

DESCRIPTION

TITLE OF THE INVENTION:

SUPERVISION DEVICE AND SUPERVISION PROGRAM

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Field

[0001] The present disclosure relates to a supervision device and a supervision program.

Background

10 [0002] In performance of tasks related to the ocean, computers included in a plurality of entities may are sometimes used.

[0003] The tasks related to the ocean include marine accident response, ship route search, and ship maintenance.

15 The plurality of entities include not only a ship but also a ship owner, a shipbuilding company, a ship engine manufacturing company, a shipper, a government office, and an insurance company.

[0004] There has been known, in distributed computing in
20 which a plurality of computers perform tasks, a technique for automatically specifying a computer that executes a task (see, for example, Patent Document 1).

[0005] There has been known a technique for organizing a plurality of vehicles including a communication function as
25 a group in which the vehicles are capable of communicating with one another (see, for example, Patent Document 2).

Citation List

Patent Literature

[0006] Patent Literature 1: JP 2016 -504696 W

30 Patent Literature 2: JP 2022 -116616 A

Summary

Technical Problem

[0007] However, the related art has a problem in that

tasks related to the ocean cannot be efficiently performed.

[0008] For example, the techniques described in Patent Literature 1 and Patent Literature 2 do not perform tasks related to the ocean.

5 [0009] In one aspect, an object is to provide a technique that can efficiently perform tasks related to the ocean.

Solution to Problem

[0010]

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Advantageous Effects of Invention

[0011] According to one aspect of the embodiment, it is possible to efficiently perform tasks related to the ocean.

Brief Description of Drawings

15 [0012] FIG. 1 is a diagram illustrating a configuration example of a network system according to an embodiment.

FIG. 2 is a diagram illustrating a configuration example of a node according to the embodiment.

20 FIG. 3 is a diagram illustrating a configuration example of a supervision node according to the embodiment.

FIG. 4 is a diagram illustrating a configuration example of an operation management function according to the embodiment.

25 FIG. 5 is a diagram illustrating an example of task information.

FIG. 6 is a diagram illustrating an example of node information.

FIG. 7 is a diagram for explaining a multiplexed structure.

30 FIG. 8 is a diagram for explaining a monitoring node.

FIG. 9 is a diagram for explaining processing of the network system.

FIG. 10 is a flowchart illustrating a flow of

processing for the supervision node according to the embodiment.

FIG. 11 is a flowchart illustrating a flow of processing for creating a group according to the
5 embodiment.

FIG. 12 is a diagram illustrating a configuration example of a network system.

FIG. 13 is a diagram illustrating a configuration example of a network system.

10 FIG. 14 is a diagram illustrating a configuration example of a network system.

FIG. 15 is a diagram illustrating a configuration example of a network system.

15 FIG. 16 is a diagram illustrating a configuration example of a network system.

FIG. 17 is a diagram illustrating a hardware configuration example of a supervision device according to the embodiment.

Description of Embodiments

20 [0013] A mode (hereinafter described as "embodiment") for carrying out a supervision device and a supervision program according to the present disclosure is explained in detail below with reference to the drawings. Note that the present disclosure is not limited by this embodiment.

25 [0014] One object of the present embodiment is to efficiently perform tasks related to the ocean. Therefore, in the present embodiment, a network (hereinafter, network system) including a computer as a node is constructed.

[0015] [Configuration of the embodiment]

30 The network system is explained with reference to FIG. 1. FIG. 1 is a diagram illustrating a configuration example of the network system according to the embodiment.

[0016] As illustrated in FIG. 1, a network system 1

includes a supervision node 20 and a plurality of nodes (a node 10a, a node 10b, a node 10c, and a node 10d). The supervision node 20 is an example of a supervision device.

[0017] Here, nodes that are not the supervision node are referred to as general nodes. In the following explanation, it is assumed that simple description of a node means both of the supervision node and the general node.

[0018] The nodes are computers. The nodes are owned by an organization such as a company or individuals. The nodes are, for example, servers installed on the cloud or in a local environment, desktop or laptop PCs, portable terminals such as smartphones, or computers provided in mobile bodies such as ships. The nodes may be ECUs (Engine Control Units) provided in ships.

[0019] The nodes included in the network system 1 can communicate data with one another. For example, the nodes of the network system 1 may perform data communication via the Internet or may directly perform data communication among the nodes. For example, the nodes perform communication via a mobile network (for example, LTE (Long Term Evolution) or 5G), local wireless communication (for example, Wi-Fi (registered trademark)), or satellite communication for ships.

[0020] The fact that the nodes included in the network system 1 can communicate data with one another not only means that the nodes are connected in a so-called physical layer but also means that connection in a layer higher than the physical layer (a data link layer or higher) can be established.

[0021] For example, the nodes included in the network system 1 store an address of a communication destination node, a password necessary for transmission and reception

of data, and the like and establish communication using the stored information.

[0022] Note that not all of the nodes included in the network system 1 need to be connected to one another. For example, a node may be indirectly connected to a communication destination node via another node.

[0023] The supervision node 20 is a node for supervising the general nodes. The supervision node 20 selects specific nodes out of a candidate node group and clusters (groups) the selected nodes. The supervision node 20 and the clustered general nodes constitute the network system 1.

[0024] Note that the nodes included in the candidate node group can function as the general nodes or can function as the supervision node.

[0025] In the example illustrated in FIG. 1, the candidate node group includes the node 10a, the node 10b, the node 10c, the node 10d, a node 10e, and a node 10f.

[0026] The supervision node 20 performs clustering to include the node 10a, the node 10b, the node 10c, and the node 10d in a cluster (the network system 1). On the other hand, the supervision node 20 does not include the node 10e and the node 10f in the cluster (the network system 1).

[0027] Here, the network system 1 is a system for performing tasks related to the ocean. The supervision node 20 selects, according to contents of the tasks, resources of the nodes, and the like, a node to be included in the network system 1.

[0028] A configuration of a node is explained with reference to FIG. 2 and FIG. 3. FIG. 2 is a diagram illustrating a configuration example of a node according to the embodiment. FIG. 3 is a diagram illustrating a configuration example of a supervision node according to

the embodiment.

[0029] A node 10 illustrated in FIG. 2 is equivalent to the general nodes, that is, the node 10a, the node 10b, the node 10c, the node 10d, the node 10e, and the node 10f illustrated in FIG. 1. However, a configuration of the general nodes may be a configuration equivalent to the configuration of the supervision node 20.

[0030] As illustrated in FIG. 2, the node 10 includes a functional unit 11 and a resource unit 12. The functional unit 11 implements functions of the node 10. The resource unit 12 is a computer resource (a computing machine resource) that can be used when the network system 1 performs a task.

[0031] For example, the functional unit 11 and the resource unit 12 are implemented by a computer including a CPU (Central Processing Unit), a GPU (Graphics Processing Unit), a ROM (Read Only Memory), a RAM (Random Access Memory), a flash memory, and an input/output port or by various circuits.

[0032] The functional unit 11 includes a resource management function 111, a communication function 112, a charging function 113, and a monitoring function 114. The functions of the functional unit 11 is implemented by the CPU executing a program.

[0033] The resource management function 111 manages resources included in the resource unit 12. For example, the resource management function 111 provides resources and limits contents and amounts of the resources to be provided.

[0034] Here, a resource unit 22 includes a hardware resource 121, a software resource 122, and a DB resource 123.

[0035] The hardware resource 121 corresponds to a

computation ability of a processor (for example, a CPU or a GPU). For example, the resource management function 111 provides the hardware resource 121, whereby the network system 1 can implement distributed computing. At this
5 time, the node 10 may function as one thread of the processor.

[0036] For example, the resource management function 111 receives a calculation formula and data necessary for computation of the calculation formula from another node.

10 Then, the resource management function 111 performs calculation according to the calculation formula using the hardware resource 121 and returns a calculation result to the other node.

[0037] The software resource 122 is a program created in
15 advance. The program provided as the software resource 122 may be different for each of the nodes. Note that the software resource 122 may be a program in a predetermined unit called module, procedure, function, or the like.

[0038] The resource management function 111 may provide
20 the program, which is the software resource 122, to the other node or may execute the program by using both of the hardware resource 121 and the software resource 122 and provide an execution result.

[0039] For example, a case is assumed in which the
25 software resource 122 includes an optimum route search program for calculating an optimum route from a current location to a destination with simulation.

[0040] At this time, the current location of the ship, the destination, route candidates between the current
30 location and the destination, other data necessary for executing the optimum route search program are given to the node 10. The resource management function 111 executes the optimum route search program based on the given data using

the hardware resource 121 and returns a route obtained as a result of the execution of the optimum route search program to the other node.

[0041] The software resource 122 may include a learned
5 machine learning model (an AI model). For example, a case is assumed in which the software resource 122 includes an image recognition model for recognizing an object reflected in an image.

[0042] At this time, the image is given to the node 10.
10 The resource management function 111 uses the hardware resource 121 to input the given image to the image recognition model and return a recognition result to the other node.

[0043] The DB resource 123 is information stored as
15 data. The data stored as the DB resource 123 may be different for each of the nodes.

[0044] For example, the DB resource 123 stores data as a table having keys and values. In that case, the resource management function 111 returns, based on a key designated
20 from the other node, a value obtained by searching through the table to the other node.

[0045] The communication function 112 communicates with other node. For example, the communication function 112 includes a communication interface such as a NIC (Network
25 Interface Controller) and a program for controlling the communication interface.

[0046] The charging function 113 is a function for charging a fee for providing a resource. For example, the charging function 113 calculates a fee according to content
30 and an amount of a resource provided to the other nodes by the resource management function 111. For example, the charging function 113 calculates a fee by multiplying the unit price for each resource by a time in which the

resource is provided or the number of times the resource is provided.

[0047] The charging function 113 can create data of a format of an invoice for billing a fee and transmit the data to a predetermined destination.

[0048] The monitoring function 114 performs negotiation with the other node. The monitoring function 114 requests the other node to provide a resource. The monitoring function 114 determines whether to accept the resource provision request received from the other node.

[0049] The monitoring function 114 can perform negotiation on a rule basis according to resources or the like of the nodes.

[0050] The monitoring function 114 may be implemented by a machine learning model (an AI model) rather than on the rule base. For example, the monitoring function 114 inputs a condition presented from the other node to the AI model. Then, the machine learning model outputs information indicating whether a resource may be provided based on the condition. The condition includes content, an amount, a time, a period, a fee, and the like of the resource to be provided. The machine learning model is updated (trained) as appropriate by adding, as teacher data, evaluation of a result in the case in which it is determined whether to provide the resource according to the input data (condition) and the output. Note that the result may be evaluated according to success or failure of a task and a degree of success (for example, in the task relates to business, a profit).

[0051] Next, a configuration of the supervision node 20 is explained with reference to FIG. 3. As illustrated in FIG. 3, the supervision node 20 includes a functional unit 21 and a resource unit 22.

[0052] The supervision node 20 has an operation management function 215 in addition to components equivalent to the components of the node 10. A resource management function 211, a communication function 212, a charging function 213, and a monitoring function 214 of the supervision node 20 are respectively functions equivalent to the resource management function 111, the communication function 112, the charging function 113, and the monitoring function 114 of the node 10.

10 [0053] The resource unit 22 (a hardware resource 221, a software resource 222, and a DB resource 223) of the supervision node 20 is a function equivalent to the resource unit 22 of the node 10.

[0054] The operation management function 215 is explained with reference to FIG. 4. FIG. 4 is a diagram illustrating a configuration example of an operation management function according to the embodiment.

[0055] As illustrated in FIG. 4, the operation management function 215 includes an information acquisition unit 2151, a group creation unit 2152, and a processing execution unit 2153. The operation management function 215 stores node information 2154 and task information 2155.

[0056] The information acquisition unit 2151 acquires information concerning a node including a resource for performing a preset task related to the ocean. The information acquisition unit 2151 acquires the information concerning the node from the node information 2154. The information acquisition unit 2151 acquires information concerning a task from the task information 2155.

30 [0057] FIG. 5 is a diagram illustrating an example of task information. As illustrated in FIG. 5, the task information 2155 is information in which a task and a software resource, a DB resource, and a hardware resource

are associated.

[0058] In the example illustrated in FIG. 5, "optimum route search", which is a software resource, "ship data", "operation schedule data", and "weather forecast data", which are DB resources, and a "CPU" and a "GPU", which are hardware resources, are associated with a task "cargo transportation".

[0059] FIG. 6 is a diagram illustrating an example of node information. As illustrated in FIG. 6, the node information 2154 is information in which nodes and software resources, DB resources, and hardware resources of the nodes are associated.

[0060] In the example illustrated in FIG. 6, "optimum route search", which is a software resource, "ship data", which is a DB resource, and a "GPU", which is a hardware resource are associated with a node "system 30a".

[0061] The group creation unit 2152 creates, according to the information concerning the nodes and the task acquired by the information acquisition unit 2151, a group including a plurality of nodes capable of communicating data with one another.

[0062] For example, a case is assumed in which a task to be performed is "cargo transportation". The task information 2155 indicates that "optimum route search", which is a software resource, "ship data", "operation schedule data", and "weather forecast data", which are DB resources, and a "CPU" and a "GPU", which are hardware resources, are necessary in order to perform the task "cargo transport".

[0063] Therefore, the group creation unit 2152 selects the "system 30a" including the software resource "optimum route search", the DB resource "ship data", and the hardware resource "GPU". The group creation unit 2152

selects a "system 30b" including the software resource "optimum route search", the DB resource "weather forecast data", and the hardware resource "CPU". The group creation unit 2152 selects a "system 30c" including the software resource "optimum route search", the DB resource "operation schedule data", and the hardware resource "GPU". On the other hand, since a "system 30d" does not have a resource necessary for the task "cargo transport", the group creation unit 2152 does not select the "system 30d".

10 [0064] The group creation unit 2152 groups the selected "system 30a", "system 30b", and "system 30c". Consequently, a network system including the "system 30a", the "system 30b", and the "system 30c" as nodes is constructed.

15 [0065] Further, the group creation unit 2152 sets a communication path among the nodes. For example, the group creation unit 2152 notifies, to the nodes included in the group, information necessary for communication of, for example, addresses of the nodes and causes the nodes to store the information.

20 [0066] The group creation unit 2152 may determine, based on the information concerning the nodes, a communication path for a plurality of nodes to communicate data with one another using a machine learning model (an AI model) that outputs a communication path for performing data communication. As explained above, if the machine learning model can be prepared in advance, it is possible to automatically determine and recommend the communication path. The machine learning model may be updated (trained) as appropriate based on the evaluation (for example, measurement values of communication speed and stability) of the determined communication path.

30 [0067] The group creation unit 2152 may connect the

nodes to a plurality of nodes to construct a mesh network.

[0068] Note that the group creation unit 2152 may create, based on the information concerning the nodes, a group using a machine learning model (an AI model) that
5 outputs a combination of nodes for executing processing. As explained above, if the machine learning model can be prepared in advance, the group can be efficiently created. The machine learning model may be updated (trained) as appropriate based on evaluation (for example, success or
10 failure of a final task) concerning the created group.

[0069] The processing execution unit 2153 causes the plurality of nodes grouped by the group creation unit 2152 to perform data communication with one another and causes the plurality of nodes to provide resources to thereby
15 execute processing corresponding to a task.

[0070] The processing execution unit 2153 distributes, according to a use status of the resources of each of the plurality of nodes, the nodes that provide the resources.

[0071] For example, both the "system 30a" and the
20 "system 30b" include a software resource "optimum route search". Therefore, the processing execution unit 2153 causes both of the "system 30a" and the "system 30b" to execute processing using the software resource "optimum route search" rather than causing only the "system 30a" to
25 execute the processing. Consequently, it is possible to prevent a load from being concentrated on one node.

[0072] Further, the processing execution unit 2153 may cause each of the plurality of nodes to store the same data and cause the plurality of nodes (the network system) to
30 function as a blockchain. Consequently, transparency and reliability of information can be ensured.

[0073] The processing execution unit 2153 calculates, in order to execute processing, a fee charged for a resource

provided by each of the plurality of nodes. In this case, the processing execution unit 2153 charges or collects the fee based on the fee calculated by the charging function 113 of the nodes.

5 [0074] Note that, when there is a customer who requested execution of a task, billing and collection of the fee are performed on the customer. The processing execution unit 2153 may transmit data of a format of an invoice to a client or may automatically withdraw the fee in cooperation
10 with a financial system.

[0075] Here, as illustrated in FIG. 7, the network system may be multiplexed. FIG. 7 is a diagram illustrating a multiplexed structure. Nodes added with "N" are general nodes. Nodes added with "L" are supervision
15 nodes.

[0076] In an example illustrated in FIG. 7, network systems including, as nodes, network systems supervised by the supervision nodes are further constructed. As described above, the supervision nodes and the network
20 systems may be multiplexed. The nodes may redundantly belong to a plurality of network systems.

[0077] A set of a plurality of nodes having the same value can be regarded as a network system. In this case, any node included in the set can behave as a supervision
25 node.

[0078] For example, the plurality of nodes having the same value are nodes owned by the same entity (company or individual). For example, a plurality of nodes having the same value are nodes owned by an entity (company or
30 individual), which is a stakes holder for one task.

[0079] As in the example illustrated in FIG. 7, a network system including, as a node, a set of a plurality of nodes having the same value may be constructed.

[0080] As illustrated in FIG. 8, parts supervision nodes and general nodes can behave as monitoring nodes. FIG. 8 is a diagram for explaining the monitoring nodes. Nodes added with "R" are monitoring nodes.

5 [0081] The monitoring nodes execute negotiation among the nodes by the monitoring function 114 explained above. The monitoring nodes recommend the communication path determined by the group creation unit 2152 to the nodes.

[0082] A flow of the processing explained above is
10 illustrated in FIG. 9. FIG. 9 is a diagram for explaining processing of the network system.

[0083] As illustrated in FIG. 9, it is assumed that the system 30a, the system 30b, the system 30c, and the system 30d are present as node candidates. The systems of the
15 node candidates are computers such as servers, terminals, or ECUs.

[0084] A terminal 50 is operated by a user U. The user U requests the supervision node 20 to perform a task via the terminal 50 and further receives a task performance
20 result from the supervision node 20.

[0085] First, the supervision node 20 acquires information concerning nodes (step S1). At this time, the supervision node 20 acquires information with reference to the node information 2154 and the task information 2155.

25 [0086] The supervision node 20 adopts (selects) the system 30a and the system 30b with the operation management function 215 (step S2). On the other hand, the supervision node 20 does not adopt the system 30d (step S3). As explained above, the operation management function 215
30 selects, based on the node information 2154 and the task information 2155, nodes having resources necessary for processing.

[0087] Here, the system 30c is selected by negotiation

(inter-node negotiation) by the monitoring function 114 of the system 30b (step S4).

[0088] Here, the supervision node 20 creates a group including the adopted nodes (step S5). Then, the
5 supervision node 20 executes processing corresponding to the task with the created group (step S6).

[0089] [Flow of processing in the embodiment]

A flow of processing of the supervision node 20 is explained with reference to FIG. 10. FIG. 10 is a
10 flowchart illustrating a flow of processing of the supervision node according to the embodiment.

[0090] As illustrated in FIG. 10, first, the supervision node 20 receives input of a task (step S11). For example, the task is input via the terminal 50.

15 [0091] Subsequently, the supervision node 20 acquires information concerning a task and nodes (step S12). Then, the supervision node 20 creates a group of the nodes based on the acquired information (step S13).

[0092] Subsequently, the supervision node 20 determines
20 a communication path among the nodes included in the group (step S14). Then, the supervision node 20 executes processing using resources of the nodes included in the group (step S15).

[0093] The processing for creating a group (step S13 in
25 FIG. 10) is explained with reference to FIG. 11. FIG. 11 is a flowchart illustrating a flow of the processing for creating a group according to the embodiment.

[0094] As illustrated in FIG. 11, the supervision node 20 sets i representing a number for identifying a candidate
30 node to 1 (step S131).

[0095] Subsequently, the supervision node 20 determines whether an i -th node matches the task (step S132). When the i -th node has a resource necessary for the task, the

supervision node 20 determines that the node matches the task. On the other hand, when the i-th node does not have a resource necessary for the task, the supervision node 20 determines that the node does not match to the task.

5 [0096] When the i-th node matches the task (step S132, Yes), the supervision node 20 adopts the i-th node (step S133) and proceeds to step S134. On the other hand, when the i-th node does not match the task (step S132, No), the supervision node 20 proceeds to step S134 without adopting
10 the i-th node.

[0097] The supervision node 20 determines whether the task can be executed in the adopted node (step S134). For example, when content and an amount of a resource necessary for the task are entirely supplemented by content and an
15 amount of the resource of the adopted node, the supervision node 20 determines that the task can be executed in the adopted node.

[0098] When determining that the task can be executed in the adopted node (step S134, Yes), the supervision node 20
20 adds the adopted node to the group (step S136) and ends the processing.

[0099] On the other hand, when determining that the task cannot be executed in the adopted node (step S134, No), the supervision node 20 increments i by 1 (step S135) and
25 returns to step S132.

[0100] [Effects of the embodiment]

As explained above, the information acquisition unit
2151 acquires information concerning a node having a resource for executing a preset task related to the ocean.
30 The group creation unit 2152 creates, according to the information concerning the nodes and the task acquired by the information acquisition unit 2151, a group including a plurality of nodes capable of communicating data with one

another. The processing execution unit 2153 causes the plurality of nodes to perform data communication with one another and causes the plurality of nodes to provide resources to thereby execute processing corresponding to the task.

[0101] As explained above, in the present embodiment, it is possible to create, according to a task, a group of nodes having resources. Therefore, according to the present embodiment, even for a task related to the ocean such as marine accident response, ship maintenance, or cargo transport, it is possible to efficiently perform the task by creating a group corresponding to the task.

[0102] Examples in which the embodiment explained above is adapted to specific cases are explained. For example, a network system in an example executes processing for supporting operation of a ship. For example, a network system in an example executes processing concerning equipment of a port at which a ship calls.

[0103] [Example 1: tsunami alert service]

An example in the case in which a task is a "tsunami alert service" is explained with reference to FIG. 12. FIG. 12 is a diagram illustrating a configuration example of a network system.

[0104] When occurrence of tsunami is detected by a ship, the task "tsunami alert service" notifies information concerning the tsunami to a research institution and the like.

[0105] As illustrated in FIG. 12, a ship 62 includes a recording device 62a and a ship ECU 62b. In the example 1, the ship ECU 62b functions as a supervision node.

[0106] When detecting tsunami while the ship 62 is in operation in a route in the Pacific Ocean, the ship ECU 62b creates a network system 1A including a cloud server 61,

another ship 62, and a research institution server 64 as nodes.

[0107] The ship ECU 62b starts processing for performing the task "tsunami alert service" using the resources of the
5 network system 1A.

[0108] First, the ship ECU 62b inquires the cloud server 61 about data according to a ship position of the ship 62 and obtains information concerning countries facing the Pacific Ocean (countries affected by the tsunami). Then,
10 the ship ECU 62b selects, based on information obtained from the research institution server 64 capable of carrying out an analysis of the tsunami, countries, research institutions, and the like to which information concerning the tsunami is transmitted. The ship ECU 62b may aggregate
15 information from a plurality of ships and then inquire the cloud server 61 about data.

[0109] Note that a plurality of ships 62 are present. A ship ECU mounted on each of the ships 62 creates a group including servers and the like of research institutions
20 belonging to countries facing a route of the ship 62. Consequently, a group in which groups are further multiplexed is created.

[0110] The ship ECU 62b causes the cloud server 61 to transmit data necessary for using an online support video
25 conference system, a detailed data collection service, and the like to the selected countries and research institutions and further to other ships and the like.

[0111] The ship ECU 62b can perform only simple processing such as threshold determination of a sensor
30 value only with resources of the ship ECU 62b. On the other hand, the ship ECU 62b can extend functions by using resources of the cloud server 61 and perform an analysis using a machine learning model.

[0112] When the ship ECU 62b performs the task "tsunami alert service", the countries and the research institutions can obtain detailed data of the tsunami and can take measures such as simulation of damage and transmission of tsunami alerts to target areas.

[0113] The ship ECU 62b can select an optimum communication line out of a plurality of communication lines including a ship-to-land communication line according to the ship position and the like of the ship 62 and set the selected communication line as a communication path.

[0114] The ship ECU 62b may provide not only the resources of the cloud server 61 but also the resources of the ship ECU 62b. The ship ECU 62b may focus on providing speed and provide only the resources of the ship ECU 62b itself without providing the resources of the cloud server 61.

[0115] The ship ECU 62b stops the provision of the resources after the task "tsunami alert service" is completed. For example, when the countries and the research institutions have finished collecting the detailed data, the ship ECU 62b disables various tools provided to the countries and the research institutions.

[0116] Then, the ship ECU 62b calculates fees charged on the countries, the research institutions, and the other ships that received the provision of the resources. The ship ECU 62b can charge for the use the resources only when the resources are used the number of times exceeding a default number of times of use.

[0117] A history of information and measures obtained by the ship ECU 62b performing the task "tsunami alert service" may be stored together with damage information by another network system configured by nodes related to the research institutions. Consequently, it is possible to

improve accuracy of simulation of damage caused by tsunami in the future.

[0118] With the task "tsunami alert service", early detection of tsunami and simulation of damage can be performed. It is possible to minimize damage.

[0119] The ship ECU 62b may negotiate with the other network system configured by the nodes related to the research institutions and determine whether to provide information, to which research institutions the information is to be provided, and a range of the information to be provided. The negotiation may be performed based on output of a machine learning model (an AI model).

[0120] For example, the ship ECU 62b may set an evaluation value and a threshold for each piece of information to be provided and provide only information for which the evaluation value exceeds the threshold. The threshold and a range of the information to be provided may be determined by negotiation.

[0121] A function of the ship ECU 62b automatically providing information may be disabled. In this case, the information is manually provided by a human.

[0122] The network system 1A can cause the nodes to store information to be provided to the other network system configured by the nodes related to the research institutions and can cause the nodes to function as a blockchain. Consequently, it is possible to ensure transparency and reliability of the information to be provided.

[0123] [Example 2: watching assistance service for a main engine]

An example in the case in which a task is a "watching assistance service for a main engine" is explained with reference to FIG. 13. FIG. 13 is a diagram illustrating a

configuration example of a network system.

[0124] The task "watching assistance service for a main engine" is to take measures when an abnormality occurs in a main engine of a ship.

5 [0125] As illustrated in FIG. 13, the ship 62 includes the recording device 62a and the ship ECU 62b. In the example 2, the ship ECU 62b functions as a supervision node.

[0126] When an abnormality occurs in the main engine of
10 the ship 62, the ship ECU 62b creates a network system 1B including the cloud server 61, an engine manufacturer server 63a, an engine manufacturer server 63b, and an engine manufacturer server 63c as nodes.

[0127] The engine manufacturer server 63a, the engine
15 manufacturer server 63b, and the engine manufacturer server 63c are servers of a plurality of different manufacturers (or licensors) that provide main engines of the same type as the type of the main engine mounted on the ship 62.

[0128] The ship ECU 62b starts processing for performing
20 the task "watching assistance service for a main engine" using the resources of the network system 1B.

[0129] First, the ship ECU 62b inquires the cloud server 61 about data according to a type of a main engine in which an abnormality has occurred and obtains a manufacturer, a
25 ship owner, a ship nationality, registered ship class information, and the like. The ship ECU 62b selects, based on the acquired information and incidental information such as a port at which the ship ECU 62b calls next time, an engine manufacturer server capable of taking measures. The
30 ship ECU 62b may aggregate information from a plurality of ships and then inquire the cloud server 61 about data.

[0130] Note that a plurality of ships 62 are present. The ship ECU mounted on each of the ships 62 creates a

group based on a type of a main engine, a manufacturer, a ship owner of the ship, a ship nationality, registered ship class information, and the like. Consequently, a group in which groups are further multiplexed is created.

5 [0131] The ship ECU 62b causes the cloud server 61 to transmit data necessary for using an online support video conference system, an abnormality correction (revision) tool, and the like to the ship 62 and the selected engine manufacturer server.

10 [0132] The ship ECU 62b can perform only simple processing such as threshold determination of a sensor value only with resources of the ship ECU 62b. On the other hand, the ship ECU 62b can extend functions by using resources of the cloud server 61 and perform an analysis
15 using a machine learning model.

[0133] When the ship ECU 62b performs the task "watching assistance service for a main engine", the engine manufacturer can easily take measures against the abnormality of the main engine. Further, it is possible to
20 reduce troubles (delays of an operation schedule) of the main engine that stop the ship 62.

[0134] The ship ECU 62b can select an optimum communication line out of a plurality of communication lines including a ship-to-land communication line according
25 to the ship position and the like of the ship 62 and set the selected communication line as a communication path.

[0135] The ship ECU 62b may provide not only the resources of the cloud server 61 but also the resources of the ship ECU 62b. The ship ECU 62b may focus on providing
30 speed and provide only the resources of the ship ECU 62b itself without providing the resources of the cloud server 61.

[0136] The ship ECU 62b stops the provision of the

resources after the task "watching assistance service for a main engine" is completed. For example, when the execution of the abnormality correction (revision) tool ends, the ship ECU 62b disables the tool.

5 [0137] The ship ECU 62b calculates a fee charged on the ship or the engine manufacturer which received the provision of the resources. The ship ECU 62b can charge for the use the resources only when the resources are used the number of times exceeding a default number of times of
10 use.

[0138] A history of information and measures obtained by the ship ECU 62b performing the task "watching assistance service for a main engine" may be stored by another network system configured by nodes related to a ship association.
15 Consequently, the stored information is used as a failure history of the ship in the ship association, and a ship owner is sometimes exempt from reporting to the ship association, on-the-spot inspection, and the like.

[0139] The ship ECU 62b may negotiate with the other
20 network system configured by the nodes related to the marine associations and determine whether to provide information, to which marine association the information is to be provided, and a range of the information to be provided. The negotiation may be performed based on output
25 of a machine learning model (an AI model).

[0140] For example, the ship ECU 62b may set an evaluation value and a threshold for each piece of information to be provided and provide only information for which the evaluation value exceeds the threshold. The
30 threshold and a range of the information to be provided may be determined by negotiation.

[0141] A function of the ship ECU 62b automatically providing information may be disabled. In this case, the

information is manually provided by a human.

[0142] The network system 1A can cause the nodes to store information to be provided to another network system including nodes related to a ship association and can cause the nodes to function as a blockchain. Consequently, it is possible to ensure transparency and reliability of the information to be provided.

[0143] [Example 3: port maintenance and watching service]

10 An example in the case in which a task is a "port maintenance and watching service" is explained with reference to FIG. 14. FIG. 14 is a diagram illustrating a configuration example of a network system.

[0144] The task "port maintenance and watching service" is to take measures when an abnormality occurs in a port facility.

[0145] As illustrated in FIG. 14, the ship 62 includes the recording device 62a and the ship ECU 62b. In the example 3, the ship ECU 62b functions as a supervision node.

[0146] When an abnormality occurs in a port facility in a port at which the ship ECU 62b is calling, the ship ECU 62b creates a network system 1C including the cloud server 61 and a port facility server 65 as nodes. The port facility includes cargo handling equipment such as a crane, a chassis, and a forklift, lighting, power receiving and transforming equipment, fuel supply equipment, and the like. The supervision node may be a computer provided in the port facility.

30 [0147] The ship ECU 62b starts processing for performing the task "port maintenance and watching service" using the resources of the network system 1C.

[0148] First, the ship ECU 62b inquires the cloud server

61 about data according to a type of the port facility in which the abnormality has occurred and obtains information concerning a manufacturer, a type, port administrators (including a local government), port operators (for
5 example, port borrowers from the port administrators or terminal operators), maintenance companies, consignors, and the like of the port facility. The ship ECU 62b selects, based on the acquired information and incidental
10 information such as a staying time of the ship 62 and weather information, the compatible port facility server 65 capable of taking measures. The ship ECU 62b may aggregate information from a plurality of ships and then inquire the cloud server 61 about data.

[0149] Note that groups may be multiply created by a
15 manufacturer, a type, port administrators, port operators, port users (for example, facility borrowers from the port operators), maintenance companies, consignors, and the like of the port facility.

[0150] The ship ECU 62b causes the cloud server 61 to
20 transmit data necessary for using an online support video conference system, an abnormality correction (revision) tool, and the like to the ship 62 and the selected port facility server 65.

[0151] The ship ECU 62b can perform only simple
25 processing such as threshold determination of a sensor value only with resources of the ship ECU 62b. On the other hand, the ship ECU 62b can extend functions by using resources of the cloud server 61 and perform an analysis using a machine learning model.

30 [0152] When the ship ECU 62b executes the task "port maintenance and watching service", the port facility manufacturer can easily take measures against the abnormality of the port facility. Further, it is possible

to reduce troubles that stop the port facility.

[0153] The ship ECU 62b can select, based on the location or the like of the port facility server 65, an optimum communication line out of a plurality of communication lines including communication lines contracted by the port administrators or the port operators and set the selected communication line as a communication path.

[0154] The ship ECU 62b may provide not only the resources of the cloud server 61 but also the resources of the ship ECU 62b. The ship ECU 62b may focus on providing speed and provide only the resources of the ship ECU 62b itself without providing the resources of the cloud server 61.

[0155] The ship ECU 62b stops the provision of the resources after the task "port maintenance and watching service" is completed. For example, when the execution of the abnormality correction (revision) tool ends, the ship ECU 62b disables the tool.

[0156] The ship ECU 62b calculates fees charged on a port facility manufacturer (an owner of the port facility server 65), the port administrators, and the port operators who received the provision of the resources. The ship ECU 62b can charge for the use the resources only when the resources are used the number of times exceeding a default number of times of use.

[0157] A history of information and measures obtained by the ship ECU 62b executing the task "port maintenance and watching service" may be stored by another network system configured by nodes related to the port administrators. Consequently, the stored information is used as a failure history of the port facility by the port administrators, and the port administrators and the port users are

sometimes exempt from reporting to the port administrators, on-the-spot inspection, and the like.

[0158] The ship ECU 62b may negotiate with the other network system configured by the nodes related to the port administrators to determine whether to provide information, to which port administrator the information is to be provided, and a range of information to be provided. The negotiation may be performed based on output of a machine learning model (an AI model).

[0159] For example, the ship ECU 62b may set an evaluation value and a threshold for each piece of information to be provided and provide only information for which the evaluation value exceeds the threshold. The threshold and a range of the information to be provided may be determined by negotiation.

[0160] A function of the ship ECU 62b automatically providing information may be disabled. In this case, the information is manually provided by a human.

[0161] The network system 1A can cause the nodes to store information to be provided to the other network system configured by the nodes related to the port administrators and can cause the nodes to function as a blockchain. Consequently, it is possible to ensure transparency and reliability of the information to be provided.

[0162] [Example 4: ship-port cooperation service]

An example in the case in which a task is a "ship-port cooperation service" is explained with reference to FIG. 15. FIG. 15 is a diagram illustrating a configuration example of a network system.

[0163] The task "ship-port cooperation service" is to perform maintenance of a ship visiting to a port.

[0164] As illustrated in FIG. 15, the ship 62 includes

the recording device 62a and the ship ECU 62b. In the example 1, the ship ECU 62b functions as a supervision node.

[0165] When the ship ECU 62b detects a decrease in fuel economy while the ship 62 is in operation in a route in the Pacific Ocean (for example, when fuel economy per unit time falls below a threshold), the ship ECU 62b creates a network system 1D including the cloud server 61 and a maintenance server 66 as nodes.

10 [0166] The ship ECU 62b starts processing for performing the task "ship-port cooperation service" using the resources of the network system 1D.

[0167] First, the ship ECU 62b inquires the cloud server 61 about data according to a ship position of the ship 62 and obtains information concerning ports of port call candidates on the operation route and information such as scheduled port call times. The ship ECU 62b selects a request destination of maintenance of a hull (inspection, cleaning (of an entire ship or around a propeller), and repairing) and a port call destination from the acquired information, a hull contamination analysis result for fuel economy decrease, and incidental information such as hull cleaning companies, repair companies, and port operators (companies or institutions).

20 [0168] Note that a plurality of ships 62 are present. A ship ECU mounted on each of the ships 62 creates a group including ports close to a route of the ship 62, maintenance request destinations, and the like. Consequently, a group in which groups are further multiplexed is created.

30 [0169] The ship ECU 62b causes the cloud server 61 to transmit data necessary for using an online support video conference system, a maintenance (inspection, cleaning, and

repairing) service, and the like to the maintenance server 66 of the selected maintenance request destination. The maintenance server 66 is a server for implementing a port management system, a port equipment remote monitoring system, and the like.

[0170] The ship ECU 62b selects a scheduled port call time of a port call destination, an estimated staying time assumed from a port operation status, and a service that can be provided by the selected request destination. At that time, the ship ECU 62b performs simulation using the resources of the cloud server 61 such that an operation rate of a port does not decrease because of a sudden stay of the ship and then adjusts a cargo handling structure and the like of the port according to necessity.

[0171] The ship ECU 62b can perform only simple processing such as threshold determination of a sensor value only with resources of the ship ECU 62b. On the other hand, the ship ECU 62b can extend functions by using resources of the cloud server 61 and perform an analysis using a machine learning model.

[0172] When the ship ECU 62b performs the task "ship-port cooperation service", a decrease in fuel economy of the ship 62 can be found at an early stage.

[0173] The ship ECU 62b can select an optimum communication line out of a plurality of communication lines including a ship-to-land communication line according to the ship position and the like of the ship 62 and set the selected communication line as a communication path.

[0174] The ship ECU 62b may provide not only the resources of the cloud server 61 but also the resources of the ship ECU 62b. The ship ECU 62b may focus on providing speed and provide only the resources of the ship ECU 62b itself without providing the resources of the cloud server

61.

[0175] The ship ECU 62b stops the provision of the resources after the task "ship-port cooperation service" is completed. For example, when the request for the maintenance such as the cleaning is completed, the ship ECU 62b disables the provided various tools.

[0176] The ship ECU 62b calculates fees charged on the maintenance request destination (the owner of the maintenance server 66) who received the provision of the resources. The ship ECU 62b can charge for the use the resources only when the resources are used the number of times exceeding a default number of times of use.

[0177] In addition, a history of information and measures obtained by the ship ECU 62b executing the task "ship-port cooperation service" may be stored in the maintenance server 66 together with information concerning a port of call. The stored information is used for maintenance simulation, fuel economy improvement, optimum route simulation, and the like.

[0178] [Other Examples]

Besides, a supervision node can create a network system illustrated in FIG. 16. FIG. 16 is a diagram illustrating a configuration example of the network system.

[0179] As illustrated in FIG. 16, a network system 1E includes the cloud server 61, the ship 62 (including the recording device 62a and the ship ECU 62b), a consignor terminal 71, an operator terminal 72, a broker terminal 73, a ship owner terminal 74, an insurance company server 75, a shipyard server 76, an engine manufacturer server 77, and a marine system server 78. Any of the devices included in the network system 1E functions as a supervision node and the other devices function as general nodes.

[0180] The cloud server 61 can provide, as resources,

data for executing the tools and the services explained in the examples.

[0181] The consignor terminal 71 is a terminal used by a consignor of the ship 62. The operator terminal 72 is a terminal used by an operator. The operator terminal 72 provides support concerning port operation cooperation, cargo handling support, and marine transportation to the consignor terminal 71. The operator terminal 72 receives fuel economy improvement support from the cloud server 61.

[0182] The broker terminal 73 is a terminal used by a broker. The ship owner terminal 74 is a terminal used by a ship owner of the ship 62. The broker terminal 73 exchanges information concerning trade of used ships with the ship owner terminal 74. The ship owner terminal 74 receives support for reduction of labor costs from the cloud server 61 and receives information concerning new ship building from the shipyard server 76.

[0183] The insurance company server 75 is a server used by an insurance company. The insurance company server 75 provides information concerning insurance and a result of monitoring and analysis of the ship 62 by AI to the ship owner terminal 74. The insurance company server 75 supports accident prevention for the ship owner terminal 74.

[0184] The insurance company server 75 receives steering skill, failure, and accident information concerning the ship 62 from the cloud server 61.

[0185] The engine manufacturer server 77 provides, for example, operation data of an engine to the marine system server 78.

[0186] The marine system server 78 is a server used in a marine system. The marine system server 78 provides operation data to the cloud server 61. The marine system

includes a system that manages cargo handling of the ship 62 and a system that monitors containers of the ship 62.

[0187] The recording device 62a records data concerning the ship 62. Data concerning operation, video, cargo, ecology, and the like is input online to the recording device 62a. Logs acquired by the ship 62 and manual input data concerning maintenance are input offline to the recording device 62a. The ship ECU 62b transmits various data including the data recorded in the recording device 62a to the cloud server 61.

[0188] The embodiment in the case in which the resources are computer resources (computing machine resources) is explained. On the other hand, the resources provided by the nodes are not limited to the computer resources.

[0189] For example, a main engine lent from an engine manufacturer to a ship may be a resource. The supervision node 20 calculates a fee charged on the main engine, which is the resource, based on a navigation distance of a ship mounted with the main engine lent by the engine manufacturer. For example, the supervision node 20 calculates a fee by multiplying a predetermined amount of money per unit distance by the navigation distance of the ship. The supervision node 20 may calculate a fee based on a navigation time instead of the navigation distance.

[0190] For example, the fee calculated by the supervision node 20 is charged to a ship owner of the ship from the engine manufacturer.

[0191] FIG. 17 is a diagram illustrating a hardware configuration example of the supervision device according to the embodiment. Note that a device functioning as a general node may also have the same configuration as the configuration of the supervision device.

[0192] As illustrated in FIG. 17, the supervision node

20 (the supervision device) includes a computer including a processor 2010, a memory 2020, an input/output IF 2030, and a bus 2040. The processor 2010, the memory 2020, and the input/output IF 2030 are capable of mutually transmitting and receiving information via the bus 2040.

[0193] The processor 2010 executes the functions by reading and executing a supervision program stored in the memory 2020. The processor 2010 is, for example, an example of a processing circuit and includes one or more of a CPU, a DSP (Digital Signal Processor), and a LSI (Large Scale Integration).

[0194] The memory 2020 includes one or more of a RAM, a ROM, a flash memory, an EPROM (Erasable Programmable Read Only Memory), and an EEPROM (registered trademark) (Electrically Erasable Programmable Read Only Memory). The input/output IF 2030 includes an AD converter, a DA converter, and an input/output port.

[0195] Note that the supervision node 20 may include a data reading unit that reads the supervision program from a computer-readable recording medium in which the supervision program is recorded. The processor 2010 can control the data reading unit to acquire the supervision program recorded in the recording medium from the data reading unit and cause the memory 2020 to store the acquired supervision program. The recording medium includes, for example, one or more of a nonvolatile or volatile semiconductor memory, a magnetic disk, a flexible memory, an optical disk, a compact disc, and a DVD (Digital Versatile Disc).

[0196] The supervision node 20 may include a communication unit that receives the supervision program from a server via a network. In this case, the processor 2010 can acquire the supervision program from the server via the communication unit and cause the memory 2020 to

store the acquired supervision program.

[0197] The supervision node 20 may include an integrated circuit such as an ASIC (Application Specific Integrated Circuit) and an FPGA (Field Programmable Gate Array).

5 [0198] It should be conceived that the embodiment disclosed herein are illustrative in all respects and are not restrictive. Indeed, the embodiment explained above can be materialized in various forms. The embodiment explained above may be omitted, substituted, or changed in
10 various forms without departing from the scope and the gist of the appended claims.

Reference Signs List

[0199] 1, 1A, 1B, 1C, 1D, 1E NETWORK SYSTEM
10, 10a, 10b, 10c, 10d, 10e, 10f NODE
15 20 SUPERVISION NODE
11, 21 FUNCTIONAL UNIT
12, 22 RESOURCE UNIT
111, 211 RESOURCE MANAGEMENT FUNCTION
112, 212 COMMUNICATION FUNCTION
20 113, 213 CHARGING FUNCTION
114, 214 MONITORING FUNCTION
121, 221 HARDWARE RESOURCE
122, 222 SOFTWARE RESOURCE
123, 223 DB RESOURCE
25 215 OPERATION MANAGEMENT FUNCTION
2151 INFORMATION ACQUISITION UNIT
2152 GROUP CREATION UNIT
2153 PROCESSING EXECUTION UNIT
2154 NODE INFORMATION
30 2155 TASK INFORMATION

CLAIMS

Claim 1. A supervision device comprising:

an information acquisition unit that acquires
information concerning a node having a resource for
5 performing a preset task related to an ocean;

a group creation unit that creates a group including a
plurality of nodes capable of communicating data with one
another according to the information concerning the node
and the task acquired by the information acquisition unit;
10 and

a processing execution unit that causes the plurality
of nodes to perform data communication with one another and
causes the plurality of nodes to provide the resource to
thereby execute processing corresponding to the task.

15

Claim 2. The supervision device according to claim 1,
wherein the processing execution unit distributes,
according to a use status of the resource of each of the
plurality of nodes, the nodes that provide the resource.

20

Claim 3. The supervision device according to claim 1,
wherein the group creation unit creates, based on the
information concerning the node, the group using a machine
learning model that outputs a combination of the nodes for
25 executing the processing.

Claim4. The supervision device according to claim 1,
wherein the processing execution unit causes each of the
plurality of nodes to store same data to thereby cause the
30 plurality of nodes to function as a blockchain.

Claim 5. The supervision device according to claim 1,
wherein the group creation unit determines, based on the

information concerning the node, using a machine learning model that outputs a communication path for performing data communication, a communication path for the plurality of nodes to communicate data with one another.

5

Claim 6. The supervision device according to claim 1, wherein, in order to execute the processing, the processing execution unit calculates a fee charged on the resource provided by each of the plurality of nodes.

10

Claim 7. The supervision device according to claim 1, wherein

the group creation unit creates a group including a cloud server, an ECU mounted on a ship, and a server of a manufacturer of a main engine of the ship as nodes, and

15

the processing execution unit causes the node to execute processing for supporting operation of the ship.

Claim 8. A supervision program for causing a computer to execute:

20

an information acquisition step for acquiring information concerning a node having a resource for performing a preset task related to an ocean;

a group creation step for creating, according to the information concerning the node and the task acquired by the information acquisition step, a group including a plurality of nodes capable of communicating data with one another; and

25

a processing execution step for causing the plurality of nodes to perform data communication with one another and causing the plurality of nodes to provide the resource to thereby execute processing corresponding to the task.

30

Claim 9. The supervision program according to claim 8,
wherein, in the processing execution step, the nodes that
provide the resource are distributed according to a use
status of the resource of each of the plurality of nodes.

5

Claim 10. The supervision program according to claim 8,
wherein, in the group creation step, the group is created
based on the information concerning the node using a
machine learning model that outputs a combination of the
nodes for executing the processing.

10

Claim 11. The supervision program according to claim 8,
wherein, in the processing execution step, by causing each
of the plurality of nodes to store same data, the plurality
of nodes are caused to function as a blockchain.

15

Claim 12. The supervision program according to claim 8,
wherein, in the group creation step, a communication path
for the plurality of nodes to communicate data with one
another is determined based on the information concerning
the node using a machine learning model that outputs a
communication path for performing data communication.

20

Claim 13. The supervision program according to claim 8,
wherein, in the processing execution step, a fee charged on
the resource provided by each of the plurality of nodes is
calculated in order to execute the processing.

25

Claim 14. The supervision program according to claim 8,
wherein

30

in the group creation step, a group including a cloud
server, an ECU mounted on a ship, and a server of a
manufacturer of a main engine of the ship as nodes is

created, and

in the processing execution step, the node is caused to execute processing for supporting operation of the ship.