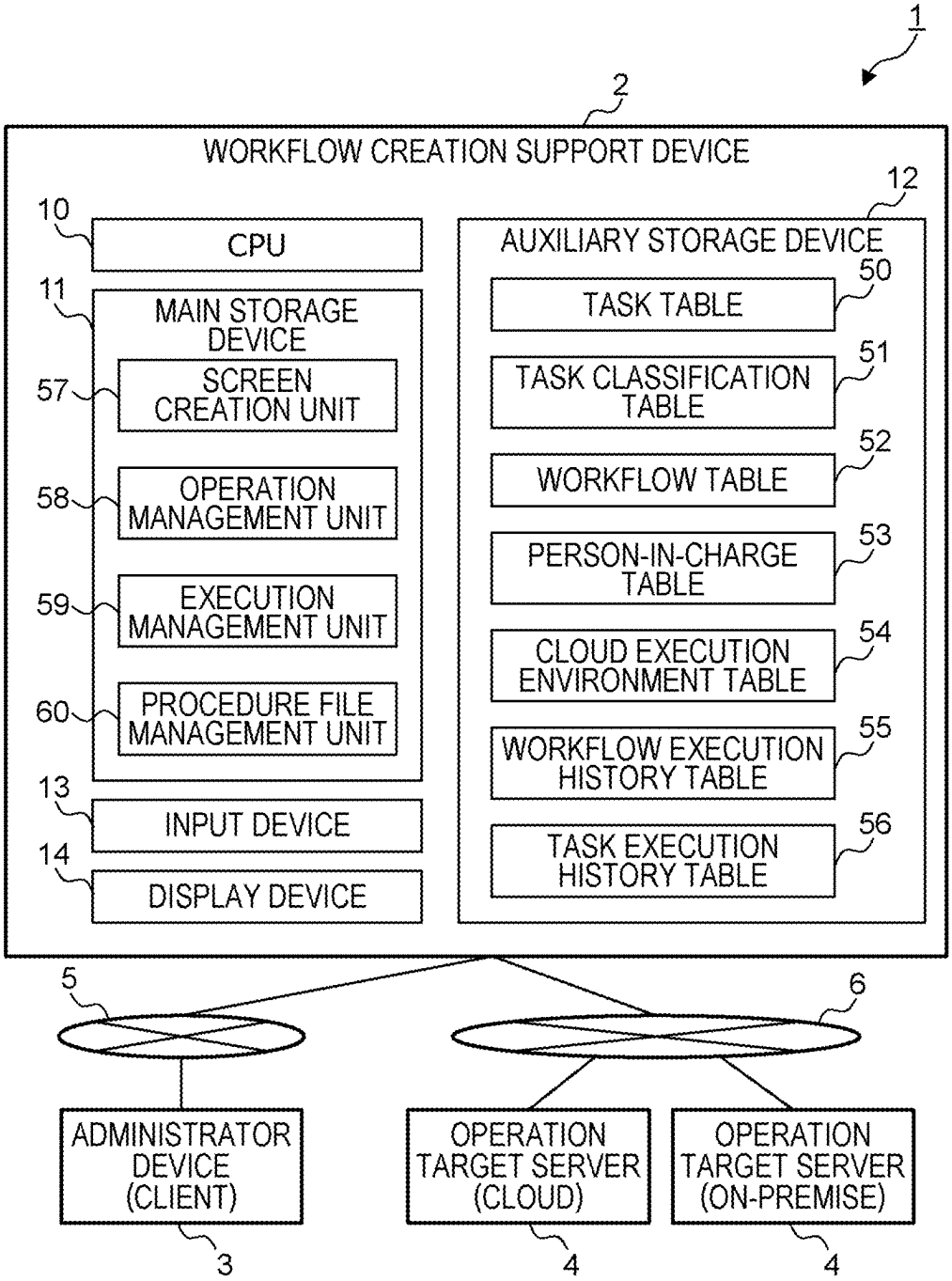

1
2
WORKFLOW CREATION SUPPORT DEVICE
10
CPU
11
MAIN STORAGE DEVICE
57
SCREEN CREATION UNIT
58
OPERATION MANAGEMENT UNIT
59
EXECUTION MANAGEMENT UNIT
60
PROCEDURE FILE MANAGEMENT UNIT
13
INPUT DEVICE
14
DISPLAY DEVICE
12
AUXILIARY STORAGE DEVICE
50
TASK TABLE
51
TASK CLASSIFICATION TABLE
52
WORKFLOW TABLE
53
PERSON-IN-CHARGE TABLE
54
CLOUD EXECUTION ENVIRONMENT TABLE
55
WORKFLOW EXECUTION HISTORY TABLE
56
TASK EXECUTION HISTORY TABLE
5
6
ADMINISTRATOR DEVICE (CLIENT)
3
OPERATION TARGET SERVER (CLOUD)
4
OPERATION TARGET SERVER (ON-PREMISE)
4

FIG. 2

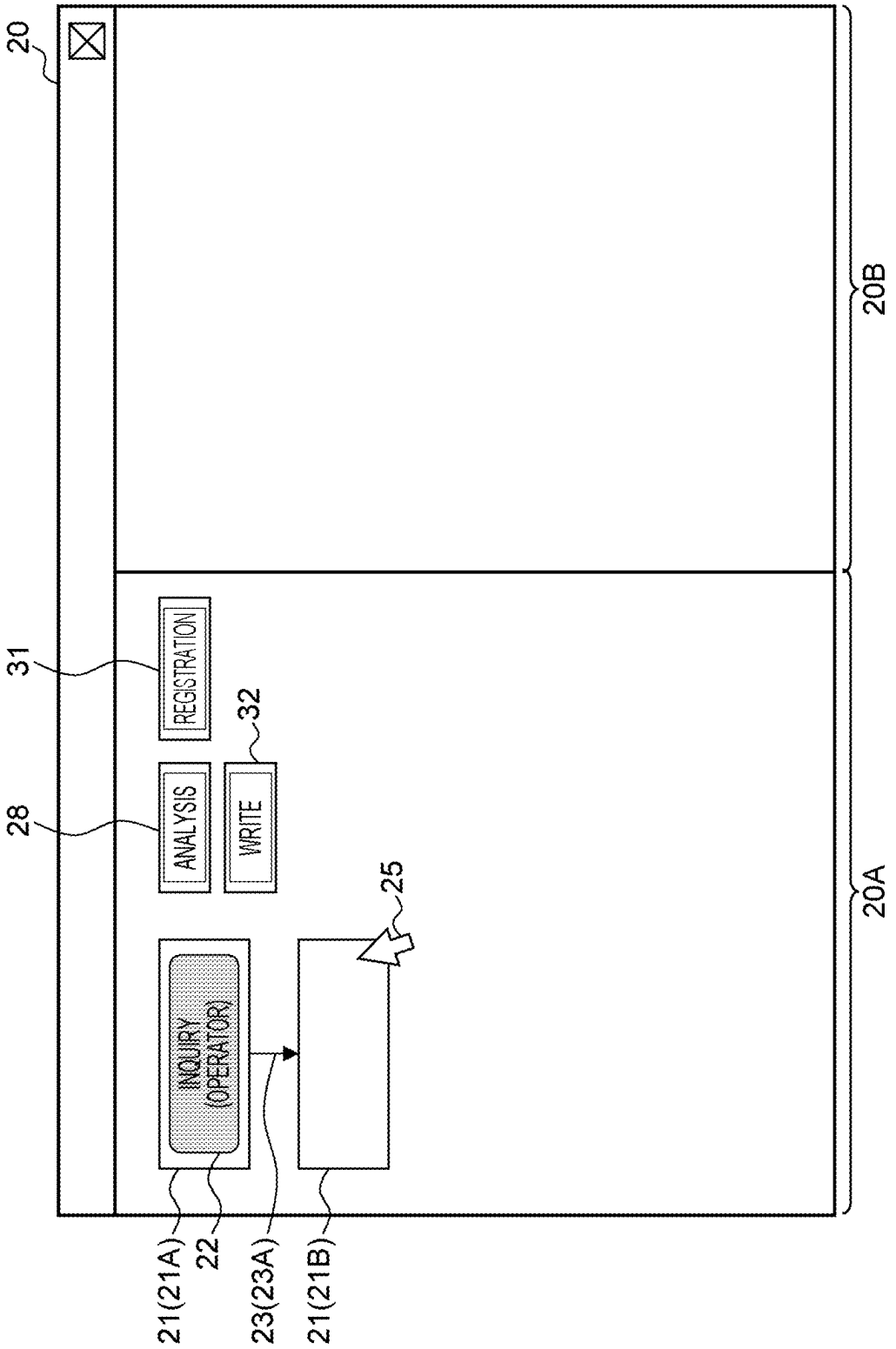

20
20B
20A
31
REGISTRATION
32
28
ANALYSIS
WRITE
25
INQUIRY (OPERATOR)
21(21A)
22
23(23A)
21(21B)

FIG. 3

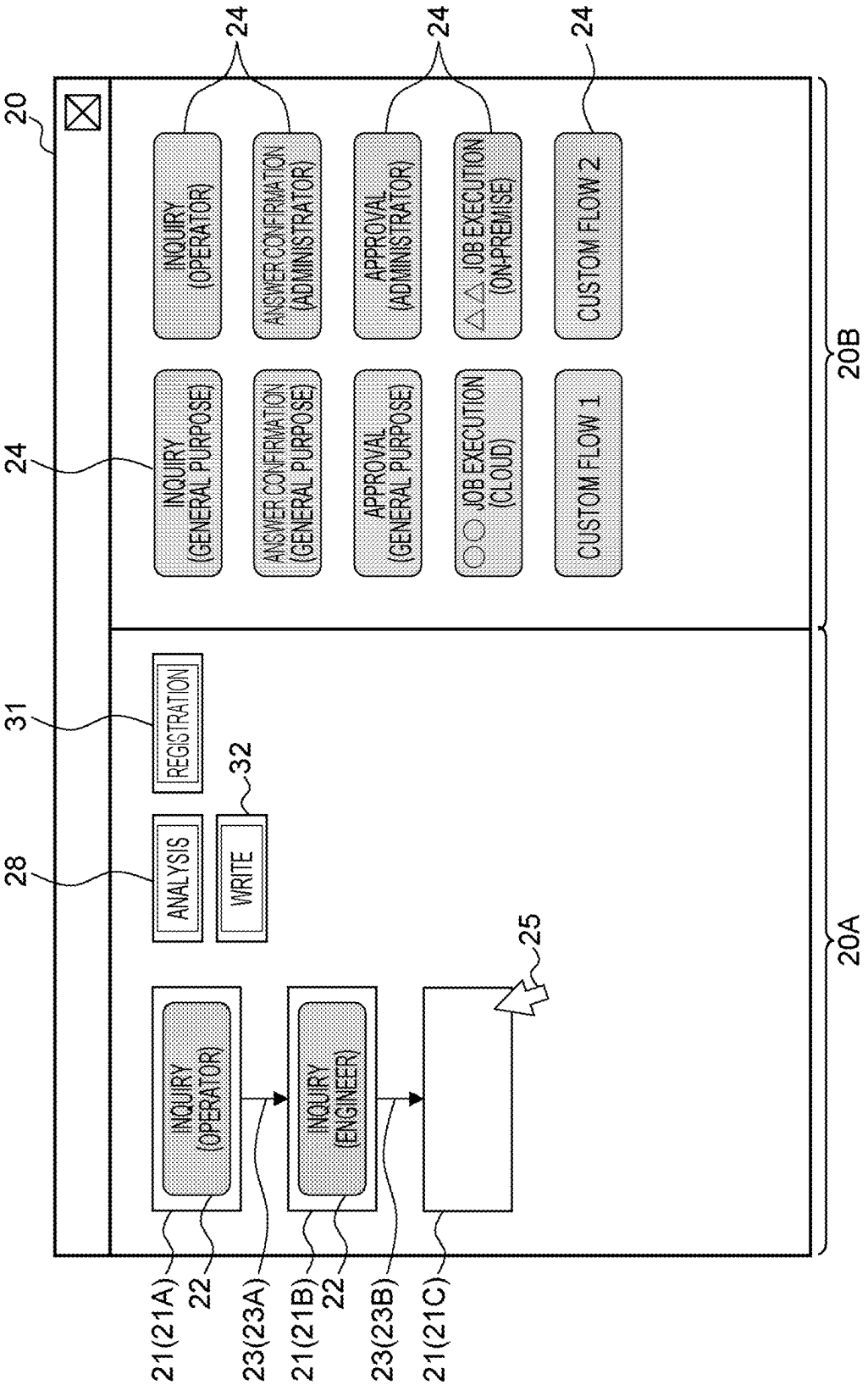

20
24
24
24
INQUIRY (OPERATOR)
ANSWER CONFIRMATION (ADMINISTRATOR)
APPROVAL (ADMINISTRATOR)
△△ JOB EXECUTION (ON-PREMISE)
CUSTOM FLOW 2
INQUIRY (GENERAL PURPOSE)
ANSWER CONFIRMATION (GENERAL PURPOSE)
APPROVAL (GENERAL PURPOSE)
○○ JOB EXECUTION (CLOUD)
CUSTOM FLOW 1
20B
31
32
REGISTRATION
28
ANALYSIS
WRITE
25
INQUIRY (OPERATOR)
INQUIRY (ENGINEER)
20A
21(21A)
22
23(23A)
21(21B)
22
23(23B)
21(21C)

FIG. 4

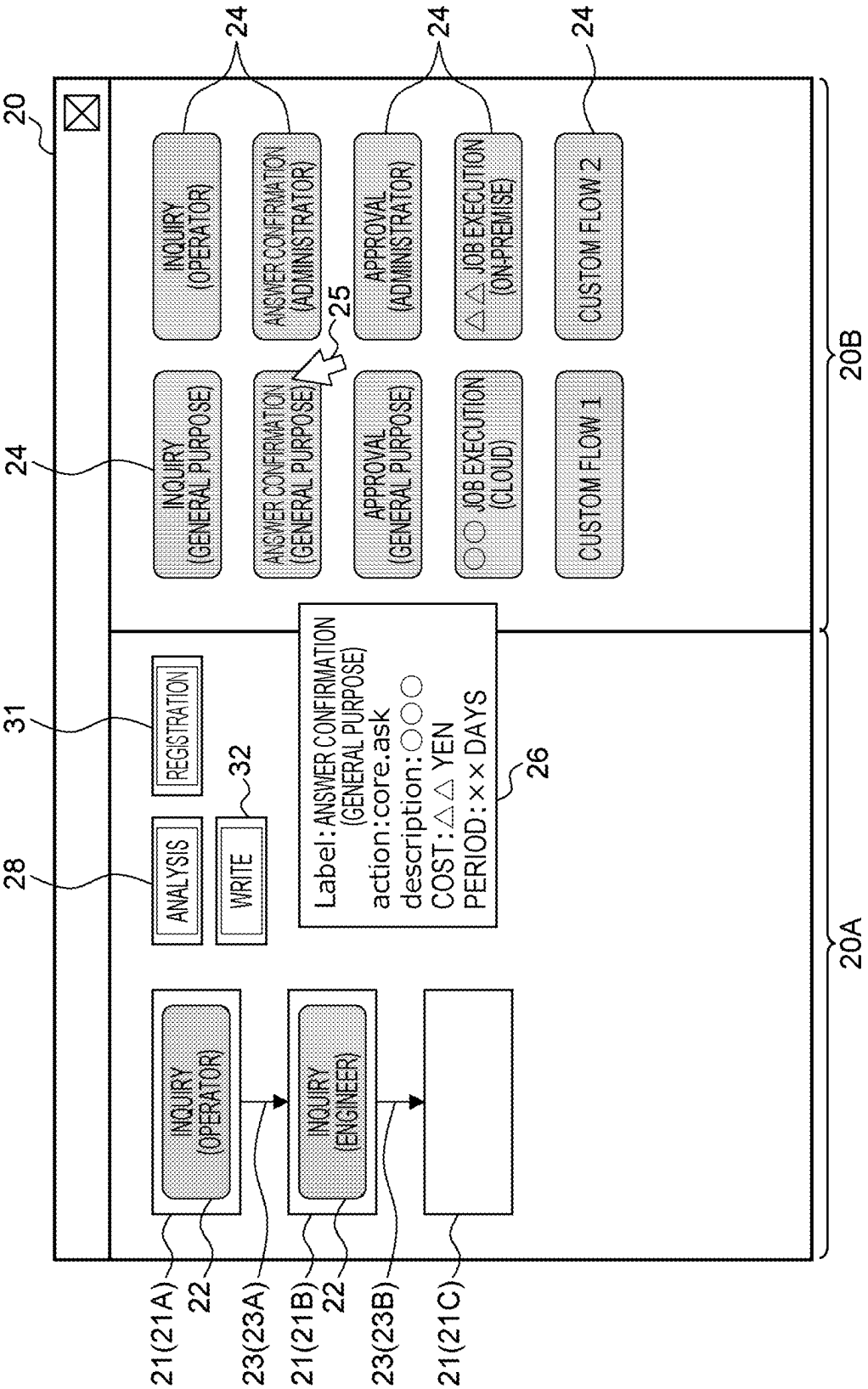

20
24
INQUIRY (OPERATOR)
ANSWER CONFIRMATION (ADMINISTRATOR)
APPROVAL (ADMINISTRATOR)
△△ JOB EXECUTION (ON-PREMISE)
CUSTOM FLOW 2
25
INQUIRY (GENERAL PURPOSE)
ANSWER CONFIRMATION (GENERAL PURPOSE)
APPROVAL (GENERAL PURPOSE)
○○ JOB EXECUTION (CLOUD)
CUSTOM FLOW 1
20B
31
REGISTRATION
32
28
ANALYSIS
WRITE
Label: ANSWER CONFIRMATION (GENERAL PURPOSE)
action: core.ask
description: ○○○
COST: △△ YEN
PERIOD: ×× DAYS
26
INQUIRY (OPERATOR)
INQUIRY (ENGINEER)
20A
21(21A)
22
23(23A)
21(21B)
22
23(23B)
21(21C)

FIG. 5

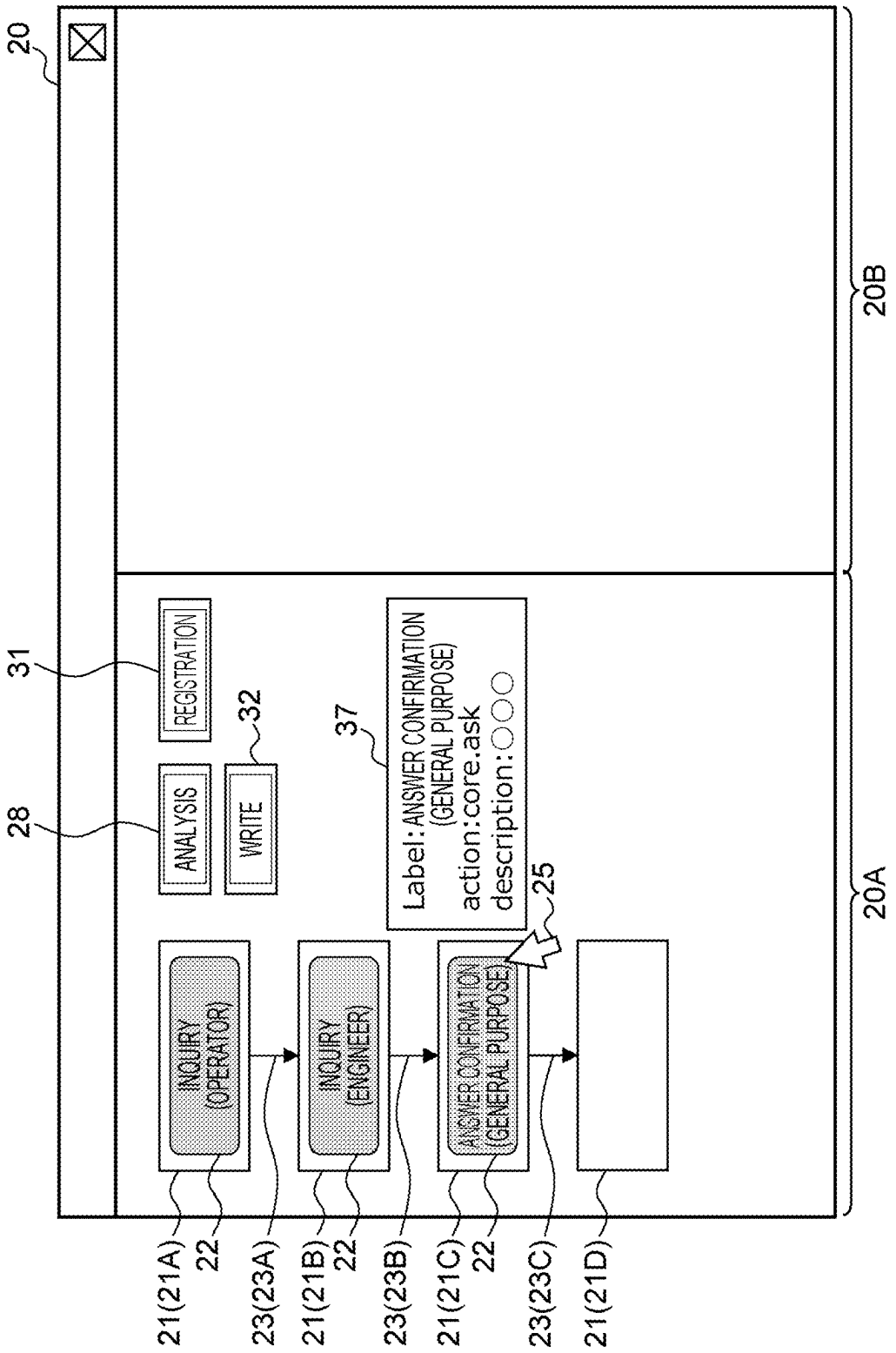

20
20B
20A
31
REGISTRATION
32
28
ANALYSIS
WRITE
37
Label: ANSWER CONFIRMATION
(GENERAL PURPOSE)
action: core.ask
description: ○○○
25
INQUIRY
(OPERATOR)
INQUIRY
(ENGINEER)
ANSWER CONFIRMATION
(GENERAL PURPOSE)
21(21A)
22
23(23A)
21(21B)
22
23(23B)
21(21C)
22
23(23C)
21(21D)

FIG. 6

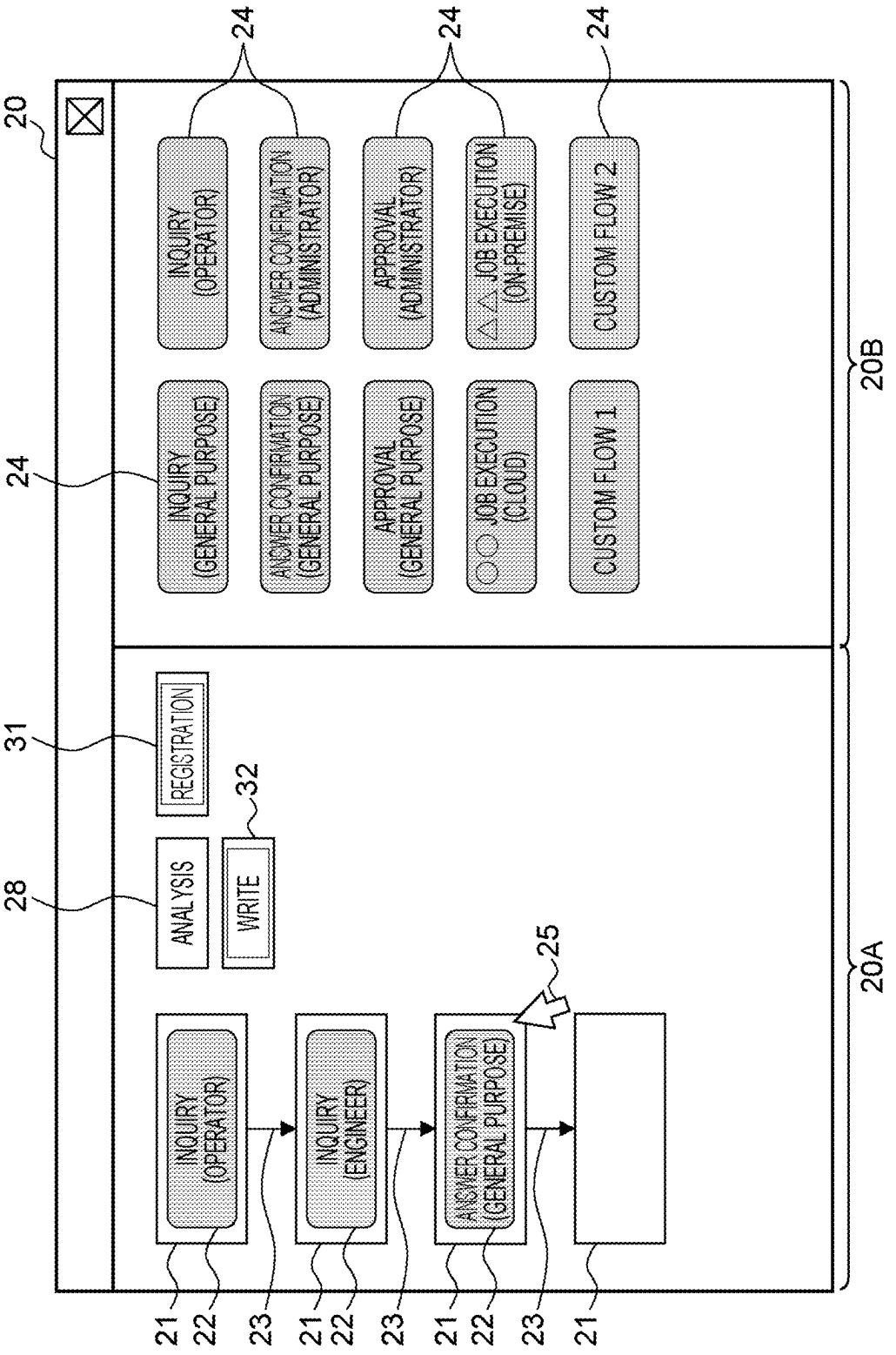

20
24
24
24
INQUIRY (OPERATOR)
ANSWER CONFIRMATION (ADMINISTRATOR)
APPROVAL (ADMINISTRATOR)
△△ JOB EXECUTION (ON-PREMISE)
CUSTOM FLOW 2
INQUIRY (GENERAL PURPOSE)
ANSWER CONFIRMATION (GENERAL PURPOSE)
APPROVAL (GENERAL PURPOSE)
○○ JOB EXECUTION (CLOUD)
CUSTOM FLOW 1
20B
24
31
REGISTRATION
32
28
ANALYSIS
WRITE
25
INQUIRY (OPERATOR)
INQUIRY (ENGINEER)
ANSWER CONFIRMATION (GENERAL PURPOSE)
20A
21
22
23
21
22
23
21
22
23
21

FIG. 7

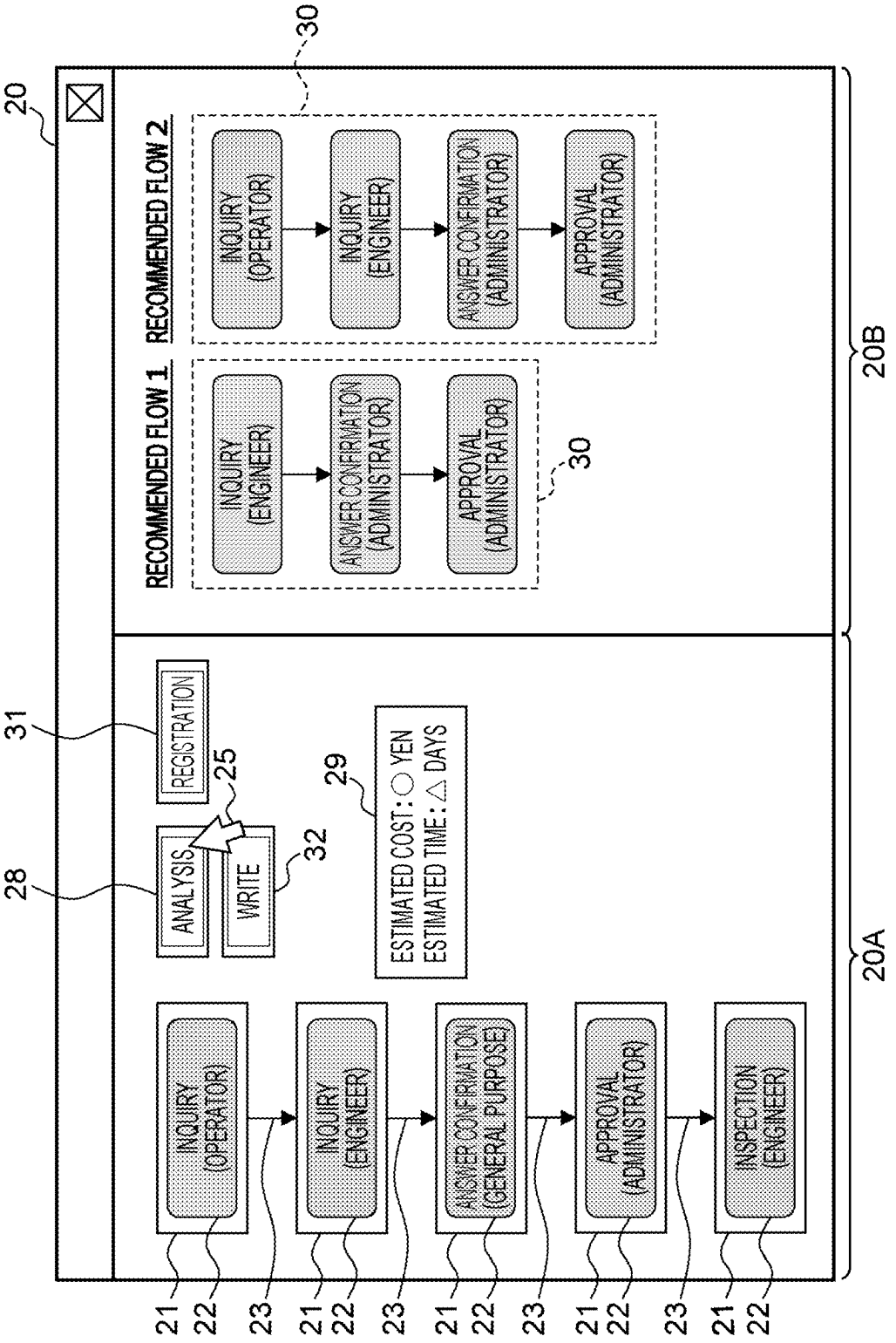

20
30
RECOMMENDED FLOW 2
INQUIRY (OPERATOR)
INQUIRY (ENGINEER)
ANSWER CONFIRMATION (ADMINISTRATOR)
APPROVAL (ADMINISTRATOR)
RECOMMENDED FLOW 1
INQUIRY (ENGINEER)
ANSWER CONFIRMATION (ADMINISTRATOR)
APPROVAL (ADMINISTRATOR)
30
20B
31
REGISTRATION
25
29
ESTIMATED COST: ○ YEN
ESTIMATED TIME: △ DAYS
28
ANALYSIS
WRITE
32
INQUIRY (OPERATOR)
INQUIRY (ENGINEER)
ANSWER CONFIRMATION (GENERAL PURPOSE)
APPROVAL (ADMINISTRATOR)
INSPECTION (ENGINEER)
20A
21
22
23

FIG. 8

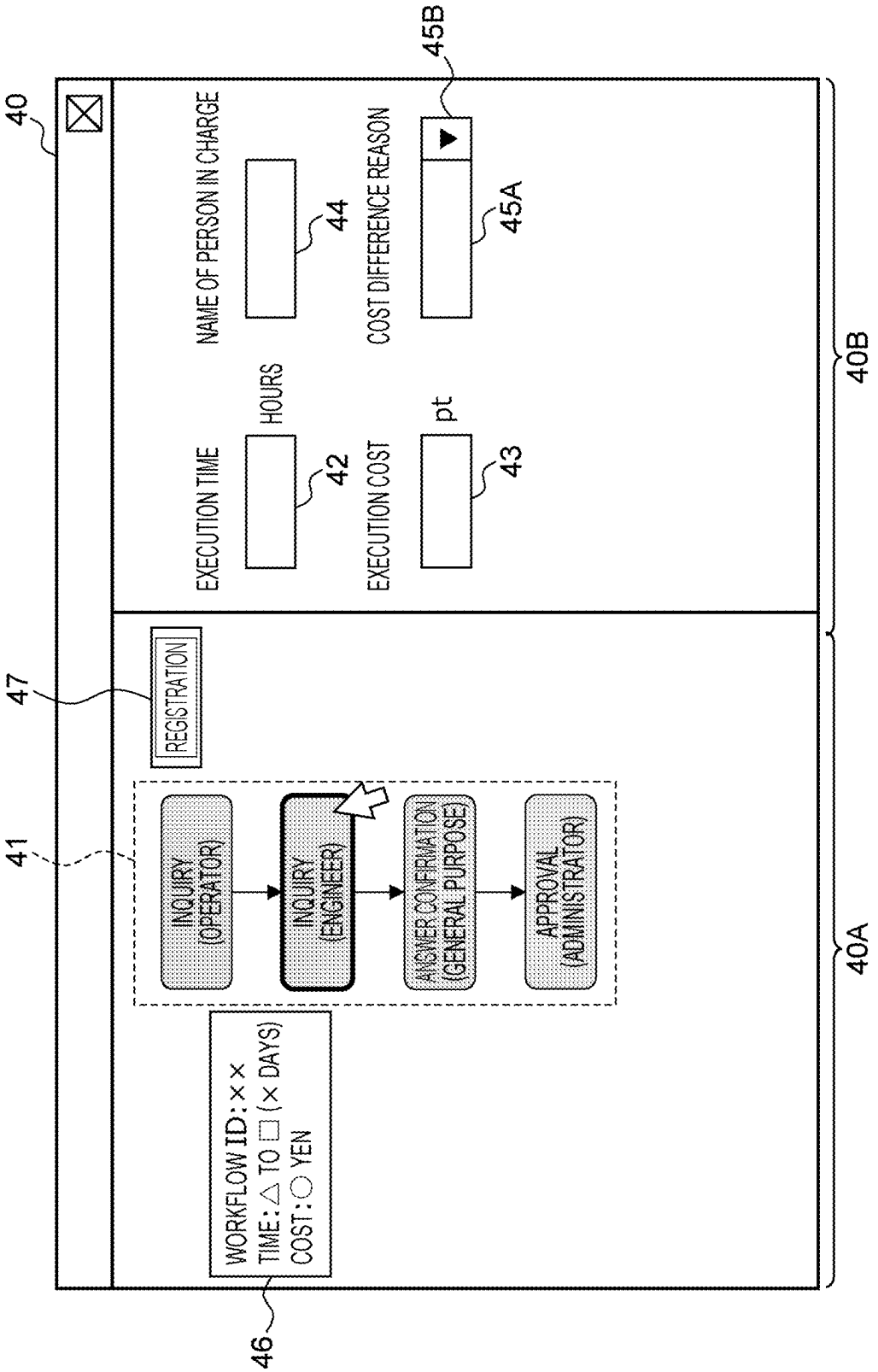

40
45B
NAME OF PERSON IN CHARGE
44
COST DIFFERENCE REASON
45A
EXECUTION TIME
HOURS
42
EXECUTION COST
pt
43
40B
47
REGISTRATION
41
INQUIRY (OPERATOR)
INQUIRY (ENGINEER)
ANSWER CONFIRMATION (GENERAL PURPOSE)
APPROVAL (ADMINISTRATOR)
WORKFLOW ID: ××
TIME: △ TO □ (× DAYS)
COST: ○ YEN
46
40A

FIG. 9

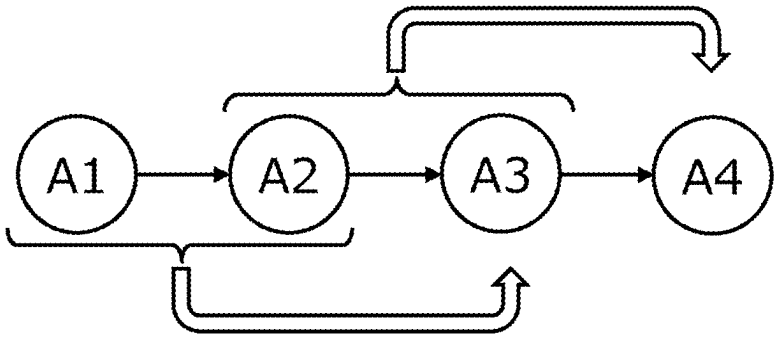


FIG. 10

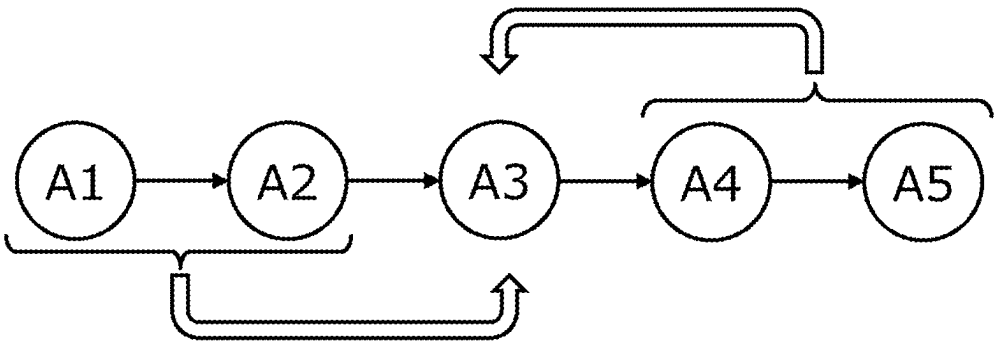


FIG. 11A

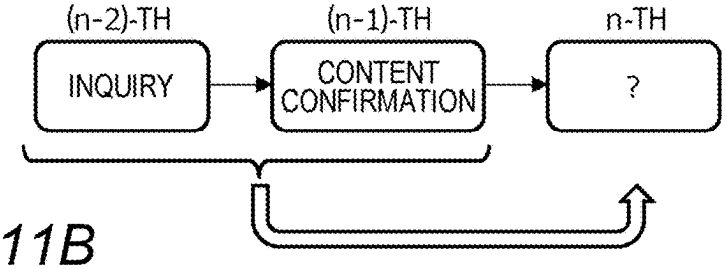


FIG. 11B

n-2	n-1	n	FREQUENCY	PERCENTAGE(P)
INQUIRY	CONTENT CONFIRMATION	ANSWER	200 TIMES	20%
		APPROVAL	400 TIMES	40%
		RECEPTION	400 TIMES	40%

FIG. 12

TASK CLASSIFICATION : APPROVAL (APPEARANCE PROBABILITY P = 40%)

TASK A

acrion:core.ask
Label:APPROVAL
group:admin

EXECUTION FREQUENCY : 70 TIMES
EXECUTION TIME : 1 DAY
EXECUTION COST : 20k YEN

TASK B

acrion:core.ask
Label:APPROVAL
group:engineer

EXECUTION FREQUENCY : 30 TIMES
EXECUTION TIME : 2 DAYS
EXECUTION COST : 10k YEN

⋮ ⋮

FIG. 13A

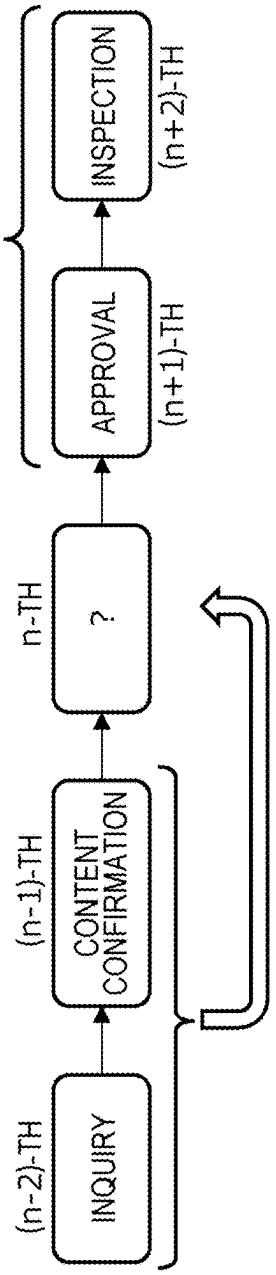


FIG. 13B

n-2	n-1	n	FREQUENCY	PERCENTAGE (P1)
INQUIRY	CONTENT CONFIRMATION	ANSWER	200 TIMES	20%
		APPROVAL	400 TIMES	40%
		RECEPTION	400 TIMES	40%

n+1	n+2	n	FREQUENCY	PERCENTAGE (P2)
APPROVAL	INSPECTION	ANSWER	300 TIMES	30%
		ACTUAL WORK	300 TIMES	30%
		RECEPTION	400 TIMES	40%

FIG. 14

PARAMETERS OF TASK

PARAMETER NAME	MEANING
label	DISPLAY NAME ON SCREEN
description	DETAILED DESCRIPTION OF TASK
action	ACTUAL PROCESSING TO BE PERFORMED
input	INPUT TO action
group / role	EXECUTABLE GROUP OR ROLE
ui	UI TO BE DISPLAYED ON SCREEN
next	NEXT TASK TO BE EXECUTED
when	TRANSITION CONDITION
do	NEXT TASK

FIG. 15

CONTENTS THAT CAN BE DESIGNATED AS action

action	MEANING
core.ask	WAIT FOR USER INPUT
core.http	TRANSMIT HTTP REQUEST
core.noop	DO NOTHING
core.sendmail	SEND EMAIL
fetch_access_token	ACQUIRE ACCESS TOKEN
run_job_template	EXECUTE AUTOMATION JOB TEMPLATE
get_job_result	ACQUIRE RESULT OF AUTOMATION JOB

FIG. 16

- FIRST PARAMETER GROUP: WHAT IS DETERMINED TO BE SAME IN EXACT MATCH

  (EXAMPLES): action, UI DEFINITION ON SCREEN,

- SECOND PARAMETER GROUP: SIMILAR ONES ARE TREATED AS SAME CLASS

  (EXAMPLES): label, description

- THIRD PARAMETER GROUP: WHAT IS NOT USED FOR ANALYSIS IN FIRST PLACE, WHAT IS DIFFICULT TO USE

  (EXAMPLES): input TO action

FIG. 17A

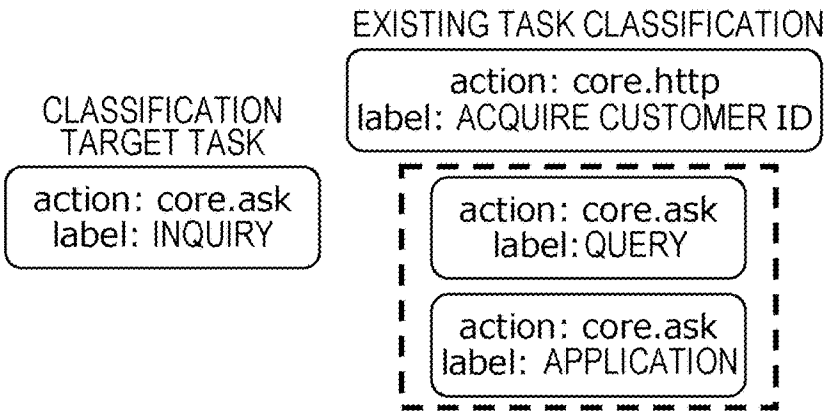


FIG. 17B

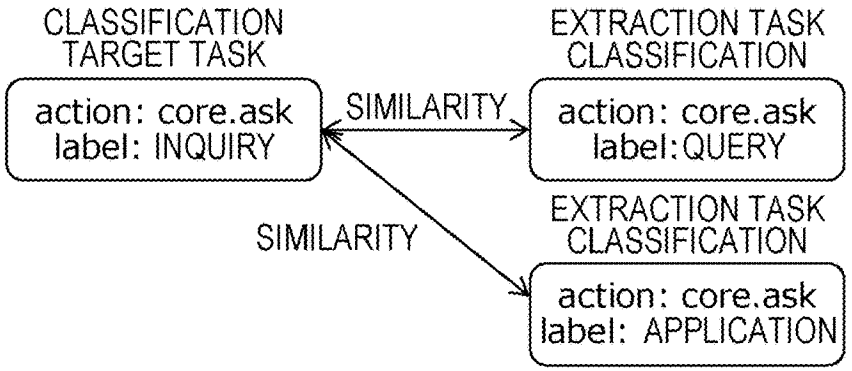


FIG. 17C

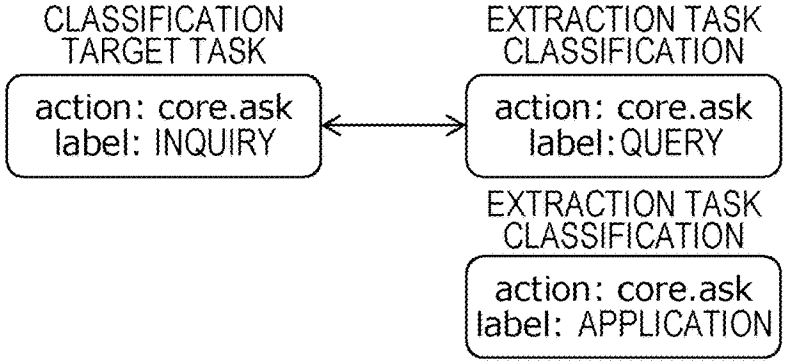


FIG. 17 D

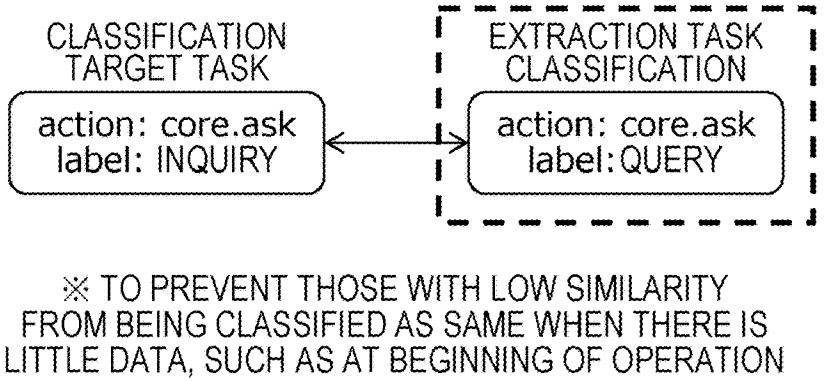


FIG. 18

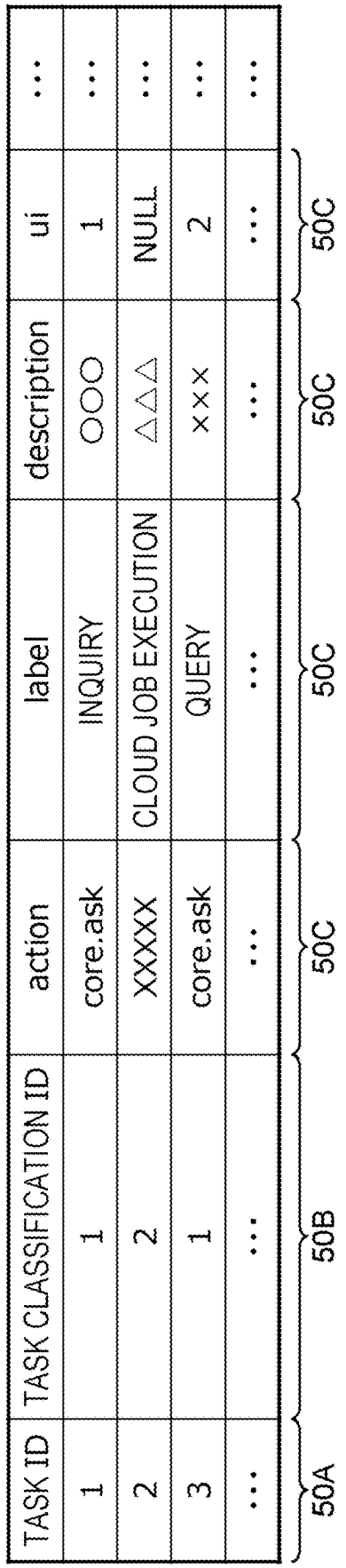

TASK TABLE 50
TASK ID
TASK CLASSIFICATION ID
action
label
description
ui
1
core.ask
INQUIRY
○○○
1
2
XXXXX
CLOUD JOB EXECUTION
△△△
NULL
3
core.ask
QUERY
×××
2
50A
50B
50C
50C
50C
50C

FIG. 19

TASK CLASSIFICATION TABLE 51

TASK CLASSIFICATION ID	action	label	description	...
1	core.ask	INQUIRY	○○○	...
2	XXXXX	CLOUD JOB EXECUTION	△△△	...
...	...	...	...	...
51A	51B	51B	51B	

FIG. 20

WORKFLOW TABLE 52

WORKFLOW ID	TASK LIST	TASK CLASSIFICATION LIST
1	[1,2,3,4]	[3,4,2,9]
2	[3,9,6,7]	[2,5,7,8]
...	...	...
52A	52B	52C

FIG. 21

PERSON-IN-CHARGE TABLE 53

PERSON IN CHARGE	COST PER UNIT TIME
1	○ YEN
2	△ YEN
...	...

53A 53B

FIG. 22

CLOUD EXECUTION ENVIRONMENT TABLE 54

CLOUD EXECUTION ENVIRONMENT ID	COST PER UNIT TIME
1	□ YEN
2	× YEN
...	...

54A 54B

FIG. 23

WORKFLOW EXECUTION HISTORY TABLE 55

WORKFLOW EXECUTION HISTORY ID	WORKFLOW ID	TOTAL EXECUTION TIME	TOTAL COST AUTOMATIC CALCULATION VALUE	TOTAL COST MANUAL INPUT VALUE
1	1	3 DAYS, 4 HOURS, 56 MINUTES	○○ YEN	NULL
2	2	7 DAYS, 3 HOURS, 45 MINUTES	△△ YEN	NULL
3	1	2 DAYS, 3 HOURS, 45 MINUTES	□□ YEN	×× YEN
55A	55B	55C	55D	55E

FIG. 24

TASK EXECUTION HISTORY TABLE 56

TASK EXECUTION HISTORY ID	WORKFLOW EXECUTION HISTORY ID	TASK ID	EXECUTION TIME	COST AUTOMATIC CALCULATION VALUE	COST MANUAL INPUT VALUE	PERSON-IN-CHARGE ID	CLOUD EXECUTION ENVIRONMENT ID
1	1	1	1 DAY, 4 HOURS, 56 MINUTES	○○ YEN	NULL	1	NULL
2	1	2	7 HOURS, 45 MINUTES	△△ YEN	NULL	NULL	1
3	1	3	8 HOURS, 10 MINUTES	□□ YEN	×× YEN	2	NULL

56A 56B 56C 56D 56E 56F 56G 56H

FIG. 25

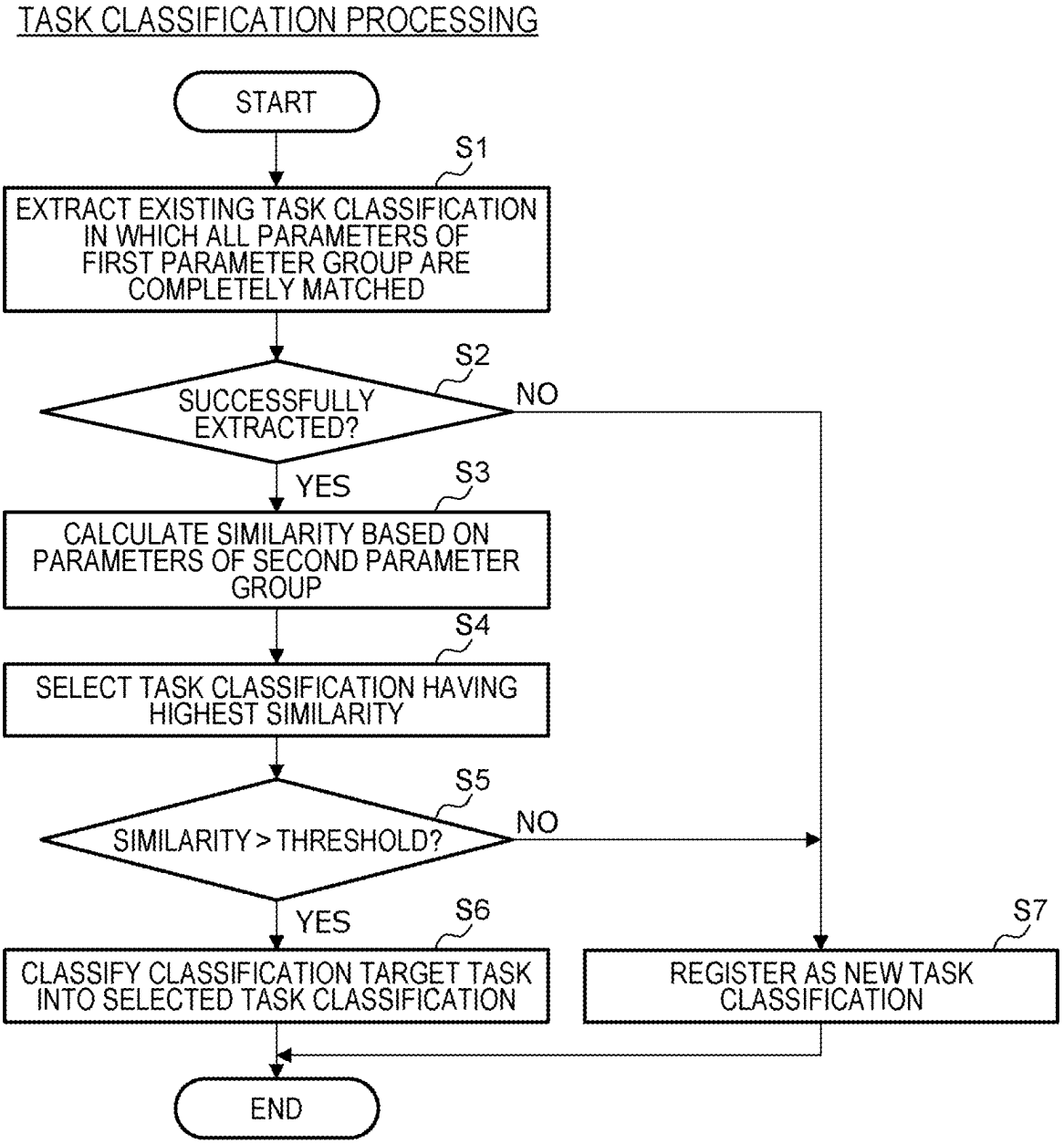

TASK CLASSIFICATION PROCESSING
START
S1
EXTRACT EXISTING TASK CLASSIFICATION IN WHICH ALL PARAMETERS OF FIRST PARAMETER GROUP ARE COMPLETELY MATCHED
S2
SUCCESSFULLY EXTRACTED?
NO
YES
S3
CALCULATE SIMILARITY BASED ON PARAMETERS OF SECOND PARAMETER GROUP
S4
SELECT TASK CLASSIFICATION HAVING HIGHEST SIMILARITY
S5
SIMILARITY > THRESHOLD?
NO
YES
S6
CLASSIFY CLASSIFICATION TARGET TASK INTO SELECTED TASK CLASSIFICATION
S7
REGISTER AS NEW TASK CLASSIFICATION
END

FIG. 26

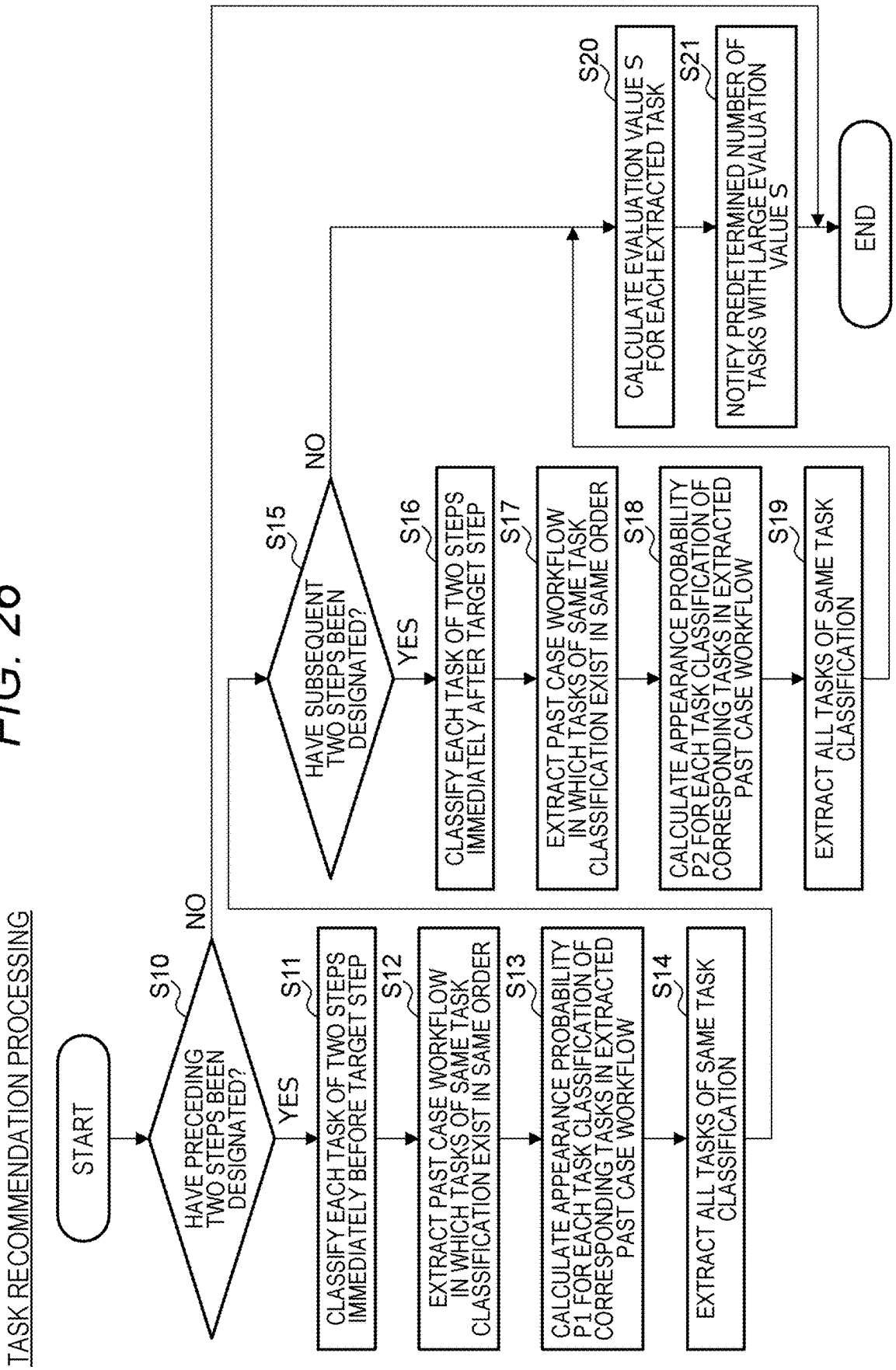

TASK RECOMMENDATION PROCESSING
START
S10
HAVE PRECEDING TWO STEPS BEEN DESIGNATED?
YES
NO
S11
CLASSIFY EACH TASK OF TWO STEPS IMMEDIATELY BEFORE TARGET STEP
S12
EXTRACT PAST CASE WORKFLOW IN WHICH TASKS OF SAME TASK CLASSIFICATION EXIST IN SAME ORDER
S13
CALCULATE APPEARANCE PROBABILITY P1 FOR EACH TASK CLASSIFICATION OF CORRESPONDING TASKS IN EXTRACTED PAST CASE WORKFLOW
S14
EXTRACT ALL TASKS OF SAME TASK CLASSIFICATION
S15
HAVE SUBSEQUENT TWO STEPS BEEN DESIGNATED?
YES
NO
S16
CLASSIFY EACH TASK OF TWO STEPS IMMEDIATELY AFTER TARGET STEP
S17
EXTRACT PAST CASE WORKFLOW IN WHICH TASKS OF SAME TASK CLASSIFICATION EXIST IN SAME ORDER
S18
CALCULATE APPEARANCE PROBABILITY P2 FOR EACH TASK CLASSIFICATION OF CORRESPONDING TASKS IN EXTRACTED PAST CASE WORKFLOW
S19
EXTRACT ALL TASKS OF SAME TASK CLASSIFICATION
S20
CALCULATE EVALUATION VALUE S FOR EACH EXTRACTED TASK
S21
NOTIFY PREDETERMINED NUMBER OF TASKS WITH LARGE EVALUATION VALUE S
END

FIG. 27

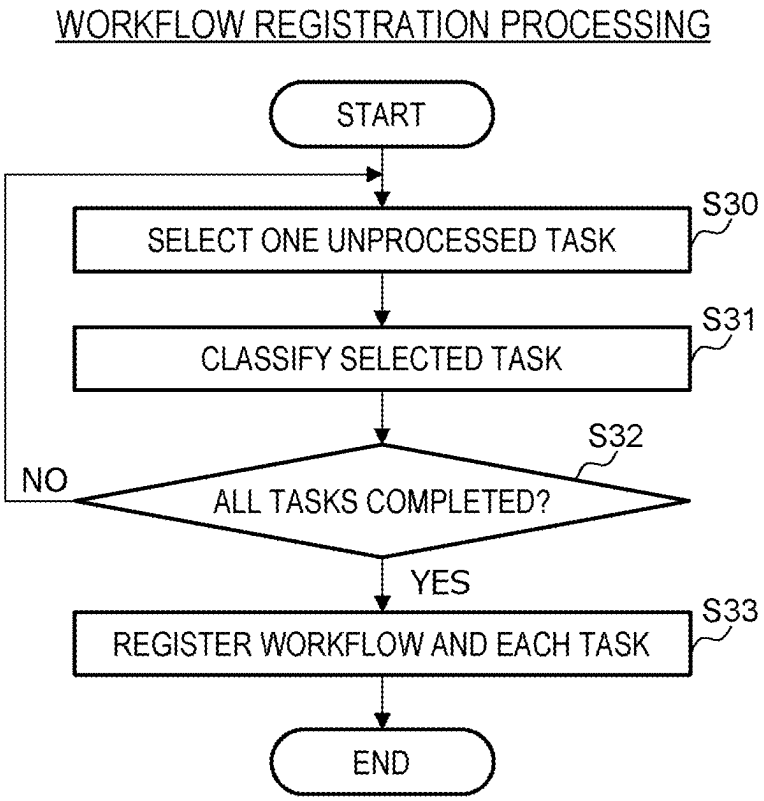

WORKFLOW REGISTRATION PROCESSING
START
SELECT ONE UNPROCESSED TASK
S30
CLASSIFY SELECTED TASK
S31
S32
NO
ALL TASKS COMPLETED?
YES
REGISTER WORKFLOW AND EACH TASK
S33
END

FIG. 28

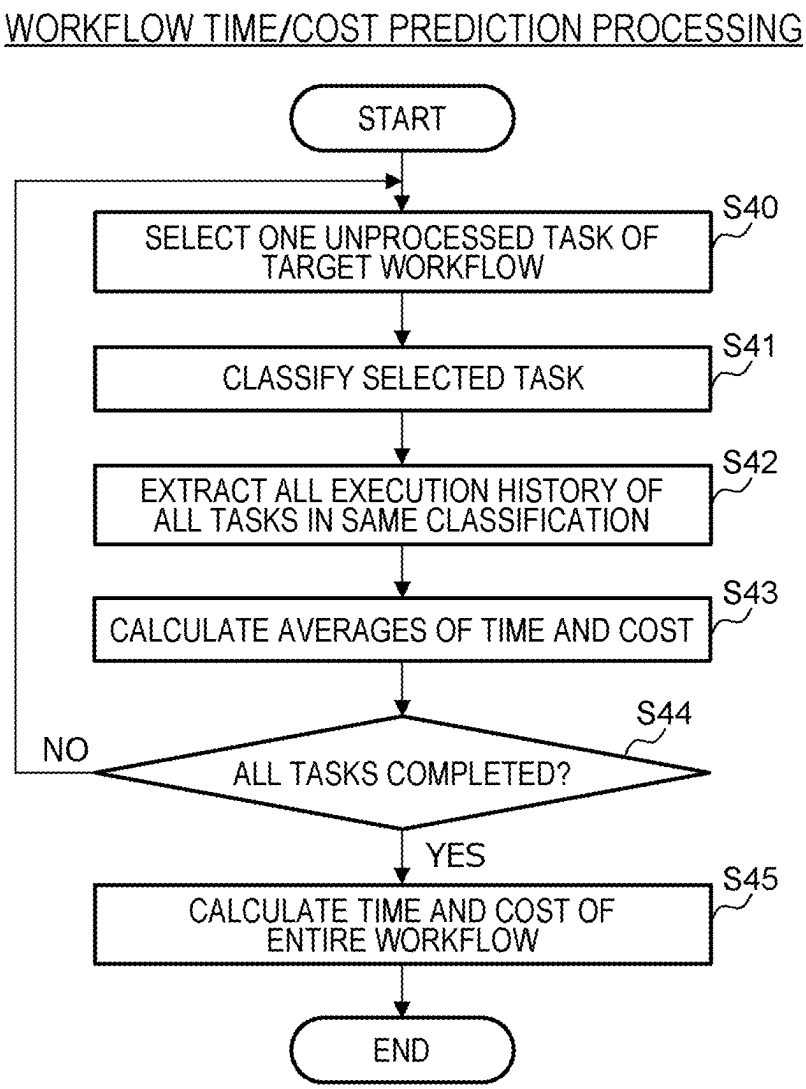

WORKFLOW TIME/COST PREDICTION PROCESSING
START
SELECT ONE UNPROCESSED TASK OF TARGET WORKFLOW
S40
CLASSIFY SELECTED TASK
S41
EXTRACT ALL EXECUTION HISTORY OF ALL TASKS IN SAME CLASSIFICATION
S42
CALCULATE AVERAGES OF TIME AND COST
S43
ALL TASKS COMPLETED?
S44
NO
YES
CALCULATE TIME AND COST OF ENTIRE WORKFLOW
S45
END

FIG. 29

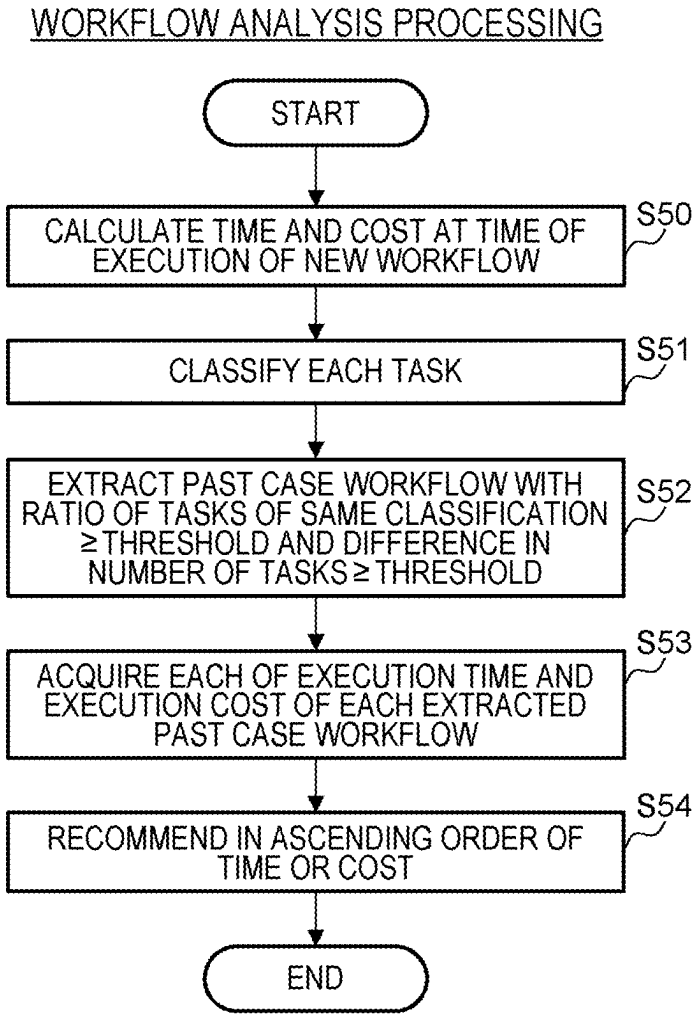

WORKFLOW ANALYSIS PROCESSING
START
CALCULATE TIME AND COST AT TIME OF EXECUTION OF NEW WORKFLOW
S50
CLASSIFY EACH TASK
S51
EXTRACT PAST CASE WORKFLOW WITH RATIO OF TASKS OF SAME CLASSIFICATION ≥ THRESHOLD AND DIFFERENCE IN NUMBER OF TASKS ≥ THRESHOLD
S52
ACQUIRE EACH OF EXECUTION TIME AND EXECUTION COST OF EACH EXTRACTED PAST CASE WORKFLOW
S53
RECOMMEND IN ASCENDING ORDER OF TIME OR COST
S54
END

FIG. 30

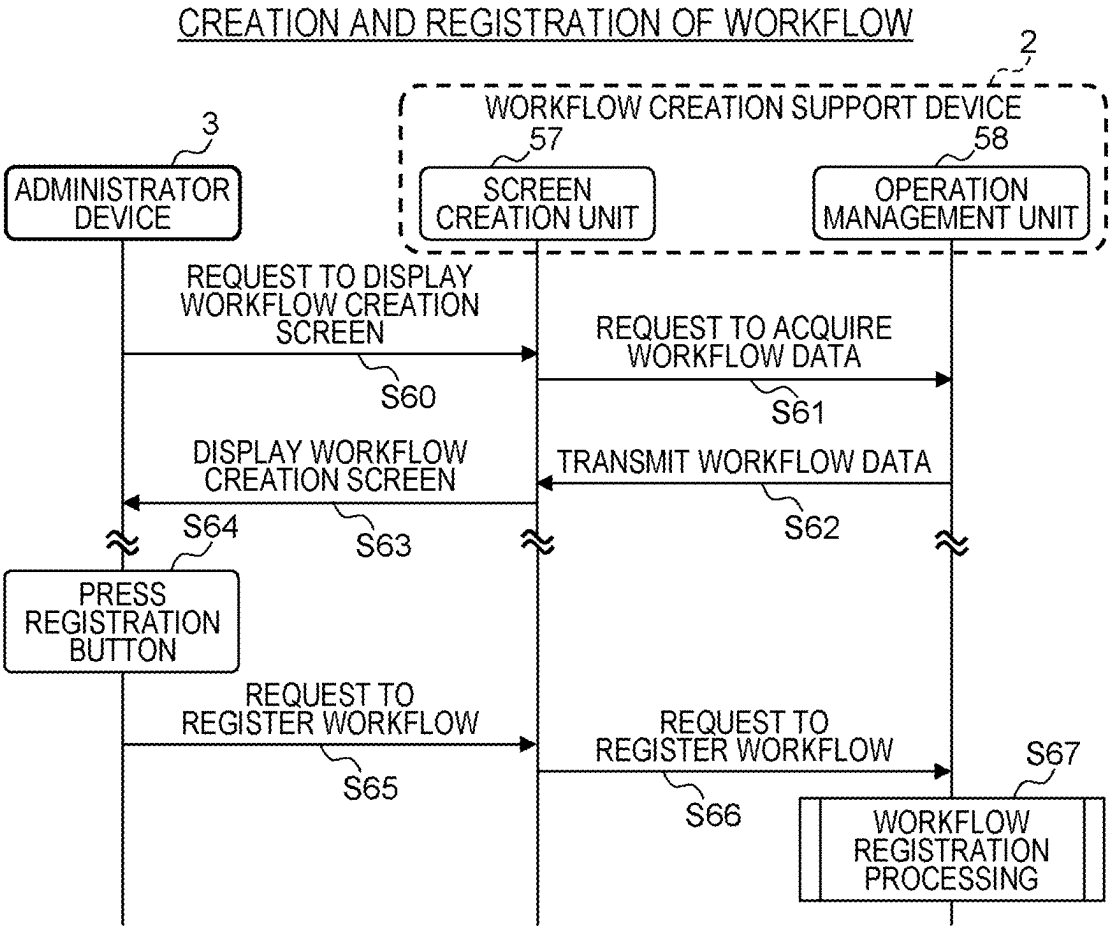

CREATION AND REGISTRATION OF WORKFLOW
2
WORKFLOW CREATION SUPPORT DEVICE
3
ADMINISTRATOR DEVICE
57
SCREEN CREATION UNIT
58
OPERATION MANAGEMENT UNIT
REQUEST TO DISPLAY WORKFLOW CREATION SCREEN
S60
REQUEST TO ACQUIRE WORKFLOW DATA
S61
DISPLAY WORKFLOW CREATION SCREEN
S63
TRANSMIT WORKFLOW DATA
S62
S64
PRESS REGISTRATION BUTTON
REQUEST TO REGISTER WORKFLOW
S65
REQUEST TO REGISTER WORKFLOW
S66
S67
WORKFLOW REGISTRATION PROCESSING

FIG. 31

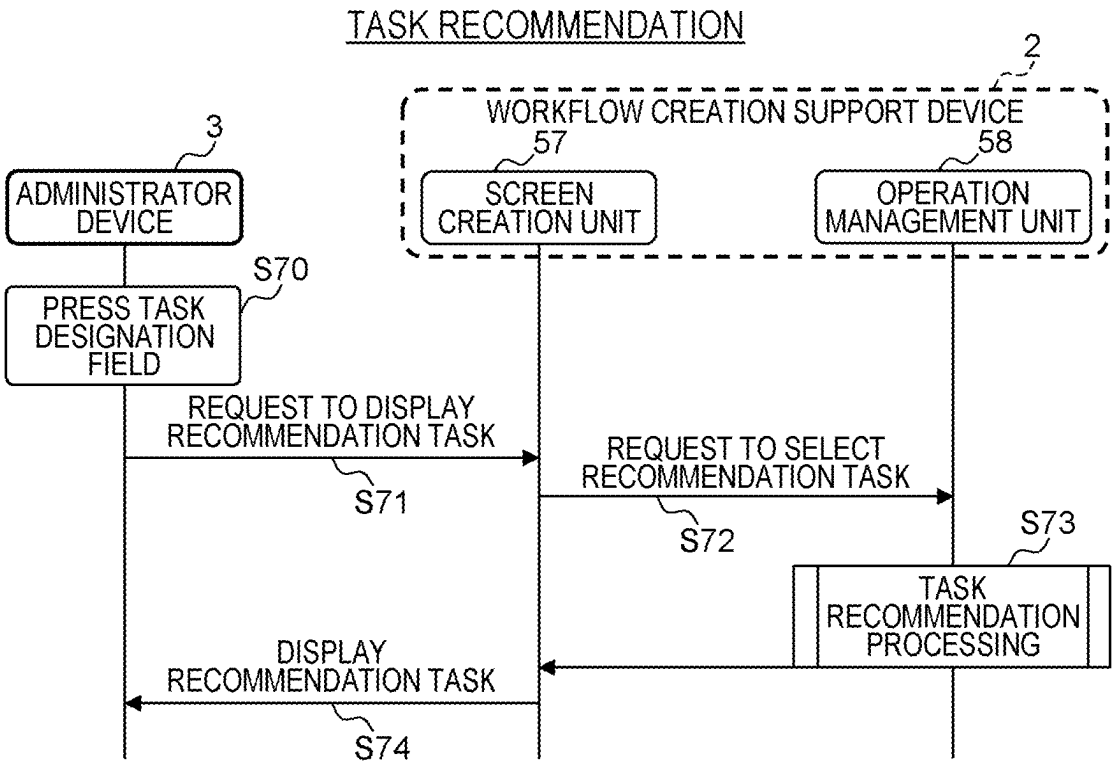

TASK RECOMMENDATION
2
WORKFLOW CREATION SUPPORT DEVICE
57
58
3
ADMINISTRATOR DEVICE
SCREEN CREATION UNIT
OPERATION MANAGEMENT UNIT
S70
PRESS TASK DESIGNATION FIELD
REQUEST TO DISPLAY RECOMMENDATION TASK
S71
REQUEST TO SELECT RECOMMENDATION TASK
S72
S73
TASK RECOMMENDATION PROCESSING
DISPLAY RECOMMENDATION TASK
S74

FIG. 32

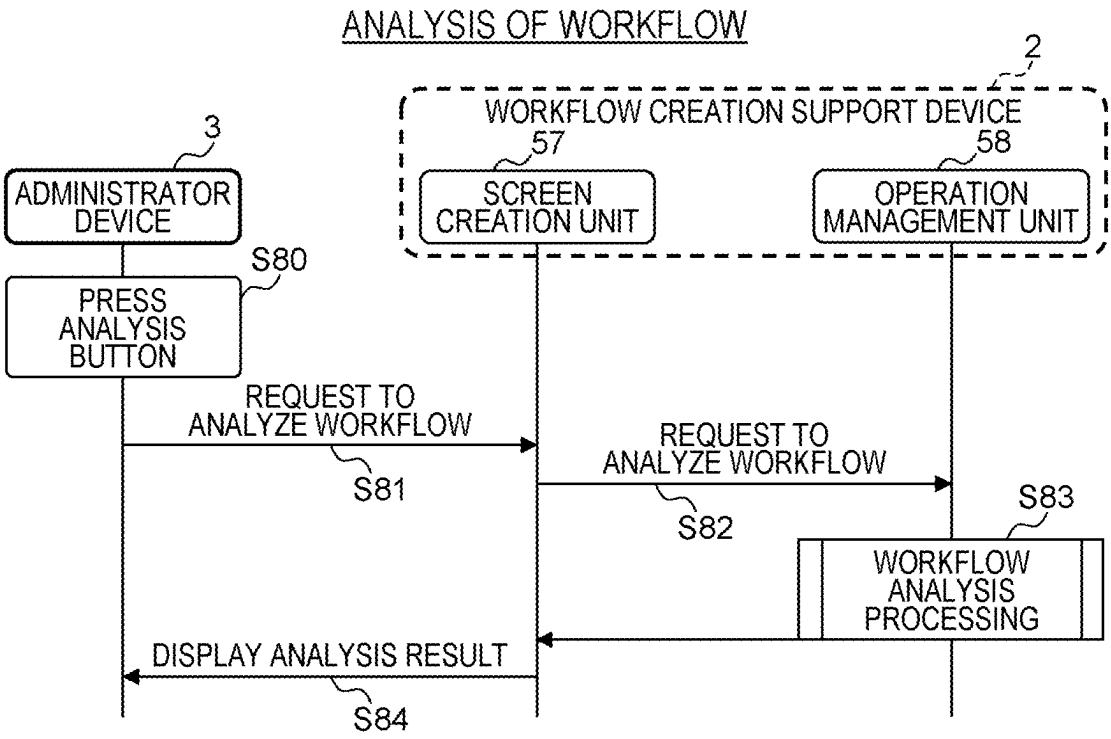

ANALYSIS OF WORKFLOW
2
WORKFLOW CREATION SUPPORT DEVICE
57
58
3
ADMINISTRATOR DEVICE
SCREEN CREATION UNIT
OPERATION MANAGEMENT UNIT
S80
PRESS ANALYSIS BUTTON
REQUEST TO ANALYZE WORKFLOW
S81
REQUEST TO ANALYZE WORKFLOW
S82
S83
WORKFLOW ANALYSIS PROCESSING
DISPLAY ANALYSIS RESULT
S84

FIG. 33

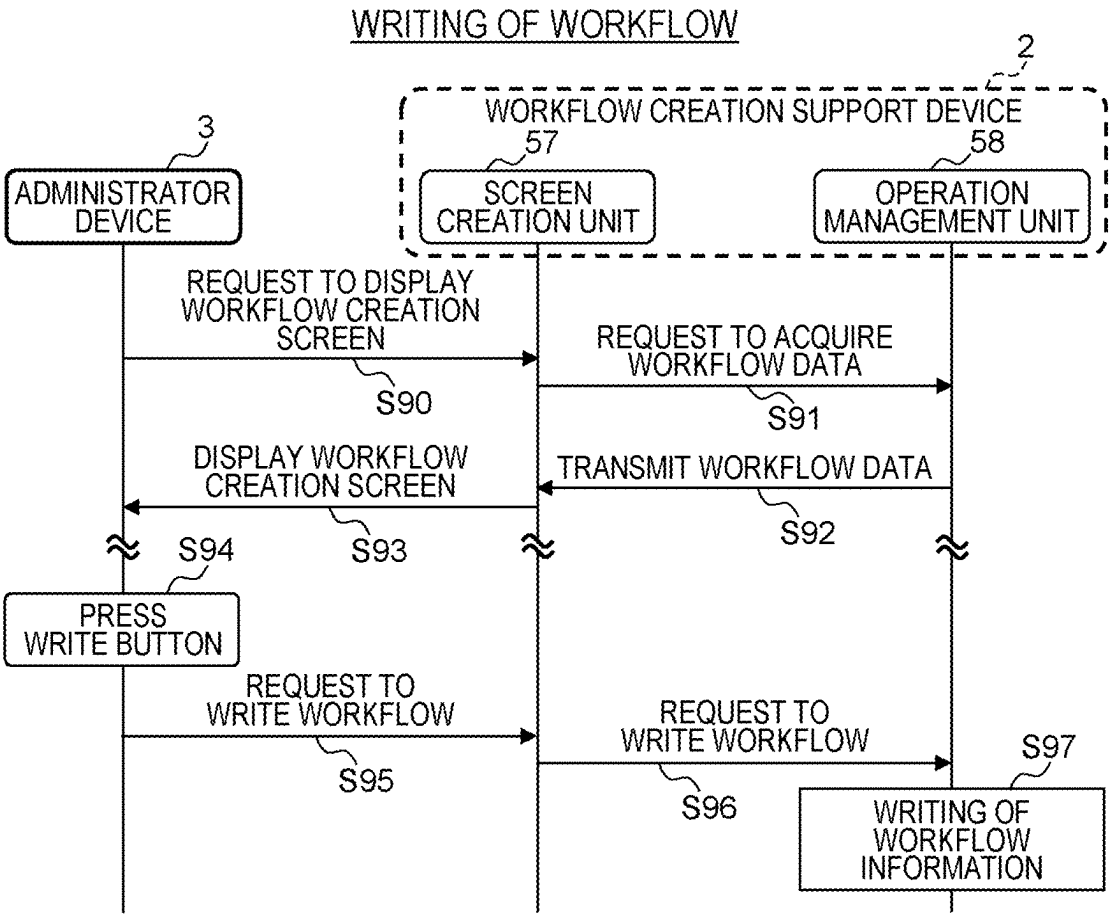

WRITING OF WORKFLOW
2
WORKFLOW CREATION SUPPORT DEVICE
3
ADMINISTRATOR DEVICE
57
SCREEN CREATION UNIT
58
OPERATION MANAGEMENT UNIT
REQUEST TO DISPLAY WORKFLOW CREATION SCREEN
S90
REQUEST TO ACQUIRE WORKFLOW DATA
S91
DISPLAY WORKFLOW CREATION SCREEN
S93
TRANSMIT WORKFLOW DATA
S92
S94
PRESS WRITE BUTTON
REQUEST TO WRITE WORKFLOW
S95
REQUEST TO WRITE WORKFLOW
S96
S97
WRITING OF WORKFLOW INFORMATION

FIG. 34

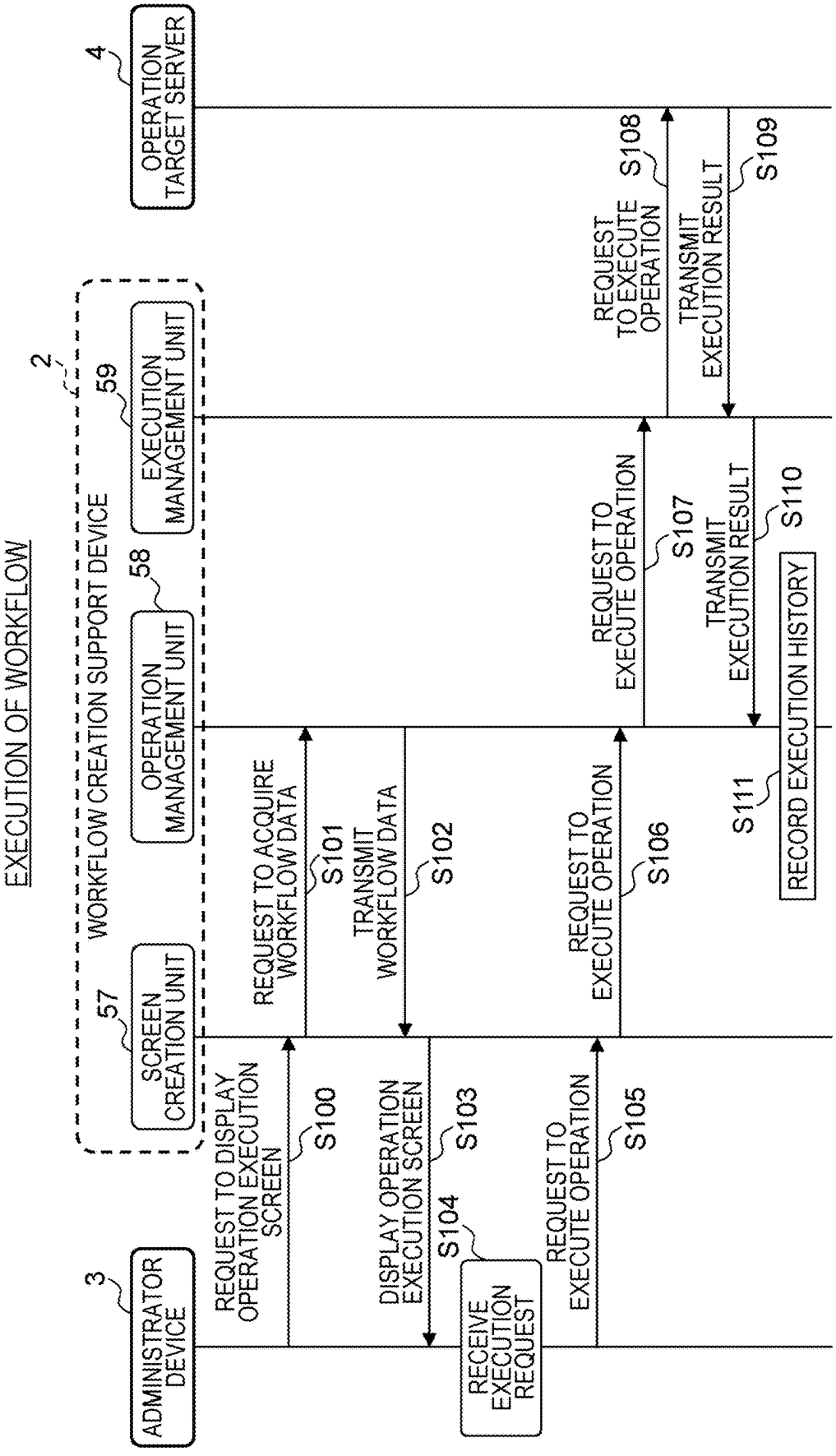

EXECUTION OF WORKFLOW
ADMINISTRATOR DEVICE
3
WORKFLOW CREATION SUPPORT DEVICE
2
SCREEN CREATION UNIT
57
OPERATION MANAGEMENT UNIT
58
EXECUTION MANAGEMENT UNIT
59
OPERATION TARGET SERVER
4
REQUEST TO DISPLAY OPERATION EXECUTION SCREEN
S100
REQUEST TO ACQUIRE WORKFLOW DATA
S101
TRANSMIT WORKFLOW DATA
S102
DISPLAY OPERATION EXECUTION SCREEN
S103
RECEIVE EXECUTION REQUEST
S104
REQUEST TO EXECUTE OPERATION
S105
REQUEST TO EXECUTE OPERATION
S106
REQUEST TO EXECUTE OPERATION
S107
TRANSMIT EXECUTION RESULT
S108
TRANSMIT EXECUTION RESULT
S109
RECORD EXECUTION HISTORY
S110
S111

FIG. 35

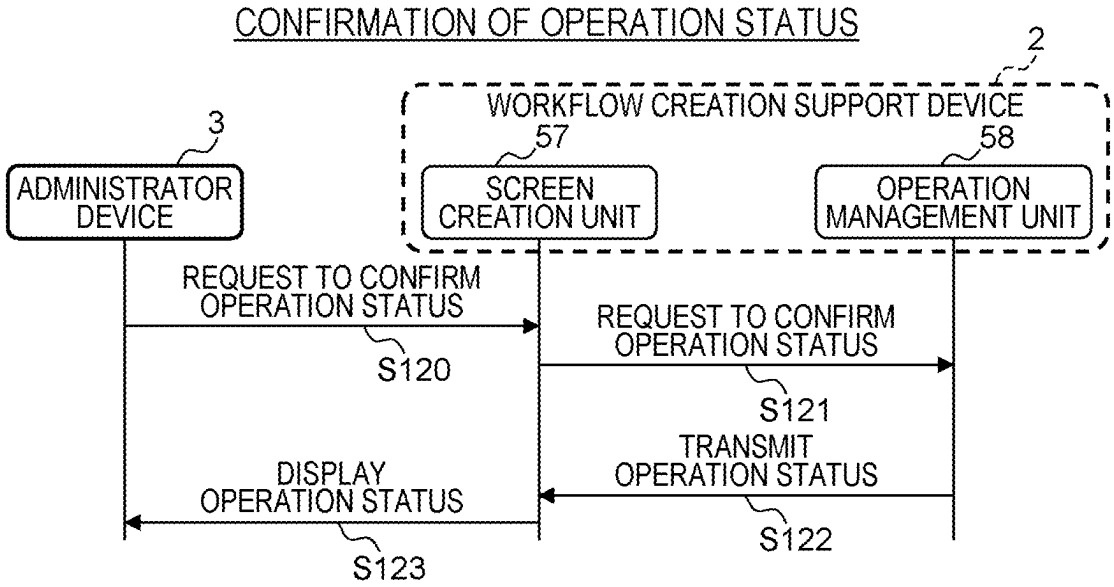
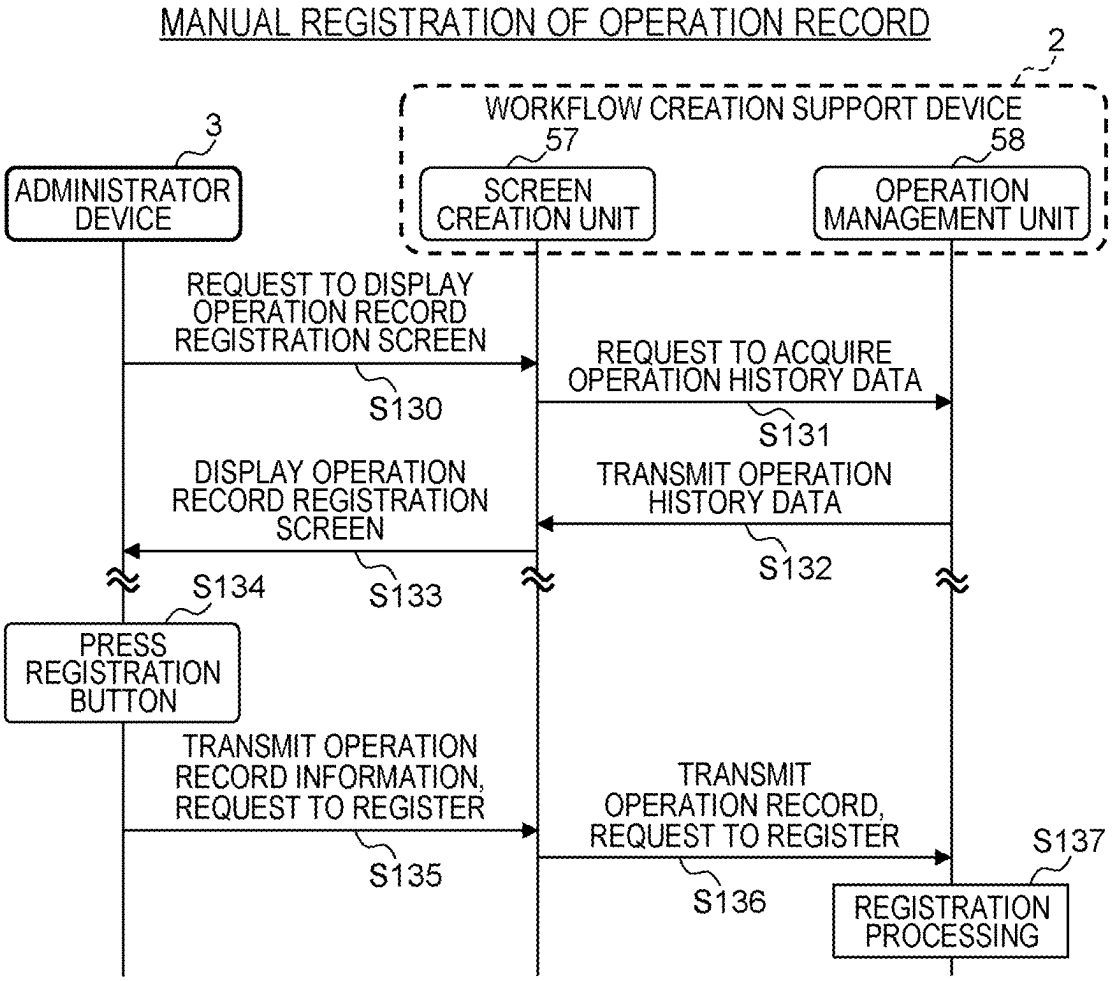

CONFIRMATION OF OPERATION STATUS
2
WORKFLOW CREATION SUPPORT DEVICE
3
ADMINISTRATOR DEVICE
57
SCREEN CREATION UNIT
58
OPERATION MANAGEMENT UNIT
REQUEST TO CONFIRM OPERATION STATUS
S120
REQUEST TO CONFIRM OPERATION STATUS
S121
TRANSMIT OPERATION STATUS
S122
DISPLAY OPERATION STATUS
S123

FIG. 36


MANUAL REGISTRATION OF OPERATION RECORD
2
WORKFLOW CREATION SUPPORT DEVICE
3
ADMINISTRATOR DEVICE
57
SCREEN CREATION UNIT
58
OPERATION MANAGEMENT UNIT
REQUEST TO DISPLAY OPERATION RECORD REGISTRATION SCREEN
S130
REQUEST TO ACQUIRE OPERATION HISTORY DATA
S131
DISPLAY OPERATION RECORD REGISTRATION SCREEN
S133
TRANSMIT OPERATION HISTORY DATA
S132
S134
PRESS REGISTRATION BUTTON
TRANSMIT OPERATION RECORD INFORMATION, REQUEST TO REGISTER
S135
TRANSMIT OPERATION RECORD, REQUEST TO REGISTER
S136
S137
REGISTRATION PROCESSING

WORKFLOW CREATION SUPPORT DEVICE AND METHOD

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority from Japanese application JP2024-024678, filed on Feb. 21, 2024, the content of which is hereby incorporated by reference into this application.

TECHNICAL FIELD

[0002] The present invention relates to a workflow creation support device and method, and is suitably applied to, for example, a workflow creation support device that supports creation of a complicated workflow.

BACKGROUND ART

[0003] In general, in operation management of an IT service that manages a computer system, if work content and a work procedure are not prepared, work becomes dependent on individuals, and work efficiency may be reduced. As a method for preventing such personalization of operation management, conventionally, a method has been widely used in which a workflow that defines in advance a work processing procedure such as work content and order is created, and work is performed according to a flow of the created workflow. According to the operation management method using the workflow, there is an advantage that it is possible to clarify the flow of the work and prevent the work from being personified, and the work can be efficiently advanced.

[0004] Note that, as a conventional technique regarding creation and review of a workflow, for example, PTL 1 discloses an operation automation support system configured to determine whether there is a shortage of work items in the created workflow, and add the missing work item when there is the shortage.

[0005] In addition, PTL 2 discloses an operation system configured to execute a registered operation procedure on a target server to be operated, store an execution result as execution history information, analyze the stored execution history information, transmit information indicating an improvement point in an operation procedure an administrator device on the basis of an analysis result, analyze mutually similar patterns of the registered operation procedures, and transmit information prompting control of the operation procedure to the administrator device on the basis of the analyzed similar patterns.

CITATION LIST

Patent Literature

[0006] PTL 1: JP 2012-248085 A

[0007] PTL 2: JP 2014-191568 A

SUMMARY OF INVENTION

Technical Problem

[0008] Incidentally, in the workflow, when the flow becomes complicated, it becomes difficult to write and set each parameter. For this reason, there is a problem that it takes a lot of labor and time to create a workflow for a person who does not have specialized knowledge.

[0009] The same applies to the improvement of the workflow, and for example, even if an improvement point as disclosed in PTL 2 is indicated, there is a problem that it is not possible to specifically know how to improve the operation procedure, causing a result that much labor and time are required for improvement.

[0010] The present invention has been made in view of the above points, and an object of the present invention is to propose a workflow creation support device and method capable of reducing labor and time required for creating a workflow.

Solution to Problem

[0011] In order to solve such a problem, in the present invention, a workflow creation support device that supports creation of a workflow including a plurality of tasks includes: a management unit that manages definition contents of a workflow created in the past; and a candidate task recommendation unit that extracts and recommends a task candidate of a step to be targeted in the workflow being created, on the basis of definition contents of a predetermined number of steps of previous and/or subsequent tasks already defined in the workflow being created and definition contents of the existing workflow managed by the management unit.

[0012] In addition, in the present invention, a workflow creation support method executed by a workflow creation support device that supports creation of a workflow including a plurality of tasks includes: a first processing step of managing definition contents of a workflow created in the past; and a second processing step of extracting and recommending a task candidate of a step to be targeted in the workflow being created, on the basis of definition contents of a predetermined number of steps of previous and/or subsequent tasks already defined in the workflow being created and definition contents of the existing workflow being managed.

[0013] According to the workflow creation support device and method of the present invention, it is possible to recommend an appropriate task already defined for an administrator who is creating a workflow.

Advantageous Effects of Invention

[0014] According to the present invention, it is possible to realize a workflow creation support device and method capable of reducing labor and time required for creating a workflow.

BRIEF DESCRIPTION OF DRAWINGS

[0015] FIG. **1** is a block diagram illustrating an overall configuration of a workflow creation support system according to an embodiment.

[0016] FIG. **2** is a diagram illustrating a configuration of a workflow creation screen.

[0017] FIG. **3** is a diagram illustrating a state of screen transition of a workflow creation screen according to an administrator operation.

[0018] FIG. **4** is a diagram illustrating a state of screen transition of the workflow creation screen according to the administrator operation.

[0019] FIG. **5** is a diagram illustrating a state of screen transition of the workflow creation screen according to the administrator operation.

[0020] FIG. **6** is a diagram illustrating a state of screen transition of the workflow creation screen according to the administrator operation.

[0021] FIG. **7** is a diagram illustrating a state of screen transition of the workflow creation screen according to the administrator operation.

[0022] FIG. **8** is a diagram illustrating a configuration of an operation record registration screen.

[0023] FIG. **9** is a conceptual diagram for explaining a prediction method of a task to be designated next.

[0024] FIG. **10** is a conceptual diagram for explaining a prediction method of a task to be designated next.

[0025] FIGS. **11**A to **11**B FIG. **11**A is a conceptual diagram for explaining a prediction method of a next task using a second-order Markov model, and FIG. **11**B is a table for explaining a specific example of the prediction method.

[0026] FIG. **12** is a diagram for explaining a method of calculating an evaluation value of a task.

[0027] FIGS. **13**A to **13**B FIG. **13**A is a conceptual diagram for explaining a prediction method of a next task using a second-order Markov model, and FIG. **13**B is a table for explaining a specific example of the prediction method.

[0028] FIG. **14** is a table for explaining parameters of a task.

[0029] FIG. **15** is a table for explaining contents that can be designated as a parameter value of a parameter "action".

[0030] FIG. **16** is a diagram for explaining a task classification method.

[0031] FIGS. **17**A to **17**D FIGS. **17**A to **17**D are conceptual diagrams illustrating a procedure of the task classification method.

[0032] FIG. **18** is a table illustrating configuration example of a task table.

[0033] FIG. **19** is a table illustrating a configuration example of a task classification table.

[0034] FIG. **20** is a table illustrating a configuration example of a workflow table.

[0035] FIG. **21** is a table illustrating a configuration example of a person-in-charge table.

[0036] FIG. **22** is a table illustrating a configuration example of a cloud execution environment table.

[0037] FIG. **23** is a table illustrating a configuration example of a workflow execution history table.

[0038] FIG. **24** is a table illustrating a configuration example of a task execution history table.

[0039] FIG. **25** is a flowchart illustrating a processing procedure of task classification processing.

[0040] FIG. **26** is a flowchart illustrating a processing procedure of task recommendation processing.

[0041] FIG. **27** is a flowchart illustrating a processing procedure of workflow registration processing.

[0042] FIG. **28** is a flowchart illustrating a processing procedure of workflow time/cost prediction processing.

[0043] FIG. **29** is a flowchart illustrating a processing procedure of workflow analysis processing.

[0044] FIG. **30** is a sequence diagram illustrating a flow of processing regarding creation/registration of a workflow.

[0045] FIG. **31** is a sequence diagram illustrating a flow of processing regarding task recommendation.

[0046] FIG. **32** is a sequence diagram illustrating a flow of processing regarding workflow analysis.

[0047] FIG. **33** is a sequence diagram illustrating a flow of processing regarding workflow writing.

[0048] FIG. **34** is a sequence diagram illustrating a flow of processing regarding workflow execution.

[0049] FIG. **35** is a sequence diagram illustrating a flow of processing regarding confirmation of an operation status.

[0050] FIG. **36** is a sequence diagram illustrating a flow of processing regarding registration of an operation record.

DESCRIPTION OF EMBODIMENTS

[0051] Hereinafter, an embodiment of the present invention will be described in detail with reference to the drawings.

(1) Configuration of Workflow Creation Support System According to Present Embodiment

[0052] In FIG. **1**, reference numeral **1** indicates a workflow creation support system as a whole according to the present embodiment. The workflow creation support system **1** includes a workflow creation support device **2**, an administrator device **3**, and an operation target server **4**.

[0053] The workflow creation support device **2** includes a general-purpose server device including a central processing unit (CPU) **10**, a main storage device **11**, an auxiliary storage device **12**, an input device **13**, a display device **14**, and the like.

[0054] The CPU **10** is a processor that controls the operation of the entire workflow creation support device **2**. In addition, the main storage device **11** includes a volatile semiconductor memory such as a static random access memory (SRAM) or a dynamic random access memory (DRAM), and is used as a working memory of the CPU **10**.

[0055] The auxiliary storage device **12** includes, for example, a large-capacity nonvolatile storage device such as a hard disk device or a solid state drive (SSD), and stores data, programs, and the like that need to be stored for a long period of time. The program stored in the auxiliary storage device **12** is read into the main storage device **11** at the time of activation of the workflow creation support device **2** or when necessary, and the CPU **10** executes the program read into the main storage device **11**, thereby executing various types of processing of the entire workflow creation support device **2** as described later.

[0056] The input device **13** includes, for example, a keyboard, a mouse, and the like, and is used by the administrator to input necessary information and commands to the workflow creation support device **2**. In addition, the display device **14** includes, for example, a liquid crystal display, an organic electro-luminescence (EL) display, or the like, and is used to display necessary information and a screen. Note that a touch panel in which the input device and the display device are integrated may be applied instead of the input device **13** and the display device **14**.

[0057] The administrator device **3** includes a general-purpose computer device such as a notebook personal computer, a disk top personal computer, or a tablet, and is connected to the workflow creation support device **2** via a first network **5** such as the Internet, a local area network (LAN), or a dedicated line. The administrator device **3** transmits various instructions and various types of data input by the administrator of the workflow creation support system **1** to the workflow creation support device **2** via the first network **5**, and displays the processing results like of various

types of processing or the like transmitted from the workflow creation support device **2** via the first network **5**.

[0058] In addition, the operation target server **4** is a general-purpose cloud server device or an on-premises server device to which a workflow created by an administrator using the workflow creation support device **2** as described later is applied, and is connected to the workflow creation support device **2** via a second network **6** such as the Internet, a LAN, or a dedicated line. Note that the first and second networks **5** and **6** may be the same network.

(2) Workflow Creation Support Function According to Present Embodiment

(2-1) Outline of Workflow Creation Support Function According to Present Embodiment

[0059] Next, the workflow creation support function mounted on the workflow creation support device **2** will be described. In the workflow creation support system **1**, the administrator can create a new workflow (hereinafter, this is referred to as a new workflow) by sequentially designating a task of each step of the workflow. At this time, the workflow creation support function is a function of extracting and recommending a designated task candidate of the new workflow from tasks used in the past case workflow on the basis of the definition content of the previous and/or subsequent tasks already defined in the new workflow and the definition content of the workflow (hereinafter, this is referred to as a past case workflow) of the past case.

[0060] In practice, in the workflow creation support system **1**, the administrator can display, on the administrator device **3**, a workflow creation screen **20** including a workflow creation area **20**A and a recommendation area **20**B as illustrated in FIG. **2** by performing a predetermined operation on the administrator device **3**.

[0061] The workflow creation area **20**A is an area for creating a new workflow by arranging tasks desired by the administrator in order. In practice, when the creation of the new workflow is started, a task setting field **21** (**21**A) of the first step is displayed in a blank state at the upper left of the workflow creation area **20**A.

[0062] Then, when the administrator sets a task of a first step of the new workflow to be created at that time by a predetermined operation, an icon **22** indicating a label of the task is displayed in the first task setting field **21** (**21**A). In addition, in addition to this, a second task setting field **21** (**21**B) for designating a task of the next step is newly displayed below the first task setting field **21** (**21**A) in a blank state, and an arrow **23** (**23**A) directed from the first task setting field **21** (**21**A) to the task setting field **21** (**21**B) of the second step is displayed between these two task setting fields **21** (**21**A, **21**B).

[0063] In addition, when the administrator clicks the second task setting field **21** (**21**B) displayed in the workflow creation area **20**A and then sets a task of a second step of the new workflow to be created at that time by a predetermined operation, as illustrated in FIG. **3**, the icon **22** indicating a label of the task is displayed in the second task setting field **21** (**21**B). In addition, in addition to this, a third task setting field **21** (**21**C) for designating a task of the next step is newly displayed below the second task setting field **21** (**21**B) in a blank state, and an arrow **23** (**23**B) directed from the second task setting field **21** (**21**B) to the third task setting field **21** (**21**C) is displayed between these two task setting fields **21** (**21**B, **21**C).

[0064] Thereafter, when the administrator clicks the third task setting field **21** (**21**C) displayed in the workflow creation area **20**A, several icons **24** each indicating the label of the task recommended by the workflow creation support device **2** as a task of a third step of the new workflow being created at that time are displayed in the recommendation area **20**B. Note that a specific selection method of how the workflow creation support device **2** selects a task to be recommended will be described later.

[0065] At this time, in the recommendation area **20**B, as illustrated in FIG. **4**, by moving a cursor **25** onto the icon **24** indicating the label of the desired task among the displayed icons **24**, it is possible to display a first pop-up **26** describing the details of the definition content of the task corresponding to the label and the cost and the period required to execute the task. As a result, the administrator can select a task to be applied as a task of the third step among the tasks recommended by the workflow creation support device **2**, depending on the information displayed on the first pop-up **26**.

[0066] Then, when the administrator moves a label of a task desired as a task of the third step of the new workflow among several tasks for which the icons **24** corresponding to the recommendation area **20**B are displayed into the third task setting field **21** (**21**C) by dragging and dropping, or sets a third task of the new workflow by a predetermined operation similar to the first and second tasks, as illustrated in FIG. **5**, the icon **22** indicating the label of the task is displayed in the third task setting field **21** (**21**C). In addition, in addition to this, a fourth task setting field **21** (**21**D) for setting a task of the next step is newly displayed below the third task setting field **21** (**21**C) in a blank state, and an arrow **23** (**23**C) directed from the third task setting field **21** (**21**C) to the fourth task setting field **21** (**21**D) is displayed between these two task setting fields **21** (**21**C, **21**D).

[0067] Thereafter, when the administrator clicks the n-th (here, $n \geq 4$) task setting field **21** displayed in the workflow creation area **20**A on the workflow creation screen **20** in the same manner as described above, one or more icons **24** each indicating a label of a task recommended by the workflow creation support device **2** as a task of the n-th step of the new workflow being created at that time are displayed in the recommendation area **20**B.

[0068] Then, when the administrator moves the icon **24** of the task desired as a task of the n-th step of the new workflow among several tasks for which the icons **24** corresponding to the recommendation area **20**B are displayed into the n-th task setting field **21** by dragging and dropping or sets the n-th task of the new workflow by a predetermined operation similar to the first task, the icon **22** indicating the label of the task is displayed in the n-th task setting field **21**. In addition, an (n+1)-th task setting field **21** for designating the next task is newly displayed below the n-th task setting field **21** in a blank state, and an arrow **23** directed from the n-th task setting field **21** to the (n+1)-th task setting field **21** is displayed between these two task setting fields **21**.

[0069] Thus, by repeating the above operation using the workflow creation screen **20**, the administrator can sequentially set the task of each step in the new workflow being created at that time, thereby creating a desired new workflow.

[0070] Note that, on the workflow creation screen **20**, the cursor **25** is moved onto the task setting field **21** of the step in which the task has already been set in the new workflow displayed in the workflow creation area **20**A, whereby it is possible to display a second pop-up **27** describing details of the definition content of the task as illustrated in FIG. **5**. Then, in this second pop-up **27**, the described definition of the task can be edited, so that the definition of the task of the step in the new workflow can also be updated.

[0071] In addition, on the workflow creation screen **20**, as illustrated in FIG. **6**, when the task setting field **21** of the third and subsequent steps in which the task is already set in the middle of creating the new workflow as described above is clicked, several icons **24** in which labels of the tasks recommended by the workflow creation support device **2** as the tasks of the steps are written can be displayed again in the recommendation area **20**B.

[0072] Then, when the administrator moves the icon **24** of the task desired as the task of the step of the new workflow from the tasks in which the icon **24** corresponding to the recommendation area **20**B is displayed into the corresponding task setting field **21** by dragging and dropping, or sets the task of the step to be changed of the new workflow by a predetermined operation similar to the first task, the icon **22** indicating the label of the task moved or set at that time is written is displayed in the task setting field **21** of the step instead of the label of the original task.

[0073] In this case, when the task of the step after the step is not designated, a blank task setting field **21** for setting the task of the next step is displayed below the task setting field **21** of the step, and an arrow **23** directed from the task setting field **21** of the step to the newly displayed next task setting field **21** is displayed between these two task setting fields **21**.

[0074] On the other hand, when the task of the step after the step is already designated (the task setting field **21** of the next step is already displayed), the task setting field **21** for setting the task of the next step is not newly displayed, and accordingly, the arrow **23** directed from the task setting field **21** of the step to the task setting field **21** of the next step is not newly displayed.

[0075] On the other hand, on the workflow creation screen **20**, as illustrated in FIG. **7**, when a new workflow is created in the workflow creation area **20**A as described above, and then the analysis button **28** provided in the workflow creation area **20**A is clicked, it is possible to cause the workflow creation support device **2** to predict the cost and time required to execute the new workflow created by the administrator at that time. Hereinafter, the cost required to execute the workflow is referred to as an execution cost, and the time is referred to as an execution time. Then, at this time, a third pop-up **29** in which the execution cost and the execution time predicted by the workflow creation support device **2** are described is displayed on the workflow creation screen **20**.

[0076] In addition, at the same time, one or more past case workflows similar to the new workflow created by the administrator at that time and recommended by the workflow creation support device **2** are extracted from the workflow (hereinafter, this is referred to as a past case workflow) created in the past and already executed in any of the operation target servers **4** (FIG. **1**), and are displayed as the recommended workflow **30** in the recommendation area **20**B. As a result, the administrator can update the content of the new workflow created on the workflow creation area **20**A as necessary while referring to the recommended workflow **30** displayed in the recommendation area **20**B.

[0077] In addition, by clicking the registration button **31** on the workflow creation screen **20** after creating a new workflow as described above, various types of information regarding the new workflow can be registered in the workflow creation support device **2**. Note that the "various types of information regarding the workflow" here is information indicating the definition of content the workflow (hereinafter, this is referred to as workflow information) including information on the definition content of each task constituting the workflow (hereinafter, this is referred to as task information), information regarding the task classification of these tasks, information on the arrangement order of these tasks, and the like.

[0078] Furthermore, when the administrator clicks the write button **32** on the workflow creation screen **20** after creating a new workflow, the workflow information of the new workflow can be converted into a file and output to the workflow creation support device **2**. In this case, the workflow information converted into a file is managed in that state in the workflow creation support device **2**.

[0079] On the other hand, the administrator can display an operation record registration screen **40** as illustrated in FIG. **8** on the administrator device **3** by performing a predetermined operation on the administrator device **3**. On the operation record registration screen **40**, the workflow (past case workflow) **41** already executed by a predetermined operation can be displayed in a record registration target workflow display area **40**A on the left side of the screen. In this case, in addition to the past case workflow **41**, a fourth pop-up **46** indicating the workflow ID of the past case workflow **41**, and the execution time and the execution cost required to execute the past case workflow is also displayed in the record registration target workflow display area **40**A.

[0080] Then, on the operation record registration screen **40**, when a desired task (hereinafter, this is referred to as a target task) in the past case workflow **41** displayed in the record registration target workflow display area **40**A as described above is clicked, the execution time text box **42** for inputting the actual time required to execute the target task and the cost text box **43** for inputting the actual cost required to execute the target task are displayed in a record input area **40**B provided on the left side of the operation record registration screen **40**.

[0081] In addition, at this time, in the record input area **40**B, a person-in-charge text box **44** for inputting the name of a person in charge who actually took charge of the target task, a cost difference reason designation field **45**A for designating the reason why a difference between the cost predicted by the workflow creation support device **2** and the actual cost required has occurred by a pull-down method, and the like are also displayed.

[0082] Thus, the administrator can manually input these pieces of information by inputting the actual time required to execute the target task in the time text box **42**, inputting the actual cost required to execute the target task in the cost text box **43**, and inputting the name of the person in charge when the target task is actually executed in the person-in-charge text box **44**.

[0083] Furthermore, the administrator can designate the reason by selecting an appropriate reason as the reason why the difference between the cost predicted by the workflow creation support device **2** and the cost actually required has

occurred from the choices written in the pull-down menu (not illustrated) displayed by clicking a pull-down button **45**B displayed on the right side of the cost difference reason designation field **45**A. The reason designated at this time is displayed in the cost difference reason designation field **45**A.

[0084] Then, on the operation record registration screen **40**, the actual time, cost, and the like required for execution of other tasks of the past case workflow **41** displayed in the record registration target workflow display area **40**A are manually input in the same manner as described above, and then the registration button **47** is clicked, so that these pieces of information can be registered as manual input information regarding the past case workflow in the workflow creation support device **2**.

(2-2) Method for Selecting and Displaying Recommendation Task by Workflow Creation Support Device

[0085] Next, a specific method of selecting and displaying a task to be recommended to the user in the workflow creation support device **2** will be described.

[0086] In the case of the present embodiment, the workflow creation support device **2** analyzes the arrangement order of the tasks in the past case workflow by using an N-th order Markov model, estimates several tasks that are likely to be set as the task of the step designated in the new workflow on the basis of the analysis result, and recommends these tasks. Here, it is assumed that for the third and subsequent steps, the workflow creation support device **2** estimates a task that is likely to be set as a task of the steps by using a second-order Markov model (N=2) as illustrated in FIGS. **9** and **10**.

[0087] In practice, when in the workflow creation area **20**A of the workflow creation screen **20** (FIGS. **2** to **7**), the n-th task setting field **21** (FIGS. **2** to **7**) is clicked in a state where each of the tasks up to (n−1)-th (here, n≥3) in the new workflow is already set, and the n-th and subsequent tasks are not set, the workflow creation support device **2** extracts, from the past case workflow, all the past case workflows in which the tasks of the same task classification as each of the tasks set as the (n−2)-th task and the (n−1)-th task in the new workflow are respectively set as the (n−2)-th task and the (n−1)-th task.

[0088] Note that here, the "task classification" is a group of tasks classified according to the definition contents, and the "tasks of the same task classification" refers to tasks that can be handled as tasks of the same task classification although the definition contents do not completely match. For example, in a case where a task of which the label defined by the administrator is "inquiry" and a task of which the label defined by the same administrator is "query" all have the same definition contents other than the label, these tasks can be treated as the same task. Therefore, such two tasks correspond to "tasks of the same task classification".

[0089] Then, the workflow creation support device **2** specifies all the tasks set as the n-th task in each extracted past case workflow, and calculates the appearance probabilities of the respective task classifications to which the specified tasks belong.

[0090] For example, as illustrated in FIG. **11**A, it is assumed that the n-th task setting field **21** is clicked in a state where a task having a task classification labeled "inquiry" is designated as the (n−2)-th task in the new workflow by the administrator, and a task having a task classification labeled "content confirmation" is designated as the (n−1)-th task by the administrator.

[0091] In this case, the workflow creation support device **2** extracts, from the past case workflows, all the past case workflows in which the (n−2)-th task is set to the task having the same task classification as the (n−2)-th task of the new workflow, and the (n−1)-th task is set to the task having the same task classification as the (n−1)-th task of the new workflow, and specifies the task classification of the n-th task in the extracted past case workflows.

[0092] In addition, as illustrated in FIG. **11**B, the workflow creation support device **2** counts the appearance frequency for each specified task classification. Then, on the basis of the counting result, the workflow creation support device **2** calculates, by the following equation

[Mathematical Formula 1]

$$P = \frac{\text{Appearance frequency of task classification to be targeted}}{\text{Total number of extracted past case workflows}} \quad (1)$$

[0093] an appearance probability P for each task classification.

[0094] Note that FIG. **11**B illustrates an example in which the labels of the n-th set tasks in the extracted past case workflow are three types of "answer", "approval", and "reception", and the appearance frequencies of the tasks for the respective task classifications to which these tasks belong are "200 times", "400 times", or "400 times", respectively, so that the appearance probabilities P of these task classifications are calculated to be "20%", "40%", or "40%", respectively.

[0095] Furthermore, as illustrated in FIG. **12**, the workflow creation support device **2** extracts, from the tasks constituting each past case workflow, all the tasks belonging to each task classification for which the appearance probability P has been calculated as described above, and calculates the appearance frequency, the execution time, and the execution cost of the extracted tasks on the basis of the execution history of the past case workflow so far. A specific calculation method of the appearance frequency, the execution time, and the execution cost of these tasks will be described later.

[0096] Then, on the basis of the calculated appearance frequency, execution time, and execution cost of these tasks, the workflow creation support device **2** calculates, by the following equation

[Mathematical Formula 2]

$$S = P \times \sum_{k=0}^{n} a_k x_k \quad (2)$$

[0097] an evaluation value S for each extracted task. Note that, in Equation (2), a is a weight for each viewpoint (appearance frequency, execution time, and execution cost), x is an average value for each viewpoint, and P is an appearance probability of a task classification to which a task to be targeted belongs.

[0098] For example, in the case of the example of FIG. **12**, the workflow creation support device **2** calculates, by the following equation for "task A"

[Mathematical Formula 3]

$$S = 0.4 \times (a_1 \times 70 + a_2 \times 1 + a_3 \times 20000) \quad (3)$$

[0099] the evaluation value S of the task, and calculates, by the following equation for "task B"

[Mathematical Formula 4]

$$S = 0.4 \times (a_1 \times 30 + a_2 \times 2 + a_3 \times 10000) \quad (4)$$

[0100] the evaluation value S of the task.

[0101] Then, the workflow creation support device **2** displays the icons **24** indicating the labels of the tasks in the recommendation area **20**B of the workflow creation screen **20**, such that the tasks are arranged in the vertical direction such that the task classification having a larger total value of the calculated evaluation values S is positioned higher, and the top several (for example, maximum 2 to 3) tasks having larger evaluation values S in the same task classification are arranged in the horizontal direction (see FIGS. **3**, **4**, and **6**).

[0102] On the other hand, in a case where the task setting field **21** corresponding to the n-th task in which each of the (n−2)-th and (n−1)-th tasks and each of the (n+1)-th and (n+2)-th tasks are already designated (that is, a task in which two tasks before and after the task are already set) is clicked, the workflow creation support device **2** selects and displays the task to be recommended as follows.

[0103] First, the workflow creation support device **2** extracts, from the past case workflows, all the past case workflows in which tasks of the same task classification as the task classification of the tasks set as the (n−2)-th task and the (n−1)-th task of the new workflow are set as the (n−2)-th task and the (n−1)-th task, respectively.

[0104] Then, as illustrated in FIGS. **13**A and **13**B, the workflow creation support device **2** specifies the task classification of the n-th task in each extracted past case workflow and calculates the appearance probability (hereinafter, this is referred to as a first appearance probability) **P1** of each of the specified task classifications, similarly to the method described above with respect to FIGS. **11**A and **11**B.

[0105] In addition, the workflow creation support device **2** extracts, from the past case workflows, all the past case workflows in which tasks of the same task classification as the task classification of tasks set as the (n+1)-th and (n+2)-th tasks in the new workflow are set as the (n+1)-th task and (n+2)-th task, respectively.

[0106] Then, as illustrated in FIGS. **13**A and **13**B, the workflow creation support device specifies all the task classifications of the tasks set as the n-th task in each extracted past case workflow and calculates the appearance probabilities (hereinafter, this is referred to as a second appearance probability) **P2** for each of the specified task classifications, by the same method as the method described above with respect to FIGS. **11**A and **11**B.

[0107] For example, as illustrated in FIG. **13**B, it is assumed that in the new workflow, a task labeled "inquiry" is designated as the (n−2)-th task by the administrator, a task labeled "content confirmation" is designated as the (n−1)-th task by the administrator, a task labeled "approval" is designated as the (n+1)-th task by the administrator, and a task labeled "inspection" is designated as the (n+2)-th task by the administrator, and the task setting field **21** corresponding to the n-th task is clicked.

[0108] In this case, the workflow creation support device **2** extracts, from the past case workflows, all the past case workflows in which the (n−2)-th task is set to the task having the same task classification as the task of "inquiry", and the (n−1)-th task is set to the task having the same task classification as the task of "content confirmation", and specifies all the task classifications of the n-th task in each extracted past case workflow. In addition, the workflow creation support device **2** calculates the first appearance probability **P1** for each specified task classification by Equation (1).

[0109] In addition, the workflow creation support device **2** extracts all the past case workflows in which the (n+1)-th task is set to the task of the same task classification as the task of "approval", and the (n+2)-th task is set to the task of the same k classification as the task of "inspection", and specifies all the task classifications set as the n-th task in the extracted past case workflows. In addition, the workflow creation support device **2** calculates the second appearance frequency **P2** for each specified task classification by Equation (1).

[0110] Furthermore, on the basis of the first and second appearance probabilities **P1** and **P2** calculated as described above for the same task classification, the workflow creation support device calculates, by the following equation

[Mathematical Formula 5]

$$P = \alpha \times P1 + \beta \times P2 \quad (5)$$

[0111] the appearance probability P of the task classification. Note that, in Equation (5), a is a weight for the first appearance probability **P1**, and β is a weight for the second appearance probability **P2**.

[0112] In addition, the workflow creation support device **2** extracts, from the tasks constituting each past case workflow, all the tasks belonging to each task classification for which the appearance probability P has been calculated as described above, and calculates the appearance frequency, the execution time, and the execution cost of the extracted tasks on the basis of the execution history of the past case workflow.

[0113] Furthermore, the workflow creation support device **2** calculates the evaluation value S for each task by the above-described Equation (2) on the basis of the calculated appearance frequency, execution time, and execution cost of these tasks.

[0114] Then, the workflow creation support device **2** displays the icons **24** (FIGS. **3**, **4**, and **6**) of the labels of the tasks in the recommendation area **20**B of the workflow creation screen **20**, such that the tasks are arranged in the vertical direction such that the task classification having a larger total value of the calculated evaluation values S is positioned higher, and the top several (for example, maximum 2 to 3) tasks having larger evaluation values S in the same task classification are arranged in the horizontal direction.

[0115] Note that, in the above-described example, a case has been described in which a task that is likely to be designated as a task of an n-th step (n≥3) is estimated by using the second-order Markov model. However, a task that

is likely to be set in an n-th step (n≥2) may be estimated in the same manner as described above by using the first-order Markov model (which is an N-th order Markov model with N=1, and is also referred to as a simple Markov model).

[0116] Note that the use of the first-order Markov model can also be applied to a case where a task that is likely to be set in the n-th step (n≥2) is estimated by using only a task in a step before the step as illustrated in FIG. **9**, and a case where a task that is likely to be set in the n-th step (n≥2) is estimated by using tasks in steps before and after the step as illustrated in FIG. **10**.

[0117] Furthermore, a task that is likely to be set in the (N+1)-th and subsequent steps may be estimated by using an N-th order Markov model in which N is 3 or more.

(2-3) Task Classification Method According to Present Embodiment

[0118] Next, a method in which the workflow creation support device **2** classifies each task of the new workflow into any task classification will be described. In the present embodiment, each task of the new workflow is classified on the basis of the parameter of the task. Here, description will be made assuming that the task is defined by nine parameters of "label", "description", "action", "input", "group/role", "ui", "next", "when", and "do" as illustrated in FIG. **14**.

[0119] Note that "action" is a parameter representing the content of processing actually performed as the task. In the present embodiment, examples of processing that can be designated as the "action" include "core.ask", "core.http", "core.noop", "core.sendmail", "fetch_access_token", "run_job_template", and "get_job_result" as illustrated in FIG. **15**.

[0120] Here, in a case where a condition that the task to be classified is classified into a certain task classification is set such that all parameters of the task to be classified and all parameters of any task belonging to such a task classification are completely matched, even though the task classification is originally the same, a case where the label ("label") differs by one character or a case where the sentence of the description of the task in the "description" differs by several characters is also determined to be a task of another classification.

[0121] However, the label ("label") and "description" are defined by the administrator, and depending on the administrator, "inquiry" may be expressed as "query", "enquiry", "question", or the like, or an explanatory sentence of a task in "description" may be expressed differently from the expressions of other administrators although the contents are originally the same. Then, in such a case, when it is determined that the task to be classified does not belong to the task classification, there is a possibility that a problem that the task to be originally recommended is not recommended or the same task is redundantly recommended occurs.

[0122] In this regard, in the present embodiment, the task to be classified is classified into an existing or new task classification by the following method.

[0123] First, as illustrated in FIG. **16**, the parameters of the task are divided into a first parameter group including parameters (for example, "action" and "ui") that is to be determined to be the same in an exact match, a second parameter group including parameters (for example, "label" and "description") in which similar ones are treated as the same, and a third parameter group including parameters (for example, "input") that are not used for analysis or are difficult to use. In addition, for each parameter belonging to the first parameter group, a representative value of the parameter in the task classification is set in advance for each task classification.

[0124] Then, in a case where the task of the new workflow is classified into any task classification, first, as illustrated in FIG. **17**A, the values of the parameters belonging to the first parameter group of the task (hereinafter, this is referred to as a classification target task) are compared with the representative values of the parameters in the existing task classification for each existing task classification.

[0125] Then, the task classification in which the values of all the parameters belonging to the first parameter group of the classification target task are completely matched with the representative values of the corresponding parameters is extracted. Hereinafter, the task classification extracted at this time is referred to as an extraction task classification.

[0126] Subsequently, as illustrated in FIG. **17**B, a similarity between the classification target task and each task classification is calculated from the representative value of each parameter belonging to the second parameter group of the classification target task and the representative value of each parameter belonging to the second parameter group of the extraction task classification.

[0127] Such a similarity can be calculated as a weighted sum of similarity between words or between sentences for each parameter. Note that, for example, the Levenshtein distance between two words can be the similarity between the two words, and the Word Mover's Distance between two sentences can be the similarity between the two sentences.

[0128] Next, as illustrated in FIG. **17**C, an extraction task classification having the highest similarity to the classification target task is selected. Furthermore, as illustrated in FIG. **17**D, it is determined whether the similarity between the selected extraction task classification and the classification target task is greater than or equal to a preset threshold, and if an affirmative result is obtained, the classification target task is classified into the selected extraction task classification. Note that the determination of FIG. **17**D is added in order to prevent the classification target task from being classified into the task classification having a small similarity when there is little data, for example, at the beginning of operation.

(2-4) Configuration of Workflow Creation Support Device Regarding Workflow Creation Support Function

[0129] As means for realizing the workflow creation support function of the present embodiment as described above, as illustrated in FIG. **1**, a task table **50**, a task classification table **51**, a workflow table **52**, a person-in-charge table **53**, a cloud execution environment table **54**, a workflow execution history table **55**, and a task execution history table **56** are stored in the auxiliary storage device **12** of the workflow creation support device **2**, and a screen creation unit **57**, an operation management unit **58**, an execution management unit **59**, and a procedure file management unit **60** read from the auxiliary storage device **12** are stored in the main storage device **11** of the workflow creation support device **2**.

[0130] The task table **50** is a table used to manage a task set in any past case workflow, and as illustrated in FIG. **18**, includes a task ID field **50**A and a task classification ID field

50B, and a parameter value field 50C for each parameter described above with respect to FIG. 14.

[0131] In the task table 50, one record (row) corresponds to task information of one task executed in any past case workflow. Note that, in the task table 50, tasks in which the parameter values of the parameters completely match are treated as the same task, and even if these tasks are executed in different past case workflows, the task information of these tasks is not redundantly registered in the task table 50.

[0132] Then, an identifier (task ID) assigned to the corresponding task and unique to the task is stored in the task ID field 50A, and an identifier (task classification ID) assigned to the task classification of the classification destination of the task and unique to the task classification is stored in the task classification ID field 50B. In addition, the parameter values of corresponding parameters set for the corresponding tasks are stored in the parameter value fields 50C.

[0133] Therefore, in the case of the example of FIG. 18, it is indicated that, for example, a task to which a task ID of "1" is assigned is a task classified into a task classification to which a task classification ID of "1" is assigned, and the parameter value of each parameter is set such that "action" is set to "core.ask", "label" is set to "inquiry", "description" is set to "ooo", and "ui" is set to "1" and so on.

[0134] The task classification table 51 is a table for managing representative values of specific parameters of tasks that can be classified into the task classification for each task classification, and as illustrated in FIG. 19, includes a task classification ID field 51A and a plurality of specific parameter fields 51B. In the task classification table 51, one record corresponds to one task classification.

[0135] Then, the task classification ID stores a task classification ID of a corresponding task classification. In addition, in each specific parameter field 51B, a representative value (parameter value) of each of several specific parameters for classifying a task into a task classification is stored.

[0136] Therefore, in the example of FIG. 19, it is indicated that, for example, in order for a certain task to be classified into a task classification to which a task classification ID of "1" is assigned, the parameter value of "action" needs to be a value that matches or is close to "core.ask", the parameter value of "label" needs to be a value that matches or is close to "inquiry", the parameter value of "description" needs to be a value that matches or is close to "ooo", and so on (since the parameter value is only a representative value).

[0137] The workflow table 52 is a table for managing a workflow created in the past (past case workflow), and includes a workflow ID field 52A, a task list field 52B, and a task classification list field 52C as illustrated in FIG. 20. In the workflow table 52, one record corresponds to one past case workflow.

[0138] Note that, in the workflow table 52, the past case workflows in which the same task is set in the same order are treated as the same past case workflow, and even if these past case workflows are executed at different timings, information regarding these past case workflows is not redundantly registered in the workflow table 52.

[0139] Then, in the workflow ID field 52A, an identifier (workflow ID) assigned to the corresponding past case workflow and unique to the past case workflow is stored, and in the task list field 52B, the task IDs of tasks of steps constituting the past case workflow are stored in a list format in which the task IDs are arranged in step order.

[0140] In addition, in the task classification list field 52C, the task classification IDs of the task classifications into which the tasks of the steps in the corresponding past case workflow are classified are stored in a list format in which the task classification IDs are arranged in the step order of the corresponding tasks.

[0141] Therefore, in the case of the example of FIG. 20, it is indicated that, for example, the past case workflow to which the workflow ID of "1" is assigned is a workflow in which the tasks to which the task IDs of "1" to "4" are respectively assigned are executed in this order, and the task classifications of the tasks of "1" to "4" are task classifications to which the task classification IDs of "3", "4", "2", or "9" are respectively assigned.

[0142] The person-in-charge table 53 is a table for managing a person in charge when the past case workflow is executed or an administrator who can be in charge when the new workflow is executed, and includes a person-in-charge ID field 53A and a cost-per-unit time field 53B as illustrated in FIG. 21. In the person-in-charge table 53, one record corresponds to one person in charge.

[0143] Then, in the person-in-charge ID field 53A, an identifier (person-in-charge ID) assigned to the corresponding person in charge and unique to the person in charge is stored, and in the cost-per-unit time field 53B, a cost per unit time of the person in charge is stored. Therefore, in the case of the example of FIG. 21, it is indicated that the cost per unit time of the person-in-charge ID of "1" is "o yen", for example.

[0144] In addition, the cloud execution environment table 54 is a table for managing a cloud environment, and includes a cloud environment ID field 54A and a cost-per-unit time field 54B as illustrated in FIG. 22. In the cloud execution environment table 54, one record corresponds to one cloud environment in which a workflow is executed.

[0145] Then, in the cloud environment ID field 54A, an identifier (cloud environment ID) assigned to the corresponding cloud environment and unique to the cloud environment is stored, and in the cost-per-unit time field 54B, a use cost per unit time of the cloud environment is stored. Therefore, in the case of the example of FIG. 22, it is indicated that the use cost per unit time of the cloud environment ID of "1" is "□ yen", for example.

[0146] The workflow execution history table 55 is a table for managing the execution history of a workflow, and includes a workflow execution history ID field 55A, a workflow ID field 55B, a total execution time field 55C, a total cost automatic calculation value field 55D, and a total cost manual input value field 55E as illustrated in FIG. 23. In the workflow execution history table 55, one record corresponds to the execution history of one workflow (past case workflow).

[0147] Then, in the workflow execution history ID field 55A, an identifier (workflow execution history ID) assigned to the corresponding execution history and unique to the execution history is stored, and in the workflow ID field 55B, the workflow ID of the past case workflow executed at that time is stored.

[0148] In addition, in the total execution time field 55C, the total time (total execution time) required to execute the past case workflow is stored, and in the total cost automatic calculation value field 55D, the total cost automatically

calculated by the workflow creation support device **2** and required to execute the corresponding past case workflow is stored.

[0149] Note that the total execution time of the past case workflow is calculated as the sum of the execution times of the individual tasks constituting the past case workflow, and the total cost of the past case workflow is calculated as the sum of the costs required to execute the individual tasks constituting the past case workflow. A method of calculating the execution time and cost of each task will be described later.

[0150] Furthermore, in the total cost manual input value field **55**E, the actual total cost manually input by the administrator and required to execute the corresponding past case workflow is stored. Note that in a case where the total cost is not manually input by the administrator, "NULL" is stored in the total cost manual input value field **55**E.

[0151] Therefore, in the case of the example of FIG. **23**, it is indicated that, for example, the execution history of the past case workflow to which the workflow execution history ID of "1" is assigned is the execution history of the past case workflow to which the workflow ID of "1" is assigned, "3 days, 4 hours, and 56 minutes" is required to execute the past case workflow, the total cost is "oo yen" in the automatic calculation by the workflow creation support device **2**, and no manual input of the total cost has been performed by the administrator (the value of the total cost manual input value field **55**E is "NULL").

[0152] The task execution history table **56** is a table used to manage the execution history of each task constituting the past case workflow, and as illustrated in FIG. **24**, includes a task execution history ID field **56**A, a workflow execution history ID field **56**B, a task ID field **56**C, an execution time field **56**D, a cost automatic calculation value field **56**E, a cost manual input value field **56**F, a person-in-charge ID field **56**G, and a cloud execution environment ID field **56**H. In the task execution history table **56**, one record corresponds to the execution history of one task.

[0153] Then, in the task ID field **56**C, the task ID of the corresponding task is stored, and in the task execution history ID field **56**A, an identifier (task execution history ID) assigned to the execution history of the task and unique to the execution history is stored. In addition, in the workflow execution history ID field **56**B, the workflow execution history ID of the execution history of the past case workflow in which the task was executed is stored.

[0154] In addition, in the execution time field **56**D, the time (execution time) required to execute the corresponding task is stored, and in the cost automatic calculation value field **56**E, the cost (execution cost) required to execute the task automatically calculated by the workflow creation support device **2** is stored.

[0155] Note that an average value of times required to execute the task is applied as the execution time of the task, and an average value of costs required to execute the task is applied as the execution cost of the task. The execution cost of the task can be calculated by adding a value obtained by multiplying the cost per unit time of the corresponding person in charge stored in the person-in-charge table **53** (FIG. **21**) by the time required to execute the task and a value obtained by multiplying the cost per unit time of the cloud environment used to execute the task stored in the cloud execution environment table **54** (FIG. **22**) by the time required to execute the task.

[0156] Furthermore, in the cost manual input value field **56**F, the cost manually input by the administrator and required to execute the corresponding past case workflow is stored. Note that in a case where the total cost is not manually input by the administrator, "NULL" is stored in the cost manual input value field **56**F. In addition, in a case where a numerical value is stored in the cost manual input value field **56**F, the numerical value stored in the cost manual input value field **56**F is preferentially used at the time of calculating the value to be input to the total cost automatic calculation value field **55**D of the workflow execution history table **55** described above with respect to FIG. **23**.

[0157] Furthermore, in the person-in-charge ID field **56**G, the person-in-charge ID of the person in charge in charge of execution of the corresponding task is stored. Note that, in a case where the task is not manually performed, "NULL" is stored in the person-in-charge ID field **56**G.

[0158] Furthermore, in the cloud execution environment ID field **56**H, the cloud environment ID of the cloud environment in which the corresponding task is executed is stored. Note that in a case where the task is a task that does not use a cloud environment, "NULL" is stored in the cloud execution environment ID field **56**H.

[0159] Therefore, in the case of the example of FIG. **24**, it is indicated that, for example, the task execution history to which the task execution history ID of "1" is assigned is the execution history of the task having the task ID of "1" of the past case workflow corresponding to the workflow execution history to which the workflow execution history ID of "1" is assigned.

[0160] In addition, FIG. **24** illustrates that "1 day, 4 hours, and 56 minutes" is required to execute the task, the execution cost is "oo yen" in the automatic calculation by the workflow creation support device **2**, and no manual input of the cost has been performed by the administrator (the value of the total cost manual input value field **56**F is "NULL"). In addition, FIG. **24** also illustrates that the task was executed by the person in charge to which the person-in-charge ID of "1" is assigned, and the cloud environment was not used (the value of the cloud execution environment ID field **56**H is "NULL").

[0161] On the other hand, the screen creation unit **57** is a program having a function of causing the administrator device **3** to display various screens by transferring various requests given from the administrator device **3** to the operation management unit **58** according to the operation of the administrator or generating various screens including the workflow creation screen **20** and the operation record registration screen **40** described above with respect to FIGS. **2** to **8** on the basis of information given from the operation management unit **58**, and transmitting the screen data to the administrator device **3**.

[0162] In addition, the operation management unit **58** is a program having a function of referring to the task table **50**, the task classification table **51**, the workflow table **52**, the person-in-charge table **53**, the cloud execution environment table **54**, the workflow execution history table **55**, and the task execution history table **56** on the basis of a request from the administrator given from the screen creation unit **57**, selecting a task or a past case workflow to be recommended to the administrator, and notifying the screen creation unit **57** of the selected task or past case workflow.

[0163] In addition, the operation management unit **58** stores and manages various types of information given from the administrator via the screen creation unit **57** and various types of information input via the input device **13** (FIG. **1**) in the task table **50**, the task classification table **51**, the workflow table **52**, the person-in-charge table **53**, the cloud execution environment table **54**, the workflow execution history table **55**, or the task execution history table **56**.

[0164] The execution management unit **59** is a program having a function of causing a new workflow created by the administrator to be executed on the operation target server **4** (FIG. **1**) instructed by the administrator in response to an instruction from the operation management unit **58**, acquiring an execution result, and notifying the operation management unit **58** of the execution result.

[0165] In addition, the procedure file management unit **60** is a program having a function of converting the workflow information of the new workflow created by the administrator into a file and storing the file according to an instruction from the operation management unit **58**.

(3) Various Types of Processing Regarding Workflow Creation Support Function

[0166] Next, specific processing contents of various types of processing executed in the workflow creation support device **2** in relation to the workflow creation support function according to the present embodiment will be described. Note that, in the following description, a processing subject of various types of processing will be described as a program (" . . . unit"), but in practice, it goes without saying that the CPU **10** (FIG. **1**) executes the processing on the basis of the program.

(3-1) Task Classification Processing

[0167] FIG. **25** illustrates a processing procedure of task classification processing executed by the operation management unit **58** when classifying tasks. The operation management unit **58** classifies the task (classification target task) to be classified at that time into any task classification in accordance with the processing procedure illustrated in FIG. **25**.

[0168] In practice, when the task classification processing is started, the operation management unit **58** first compares the parameter value of each parameter belonging to the first parameter group described above with respect to FIG. **16** of each task classification registered in the task classification table **51** (FIG. **19**) with the parameter value of each parameter belonging to the first parameter group of the classification target task, and extracts all existing task classifications in which the parameter values of all the parameters belonging to the first parameter group match (S**1**).

[0169] Subsequently, the operation management unit **58** determines whether at least one task classification has been extracted in step S**1** (S**2**). Then, if a negative result is obtained in this determination, the operation management unit **58** determines that there is no existing task classification to which the classification target task is applicable, and registers a necessary parameter of the classification target task as a parameter of a new task classification in the task classification table **51** (S**7**). Thereafter, the operation management unit **58** ends the task classification processing.

[0170] On the other hand, if an affirmative result is obtained by the determination in step S**2**, the operation management unit **58** calculates the similarity between each extraction task classification and the target task as described above, on the basis of the parameter value of each parameter belonging to the second parameter group of each task classification (extraction task classification) extracted in step S**1** and the parameter value of each parameter belonging to the second parameter group of the classification target task, the parameter value being registered in the task classification table **51** (S**3**).

[0171] Subsequently, the operation management unit **58** selects one extraction task classification having the highest similarity to the classification target task on the basis of the similarity between each extraction task classification calculated in step S**3** and the classification target task (S**4**), and determines whether the similarity is larger than a preset threshold (S**5**).

[0172] Then, if a negative result is obtained in this determination, the operation management unit **58** classifies the classification target task into the extraction task classification selected in step S**4**, and then, ends the task classification processing.

(3-2) Task Recommendation Processing

[0173] FIG. **26** illustrates a processing procedure of the task recommendation processing executed by the operation management unit **58** when the workflow creation support device **2** recommends a task while the administrator is creating a new workflow. In accordance with the processing procedure illustrated in FIG. **26**, the operation management unit **58** extracts a task candidate of a step designated by the administrator and recommends the task candidate to the administrator.

[0174] In practice, for example, when the task setting field **21** (FIGS. **2** to **7**) of any step (hereinafter, this is referred to as a target step) is clicked while the administrator is creating a new workflow by using the workflow creation screen **20**, the operation management unit **58** starts the task recommendation processing illustrated in FIG. **26**.

[0175] Then, the operation management unit **58** first determines whether the tasks of two steps immediately before the target step in the new workflow have already been set (S**10**). Then, if a negative result is obtained in this determination, the operation management unit **58** ends the task recommendation processing. Therefore, in this case, the task recommended as the task of the target step by the workflow creation support device **2** is not displayed in the recommendation area **20**B (FIGS. **2** to **7**) of the workflow creation screen **20**.

[0176] On the other hand, if an affirmative result is obtained in the determination of step S**10**, the operation management unit **58** classifies each task into any task classification by executing the task classification processing described above with respect to FIG. **25** for each task in the two steps immediately before the target step (S**11**).

[0177] Subsequently, on the basis of the classification result in step S**11**, the operation management unit **58** extracts, from the workflow table **52**, all the past case workflows in which tasks of the same task classification as the task classification of each task of the two steps immediately before the target step in the new workflow exist in the same order (S**12**).

[0178] Specifically, the operation management unit **58** refers to the task classification list **52**C (FIG. **20**) of the workflow table **52**, and extracts all the workflow IDs of the

past case workflows in which the same task classification as the task classification of each task of the two steps immediately before the target step in the new workflow exists in the same order.

[0179] Next, the operation management unit **58** refers to the task classification list field **52**C of the workflow table **52**, specifies the task classification of the task of the step corresponding to the target step of the new workflow in each past case workflow (hereinafter, this is referred to as a first extracted past case workflow) extracted in step S**12**, and calculates the appearance probability P**1** for each specified task classification by the method described above with respect to FIGS. **11**A and **11**B (S**13**).

[0180] Furthermore, the operation management unit **58** extracts all the tasks belonging to each task classification specified in step S**13** (S**14**). Specifically, the operation management unit **58** extracts all the task IDs in which the task classification IDs of the task classifications specified in step S**13** are stored in the task classification ID field **50**B of the task table **50** (FIG. **18**).

[0181] Subsequently, the operation management unit **58** determines whether each task of two steps immediately after the target step in the new workflow has already been set (S**10**). Then, if a negative result is obtained in this determination, the operation management unit **58** proceeds to step S**20**.

[0182] On the other hand, if an affirmative result is obtained in the determination of step S**15**, the operation management unit **58** classifies each task into any task classification by executing the task classification processing described above with respect to FIG. **25** for each task of the two steps immediately after the target step (S**16**).

[0183] In addition, similarly to step S**12**, on the basis of the classification result of step S**16**, the operation management unit **58** extracts, from the workflow table **52**, all the past case workflows in which the same task classification as the task classification of each task of the two steps immediately after the target step in the new workflow exists in the same order (S**17**).

[0184] Furthermore, the operation management unit **58** refers to the task classification list field **52**C of the workflow table **52**, specifies the task classification of the task of the step corresponding to the target step of the new workflow in each past case workflow (hereinafter, this is referred to as a second extracted past case workflow) extracted in step S**12**, and calculates the appearance probability P**2** for each specified task classification by the method described above with respect to FIGS. **11**A and **11**B (S**18**).

[0185] Furthermore, similarly to step S**14**, the operation management unit **58** extracts all the tasks belonging to each task classification specified in step S**18** (S**19**).

[0186] Thereafter, the operation management unit **58** calculates the evaluation value S for each task extracted in step S**14** and/or step S**19** (S**20**).

[0187] Specifically, if a negative result is obtained in the determination in step S**15**, and the process proceeds to step S**20**, the operation management unit **58** calculates the evaluation value S of each task extracted in step S**14** by the above-described Equation (2). Note that, in this case, the appearance probability P**1** calculated in step S**13** is P in Equation (2).

[0188] In addition, if the process proceeds to step S**20** through step S**19**, the operation management unit **58** calculates the evaluation value S of each task extracted in steps S**14** and S**19** by the above-described Equation (2). In this case, the appearance probability P is calculated by Equation (5) on the basis of the appearance probability P**1** calculated in step S**13** and the appearance probability P**2** calculated in step S**18**, and then the evaluation value S of each task is calculated by Equation (2).

[0189] Furthermore, the operation management unit **58** notifies the screen creation unit **57** (FIG. **1**) of the tasks extracted in step S**14** and step S**19** and the task classifications of the tasks, and the evaluation value S for each task calculated in step S**20** (S**21**), and then ends the task recommendation processing.

[0190] Thus, thereafter, the screen creation unit **57** generates the workflow creation screen **20** in which the icons **24** indicating the labels of the tasks are displayed in the recommendation area **20**B such that the tasks are arranged in the vertical direction such that the task classification having a larger total value of the evaluation values S is positioned higher, and the top several (for example, maximum 2 to 3) tasks having larger evaluation values S in the same task classification are arranged in the horizontal direction, and t transmits the screen data to the corresponding administrator device **3**, thereby displaying the workflow creation screen **20** on the administrator device **3**.

(3-3) Workflow Registration Processing

[0191] On the other hand, FIG. **27** illustrates a processing procedure of the workflow registration processing executed by the operation management unit **58** in a case where the registration button **31** (FIGS. **2** to **7**) is clicked after the administrator creates a new workflow by using the workflow creation screen **20**. In accordance with the processing procedure illustrated in FIG. **27**, the operation management unit **58** registers various types of information regarding the new workflow created by the administrator in the workflow table **52** (FIG. **20**), the task table **50** (FIG. **18**), and the task classification table **51** (FIG. **19**).

[0192] In practice, when the registration button **31** is clicked after the administrator creates a new workflow by using the workflow creation screen **20**, the operation management unit **58** starts the workflow registration processing illustrated in FIG. **27**, and first, selects one task, which is not processed in step S**31**, among the tasks constituting the new workflow.

[0193] Subsequently, with the task selected in step S**30** (hereinafter, in the description of FIG. **27**, this is referred to as a selection task) as the classification target task, the operation management unit **58** classifies the selection task into any task classification by executing the task classification processing described above with respect to FIG. **25** (S**31**).

[0194] Next, the operation management unit **58** determines whether the processing of steps S**31** to S**33** has been executed for all the tasks of the new workflow to be registered (S**32**). Then, if a negative result is obtained in this determination, the operation management unit **58** returns to step S**30**, and thereafter, repeats the processing of steps S**30** to S**32** while sequentially switching the task selected in step S**30** to another unprocessed task in step S**31**.

[0195] Then, if an affirmative result is obtained in step S**32** by eventually completing the classification of all the tasks of the new workflow to be registered into any task classification, the operation management unit **58** newly registers information regarding the new workflow to be registered in

the workflow table **52**, and newly registers task information of each task constituting the new workflow in the task table **50** (S**33**).

[0196] However, at this time, in a case where the completely same past case workflow as the new workflow to be registered has already been registered in the workflow table **52**, the operation management unit **58** does not register the new workflow in the workflow table **52**. Similarly, in a case where a task in which the parameter values of all the parameters are completely matched with those of the task already registered in the task table **50** exists among the tasks constituting the new workflow to be registered, the operation management unit **58** does not register the task in the task table **50**.

[0197] Thereafter, the operation management unit **58** ends the workflow registration processing.

(3-4) Workflow Time/Cost Prediction Processing

[0198] FIG. **28** illustrates a processing procedure of the workflow time/cost prediction processing executed by the operation management unit **58** to predict the execution time of the workflow and the execution cost of the workflow.

[0199] For example, in a case where the analysis button **28** (FIGS. **2** to **7**) is clicked after the administrator creates a new workflow by using the workflow creation screen **20**, the operation management unit **58** starts the workflow time/cost prediction processing illustrated in FIG. **28**.

[0200] Then, the operation management unit **58** first selects one unprocessed task after step S**41** among the tasks of a workflow to be targeted (hereinafter, this is referred to as a target workflow) (S**40**). In addition, by executing the task classification processing described above with respect to FIG. **25** for the selected task (hereinafter, in the description of FIG. **28**, this is referred to as a selection task), the operation management unit **58** classifies the selection task into any task classification.

[0201] Subsequently, the operation management unit **58** extracts all the execution histories of the tasks classified into the same task classification as the selection task from the task execution history table **56** (FIG. **24**) (S**42**). Specifically, the operation management unit **58** specifies, among the records of the task table **50**, all records in which the task classification IDs of the same task classification as that of the selection task are stored in the task classification ID field **50**B, and extracts all the task IDs stored in the task IDs of these records. Then, the operation management unit **58** extracts, from the task execution history table **56**, all pieces of information of records in which any task ID among the task IDs extracted as described above is stored in the task ID field **56** C among the records of the task execution history table **56**.

[0202] Next, the operation management unit **58** calculates an average value of the execution times of the tasks and an average value of the execution costs of the tasks from the execution histories of the tasks extracted in step S**42** (S**43**). Specifically, the operation management unit **58** calculates an average value of the execution times of the tasks included in the execution histories of the tasks acquired in step S**42**. In addition, the operation management unit **58** calculates an average value of the execution costs of these tasks included in the execution history of the tasks acquired in step S**42**.

[0203] At this time, for the task in which the cost manual input value (the value stored in the cost manual input value field **56**F in FIG. **24**) is registered among the tasks for which the execution history is acquired in step S**42**, the operation management unit **58** uses the cost manual input value as the execution cost of the task, and for the task in which the cost manual input value is not registered, the operation management unit uses the cost automatic calculation value (the value stored in the cost automatic calculation value field **56**E in FIG. **24**) as the execution cost of the cost.

[0204] Thereafter, the operation management unit **58** determines whether the processing of steps S**41** to S**43** has been executed for all the tasks of the target workflow (S**44**). Then, if a negative result is obtained in this determination, the operation management unit **58** returns to step S**40**, and thereafter, repeats the processing of steps S**40** to S**44** while sequentially switching the task selected in step S**40** to an unprocessed task after step S**41**.

[0205] Then, when an affirmative result is obtained in step S**44** by eventually completing the calculation of the average values of the execution time and the execution cost of the task in the execution history for all the tasks of the target workflow, the operation management unit **58** calculates the predicted values of the execution time and the execution cost of the entire target workflow by adding up the average values of the execution time and the execution cost of each task of the target workflow calculated so far (S**45**). Thereafter, the operation management unit **58** ends the workflow time/cost prediction processing.

(3-5) Workflow Analysis Processing

[0206] FIG. **29** illustrates a flow of workflow analysis processing executed by the operation management unit **58** when the workflow creation support device **2** analyzes a new workflow created by using the workflow creation screen **20** and presents another recommended workflow to the administrator.

[0207] When the analysis button **28** (FIGS. **2** to **7**) is clicked after a new workflow is created on the workflow creation screen **20**, the operation management unit **58** starts the workflow analysis processing illustrated in FIG. **28**.

[0208] Then, the operation management unit **58** first executes the workflow time/cost prediction processing described above with respect to FIG. **28** with the new workflow as the target workflow, thereby calculating the predicted values of the execution time and the execution cost of the new workflow (S**50**).

[0209] Subsequently, by executing the task classification processing described above with respect to FIG. **25** for each of the tasks of the new workflow the operation management unit **58** classifies each of the tasks into any task classification (S**51**).

[0210] Next, the operation management unit **58** extracts, from the past case workflow, all past case workflows in which a ratio of tasks having the same task classification as the task classification of each task of the new workflow to the entire tasks of the past case workflow is equal to or larger than a predetermined first threshold, and a difference between the number of tasks (the number of steps) in the new workflow and the number of tasks (the number of steps) in the past case workflow is equal to or smaller than a preset second threshold (S**52**).

[0211] Next, the operation management unit **58** acquires, from the workflow execution history table **55**, the execution time and the execution cost of each past case workflow extracted in step S**52** (S**53**). At this time, in a case where the execution cost is stored in the corresponding total cost

manual input value field of the workflow execution history table **55**, the execution cost is acquired.

[0212] Then, on the basis of the execution time and the execution cost of each past case workflow acquired in step S**53**, the operation management unit **58** notifies the screen creation unit **57** of the top several past case workflows having the shortest execution time or the top several past case workflows having the lowest execution cost among these past case workflows (S**54**).

[0213] As a result, the workflow creation screen **20** in which the display is made in the recommendation area **20**B in the ascending order of the execution time or the execution cost is generated by the screen creation unit **57**, and the screen data is transmitted to the corresponding administrator device **3**, whereby the workflow creation screen **20** is displayed on the administrator device **3**.

[0214] Thereafter, the operation management unit **58** ends the workflow analysis processing.

(4) Flow of Various Types of Processing

[0215] Next, a flow of various types of processing executed in the entire workflow creation support system **1** in relation to the above-described workflow creation support function will be described.

(4-1) Creation/Registration of Workflow

[0216] FIG. **30** illustrates a flow of a series of processing executed in the workflow creation support system **1** until the administrator creates a new workflow by using the workflow creation screen **20** and registers the created new workflow in the workflow creation support device **2**.

[0217] When the administrator performs a predetermined operation for displaying the workflow creation screen **20** on the administrator device **3**, a workflow creation screen display request is transmitted from the administrator device **3** to the workflow creation support device **2** (S**60**).

[0218] Then, the screen creation unit **57** of the workflow creation support device **2** that has received the workflow creation screen display request transfers a workflow data acquisition request to the operation management unit **58** (S**61**). In addition, in a case where there is a new workflow being created, the operation management unit **58** that has received the workflow acquisition request transmits, as workflow data, workflow information up to that time of the new workflow to the screen creation unit **57**, and in a case where there is no new workflow being created, the operation management unit notifies the screen creation unit **57** of the fact (S**61**).

[0219] In a case where the workflow data is received, on the basis of the workflow data, the screen creation unit **57** generates a workflow creation screen **20** in which a new workflow being created is displayed in the workflow creation area **20**A, and transmits the screen data of the generated workflow creation screen **20** to the administrator device **3**. As a result, the workflow creation screen **20** is displayed on the administrator device **3**. In addition, in the case of receiving the notification that there is no new workflow being created, the screen creation unit **57** transmits the screen data of the workflow creation screen **20** in an initial state to the administrator device **3**. As a result, the workflow creation screen **20** in the initial state is displayed on the administrator device **3** (S**63**).

[0220] Thereafter, according to the operation **1** of the administrator, the screen transition of the workflow creation screen **20** described above with respect to FIGS. **2** to **7** is performed by the cooperative processing of the screen creation unit **57** and the operation management unit **58** of the workflow creation support device **2**. Then, when the administrator eventually completes the creation of the new workflow and clicks the registration button **31** (FIGS. **2** to **7**) on the workflow creation screen **20** (S**64**), a workflow registration request is transmitted from the administrator device **3** to the workflow creation support device **2** (S**65**).

[0221] Then, the screen creation unit **57** of the workflow creation support device **2** that has received the workflow registration request transfers the received workflow registration request to the operation management unit **58** (S**66**). In addition, the operation management unit **58** that has received the workflow registration request registers information regarding the new workflow in the workflow table **52** by executing the workflow registration processing described above with respect to FIG. **27**, and registers task information of each task of the new workflow in the task table **50** (FIG. **18**) (S**67**). As described above, this series of processing ends.

(4-2) Recommendation of Task

[0222] FIG. **31** illustrates a flow of a series of processing executed in the workflow creation support system **1** in a case where the administrator clicks any task setting field **21** (FIGS. **2** to **7**) displayed in the workflow creation area **20**A of the workflow creation screen **20** when creating a new workflow with the flow described above with respect to FIGS. **2** to **7** by using the workflow creation screen **20** displayed on the administrator device **3** in step S**63** of the series of processing described above with respect to FIG. **30**.

[0223] In the workflow creation support system **1**, tasks to be recommended to the administrator are selected in the following flow illustrated in FIG. **31**, and the icons **24** (FIGS. **3**, **4**, and **6**) indicating the labels of these tasks are displayed in the recommendation area **20**B of the workflow creation screen **20**.

[0224] In practice, when the administrator clicks the task setting field **21** of any step after the third step in the new workflow displayed in the workflow creation area **20**A of the workflow creation screen **20** (S**70**), a recommendation task display request for requesting display of a task to be recommended as a task of the step is transmitted from the administrator device **3** to the workflow creation support device **2** (S**71**).

[0225] The screen creation unit **57** of the workflow creation support device **2** that has received the recommendation task display request transmits, to the operation management unit **58**, a recommendation task selection request for requesting selection of a task to be recommended as the task of the step (hereinafter, in the description of FIG. **31**, this is referred to as a target step) in which the task setting field **21** is clicked at that time (S**72**).

[0226] The operation management unit **58** that has received the recommendation task selection request selects a task to be recommended by executing the task recommendation processing described above with respect to FIG. **26**, and transmits necessary information such as the title of each selected task and the above-described evaluation value S to the screen creation unit **57** (S**73**).

[0227] Then, the screen creation unit **57** that has received the information of the tasks generates the workflow creation screen **20** in which the icons **24** indicating the label of the tasks to be recommended selected by the operation management unit **58** are arranged in the recommendation area **20**B as described above with respect to FIG. **3**, and transmits the screen data to the administrator device **3** (S**74**). As a result, the workflow creation screen **30** is d displayed on the administrator device **3**. As described above, this series of processing ends.

(4-3) Analysis of Workflow

[0228] FIG. **32** illustrates a flow of a series of processing executed in the workflow creation support system **1** in a case where the administrator clicks the analysis button **28** (FIGS. **2** to **7**) of the workflow creation screen **20** after creating a new workflow with the flow described above with respect to FIGS. **2** to **7** by using the workflow creation screen **20** displayed on the administrator device **3** in step S**63** of the series of processing described above with respect to FIG. **30**. In the workflow creation support system **1**, analysis processing for the new workflow created at that time is executed in the following flow illustrated in FIG. **32**.

[0229] In practice, when the administrator clicks the analysis button **28** after creating a new workflow on the workflow creation screen **20** (S**80**), a workflow analysis request for requesting analysis of the new workflow is transmitted from the administrator device **3** to the workflow creation support device **2** (S**81**). In addition, the screen creation unit **57** of the workflow creation support device **2** that has received the workflow analysis request transfers the workflow analysis request to the operation management unit **58** (S**82**).

[0230] Then, the operation management unit **58** that has received the workflow analysis request executes the workflow analysis processing described above with respect to FIG. **29** (S**83**). As a result, the predicted values of the execution time and the execution cost of the new workflow are calculated, the recommended workflow is extracted from the past case workflow, and the calculated execution time and execution cost and the information regarding the extracted recommended workflow are transmitted as an analysis result to the screen creation unit **57**.

[0231] When the analysis result is given from the operation management unit **58**, the screen creation unit **57** generates the workflow creation screen **20** described above with respect to FIG. **7** in which the predicted values of the execution time and the execution cost of the new workflow are displayed in the workflow creation area **20**A and the recommended workflow **30** (FIG. **7**) is displayed in the recommendation area **20**B, and transmits the screen data to the administrator device **3** (S**84**). As a result, the workflow creation screen **20** is displayed on the administrator device **3**. As described above, this series of processing ends.

(4-4) Writing of New Workflow

[0232] FIG. **33** illustrates a flow of a series of processing executed in the workflow creation support system **1** until the administrator creates a new workflow by using the workflow creation screen **20** and writes the created new workflow. Note that, in FIG. **33**, the processing of steps S**90** to S**93** is similar to the processing of steps S**60** to S**63** in FIG. **30**, and thus description thereof is omitted here.

[0233] When the administrator clicks the write button **32** (FIGS. **2** to **7**) after creating a new workflow by using the workflow creation screen **20** (S**94**), a workflow write request for requesting writing of the new workflow created at that time is transmitted from the administrator device **3** to the workflow creation support device **2** (S**95**). In addition, the screen creation unit **57** of the workflow creation support device **2** that has received the workflow write request transfers the workflow write request to the operation management unit **58** (S**96**).

[0234] Then, the operation management unit **58** that has received the workflow write request delivers the workflow information of the new workflow to the procedure file management unit **60** (FIG. **1**) (S**97**). Thus, the procedure file management unit **60** to which the workflow information has been delivered converts the flowchart information into a file and stores the file data of the file in the auxiliary storage device **12** (FIG. **1**). As described above, this series of processing ends.

(4-5) Execution of Workflow

[0235] FIG. **34** illustrates a flow of a series of processing when the administrator causes a desired workflow to be executed in the desired operation target server **4**.

[0236] First, when the administrator designates a desired workflow and performs a predetermined operation for displaying a predetermined operation execution screen (not illustrated), an operation execution screen display request is transmitted from the administrator device **3** to the workflow creation support device **2** (S**100**). Note that the operation execution screen display request also includes the workflow ID of the workflow designated by the administrator at that time.

[0237] Then, the screen creation unit **57** of the workflow creation support device **2** that has received the workflow creation screen display request transmits, to the operation management unit **58**, a workflow data acquisition request for requesting acquisition of data of the workflow to be executed included in the operation execution screen request (S**101**).

[0238] In addition, the operation management unit **58** that has received the workflow acquisition request refers to the task list field **52**B (FIG. **20**) of the workflow table **52** (FIG. **20**) to acquire each task constituting the requested workflow and acquires the acquired task information of each task from the task table **50** (FIG. **18**), and transmits these pieces of information as workflow data to the screen creation unit **57** (S**102**). As a result, the workflow designated by the administrator is displayed on the administrator device **3**.

[0239] Thereafter, the administrator designates, on the operation execution screen, the operation target server **4** on which the workflow is to be executed, and instructs, on the operation execution screen, execution of the workflow on the operation target server **4**. Then, when this instruction is received by the administrator device **3** (S**104**), an operation execution request indicating that the workflow is to be executed by the target server is transmitted from the administrator device **3** to the workflow creation support device **2** (S**105**).

[0240] In addition, the screen creation unit **57** of the workflow creation support device **2** that has received the operation record request transfers the received operation execution request to the operation management unit **58** (S**106**), and the operation management unit **58** that has

received the operation execution request transfers the operation execution request to the execution management unit **59** (S**107**).

[0241] When receiving the operation execution request, on the basis of the operation execution request, the execution management unit **59** transmits the workflow information of the workflow and an operation execution command indicating that the workflow is to be executed, to the operation target server **4** designated on the operation execution screen by the administrator (S**108**).

[0242] Thus, the workflow is executed in the operation target server **4** that has received the operation execution command. Then, when the operation target server **4** ends executing the workflow, the operation target server **4** transmits the execution result to the workflow creation support device **2** (S**109**).

[0243] In addition, the execution management unit **59** of the workflow creation support device **2** that has received the execution result transfers the received execution result to the operation management unit **58** (S**110**). Thus, the operation management unit **58** that has received the execution result stores necessary information including the time and cost required to execute the workflow automatically calculated for the entire workflow and the time and cost required to execute the task automatically calculated for each task constituting the workflow in the workflow execution history table **55** (FIG. **23**) and the task execution history table **56** (FIG. **24**), respectively (S**111**). As described above, this series of processing ends.

(4-6) Operation Status Confirmation

[0244] FIG. **35** illustrates a flow of a series of processing when the execution status of the workflow performed or being performed in the operation target server **4** is displayed on the administrator device **3** in response to a request from the administrator. Note that as a premise of this processing, it is assumed that the operation target server **4** executing the workflow notifies the workflow creation support device **2** of the execution result every time one task of the workflow is completed, and the operation management unit **58** manages this notification.

[0245] In this case, first, when the administrator performs a predetermined operation on the administrator device **3**, an operation status confirmation request is given from the administrator device **3** to the screen creation unit **57** of the workflow creation support device **2** in response to the predetermined operation (S**120**). In addition, when receiving the operation status notification request, the screen creation unit **57** transmits the operation status notification request to the operation management unit **58** (S**121**).

[0246] When receiving the operation status confirmation request, the operation management unit **58** transmits, to the screen creation unit **57**, the execution result of each task given so far from the operation target server **4** with respect to the execution of the workflow to be targeted (S**122**). In addition, the screen creation unit **57** displays the execution result of each task given from the operation management unit **58** on the administrator device **3** (S**123**). As described above, this series of processing ends. (**4-7**) Manual registration of operation record

[0247] FIG. **36** illustrates a flow of a series of processing when the administrator manually registers the operation record of the workflow performed in the target server.

[0248] In this case, when the administrator designates the past case workflow to be targeted and then performs a predetermined operation on the administrator device **3** to display the operation record registration screen **40** described above with respect to FIG. **8**, an operation record registration screen display request indicating that the operation record registration screen **40** is to be displayed is transmitted from the administrator device **3** to the screen creation unit **57** of the workflow creation support device **2** (S**130**). Note that the operation record registration screen display request also includes the workflow ID of the workflow to be targeted designated by the administrator at that time and the workflow execution history ID of the workflow.

[0249] When receiving the operation record registration screen display request, the screen creation unit **57** transmits, to the operation management unit **58**, an operation history data acquisition request indicating that the operation history data of the workflow to be targeted designated in the operation record registration screen display request is to be transferred (S**131**).

[0250] When the operation history data acquisition request is given from the screen creation unit **57**, the operation management unit **58** transmits the operation history data of the workflow to be targeted to the screen creation unit **57** (S**132**). Specifically, the operation management unit **58** acquires a list (task list) of tasks constituting the workflow to be targeted from the task list field **52**B (FIG. **20**) of the corresponding record in the workflow table **52** (FIG. **20**), and acquires a label of each task included in the acquired task list from the task table **50** (FIG. **18**). In addition, the operation management unit **58** transmits the acquired task list and the level of each task as operation history data to the screen creation unit **57**.

[0251] The screen creation unit **57** that has received the operation history data generates the operation record registration screen **40** described above with respect to FIG. **8** on the basis of the received operation history data, and transmits the screen data to the administrator device **3** (S**133**). As a result, the operation record registration screen **40** is displayed on the administrator device **3**.

[0252] Thereafter, when the administrator manually inputs the execution time of the workflow, the name of a person in charge, a total cost, and the like and then clicks the registration button **47** (FIG. **8**) (S**134**), the administrator device **3** transmits, as operation record information, the various types of information input at this time to the workflow creation support device **2** together with a registration request (S**135**). In addition, the screen creation unit **57** of the workflow creation support device **2** that has received the operation record information and the registration request transfers the operation record information and the registration request to the operation management unit **58** (S**136**).

[0253] Thus, the operation management unit **58** that has received the operation record information and the registration request stores various types of information included in the operation record information in the total cost manual input value field **55**E (FIG. **23**) of the corresponding record of the workflow record history table **55** (FIG. **23**) and the total cost manual input value field **56**F (FIG. **24**) of the corresponding record of the task execution history table **56** (FIG. **24**) (S**137**). As described above, this series of processing ends.

(5) Effects of Present Embodiment

[0254] As described above, on the basis of the workflow information and the execution history of the past case workflow and the task information and the execution history of each task constituting the past case workflow, the workflow creation support device **2** of the present embodiment extracts a candidate of a step designated in the new workflow from the tasks of the past case, and recommends the extracted task as a task of the step.

[0255] Therefore, according to the present workflow creation support device **2**, it is possible to recommend an appropriate task that has already been defined to the administrator who is creating the workflow, and thus it is possible to reduce labor and time required for creating the workflow.

(6) Other Embodiments

[0256] Note that, in the above-described embodiment, a case has been described in which the workflow creation support device **2** is configured by one computer device, but the present invention is not limited thereto, and the workflow creation support device **2** may be configured by a plurality of computer devices constituting a distributed computing system.

[0257] In addition, in the above-described embodiment, a case has been described in which a task of a certain step is set by a predetermined operation on the workflow creation screen **20**, and the task setting field **21** of the next step is automatically displayed when the icon **22** indicating the label of the task is displayed in the task setting field **21**, but the present invention is not limited thereto, and a dedicated button for displaying the task setting field **21** may be provided, and the task setting field **21** of the next step may be displayed by clicking the button.

[0258] Furthermore, in the above-described embodiment, a case has been described in which the processing of steps S**15** to S**19** is executed after r steps S**10** to S**14** in the task recommendation processing described above with respect to FIG. **26**, but the present invention is not limited thereto, and the processing of steps S**10** to S**14** and steps S**15** to S**19** may be simultaneously performed in parallel.

INDUSTRIAL APPLICABILITY

[0259] The present invention can be widely applied to various workflow creation support devices that support creation of a workflow including a plurality of tasks.

REFERENCE SIGNS LIST

[0260] **1** workflow creation support system
[0261] **2** workflow creation support device
[0262] **3** administrator device
[0263] **4** operation target server
[0264] **10** CPU
[0265] **20** workflow creation screen
[0266] **21** task setting field
[0267] **22**, **24** icon
[0268] **26** first pop-up
[0269] **27** second pop-up
[0270] **28** analysis button
[0271] **29** third pop-up
[0272] **31**, **47** registration button
[0273] **32** write button
[0274] **40** operation record registration screen
[0275] **42** execution time text box
[0276] **43** cost text box
[0277] **44** person-in-charge text box
[0278] **45**A cost difference reason designation field **45**A
[0279] **46** fourth pop-up
[0280] **50** task table
[0281] **51** task classification table
[0282] **52** workflow table
[0283] **53** person-in-charge table
[0284] **54** cloud execution environment table
[0285] **55** workflow execution history table
[0286] **56** task execution history table
[0287] **57** screen creation unit
[0288] **58** operation management unit
[0289] **59** execution management unit
[0290] **60** procedure file management unit

1. A workflow creation support device that supports creation of a workflow including a plurality of tasks, the workflow creation support device comprising:

a management unit that manages definition contents of a workflow created in past; and

a candidate task recommendation unit that extracts and recommends a task candidate of a step to be targeted in the workflow being created, on a basis of definition contents of a predetermined number of steps of previous and/or subsequent tasks already defined in the workflow being created and definition contents of the existing workflow managed by the management unit.

2. The workflow creation support device according to claim **1**, wherein

the candidate task recommendation unit

classifies each of previous and/or subsequent tasks of each step already defined in the workflow being created into any of task classifications,

extracts the existing workflow in which tasks of a same task classification exist in a same order,

specifies a task classification of a task of a step to be targeted in each extracted existing workflow, and

recommends a task of a task classification having a higher appearance probability as a task candidate of a step to be targeted in the workflow being created, on a basis of an appearance probability of each specified task classification.

3. The workflow creation support device according to claim **2**, wherein

the task is defined by a plurality of types of parameters,

the parameters of the task are managed to be divided into

a first parameter group that is determined to be same in an exact match, a second parameter group in which similar ones are treated as same, and a third parameter group other than the parameters belonging to the first and second parameter groups, and

the candidate task recommendation unit

classifies a task into a task classification in which values of parameters belonging to the first parameter group are completely matched with each other and the parameters belonging to the second parameter group are similar to each other among existing task classifications.

4. The workflow creation support device according to claim **2**, wherein

the candidate task recommendation unit

extracts all tasks of a task classification having a higher appearance probability from each of the existing workflows, evaluates the extracted tasks on a basis of an

appearance frequency, an execution time, and an execution cost of the task, and recommends a predetermined number of top tasks having a large evaluation value as task candidates of a step to be targeted in the workflow being created.

5. The workflow creation support device according to claim **1**, wherein

a new workflow is able to be created by sequentially designating a task of each step of the workflow on a predetermined screen, and

the candidate task recommendation unit

recommends each task candidate by displaying, on the predetermined screen, an icon corresponding to each of the task candidates of a step to be targeted in the workflow being created.

6. A workflow creation support method executed by a workflow creation support device that supports creation of a workflow including a plurality of tasks, the workflow creation support method comprising:

a first processing step of managing definition contents of a workflow created in past; and

a second processing step of extracting and recommending a task candidate of a step to be targeted in the workflow being created, on a basis of definition contents of a predetermined number of steps of previous and/or subsequent tasks already defined in the workflow being created and definition contents of the existing workflow being managed.

7. The workflow creation supporting method according to claim **6**, wherein

in the second processing step, the workflow creation support device

classifies each of previous and/or subsequent tasks of each step already defined in the workflow being created into any of task classifications,

extracts the existing workflow in which tasks of a same task classification exist in a same order,

specifies a task classification of a task of a step to be targeted in each extracted existing workflow, and

recommends a task of a task classification having a higher appearance probability as a task candidate of a step to be targeted in the workflow being created, on a basis of an appearance probability of each specified task classification.

8. The workflow creation supporting method according to claim **7**, wherein

the task is defined by a plurality of types of parameters,

the parameters of the task are managed to be divided into a first parameter group that is determined to be same in an exact match, a second parameter group in which similar ones are treated as same, and a third parameter group other than the parameters belonging to the first and second parameter groups, and

in the second processing step, the workflow creation support device

classifies a task into a task classification in which values of parameters belonging to the first parameter group are completely matched with each other and the parameters belonging to the second parameter group are similar to each other among existing task classifications.

9. The workflow creation supporting method according to claim **7**, wherein

in the second processing step, the workflow creation support device

extracts all tasks of a task classification having a higher appearance probability from each of the existing workflows, evaluates the extracted tasks on a basis of an appearance frequency, an execution time, and an execution cost of the task, and recommends a predetermined number of top tasks having a large evaluation value as task candidates of a step to be targeted in the workflow being created.

10. The workflow creation supporting method according to claim **6**, wherein

a new workflow is able to be created by sequentially designating a task of each step of the workflow on a predetermined screen, and

in the second processing step, the workflow creation support device

recommends each task candidate by displaying, on the predetermined screen, an icon corresponding to each of the task candidates of a step to be targeted in the workflow being created.

* * * * *