Claims

[Claim 1]

A control system comprising:

in a facility in which a plurality of server groups, each composed of a plurality of servers arranged in a first horizontal direction, are installed at intervals in a second horizontal direction orthogonal to the first horizontal direction,

a cooling system configured to cool the servers; and

a control device configured to control the servers and the cooling system,

wherein the cooling system includes

a cooling device configured to cool a primary-side refrigerant,

a primary-side pipe provided with a primary-side pump configured to deliver the primary-side refrigerant cooled by the cooling device,

a heat exchanger configured to perform heat exchange between the primary-side refrigerant cooled by the cooling device and a secondary-side refrigerant used for cooling the servers,

a secondary-side pipe provided with a secondary-side pump configured to deliver the secondary-side refrigerant cooled by the heat exchanger, the secondary-side pipe having, for each server group, a flow path composed of a main pipe, a plurality of first branch pipes branching from the main pipe at branch positions corresponding to the respective server groups, and a plurality of second branch pipes branching from the first branch pipes to the respective servers, and

on-off valves provided in each of the plurality of second branch pipes of the secondary-side pipe,

the control device includes a first assignment unit configured to concentratedly

assign, based on schedule information for jobs to perform computational processing on the servers and server information including arrangement of the servers, the jobs to the server groups in order from the server group having a shorter flow-path distance, and

opening degrees of the on-off valves are changed in accordance with a processing load of the server.

[Claim 2]

The control system according to claim 1,

wherein the opening degrees of the on-off valves are automatically changed based on a temperature difference of the secondary-side refrigerant between an inlet and an outlet of the server in the second branch pipe.

[Claim 3]

The control system according to claim 1,

wherein the control device further includes a control unit configured to perform control of changing the opening degrees of the on-off valves based on an operation instruction from a user or based on a temperature difference of the secondary-side refrigerant between an inlet and an outlet of the server in the second branch pipe.

[Claim 4]

The control system according to any one of claims 1 to 3,

wherein the control device further includes

a second assignment unit configured to assign, based on the schedule information and the server information, the jobs to all the servers of all the server groups so that the processing loads are equalized,

a power calculation unit configured to calculate, based on information indicating a relationship among an allowable temperature of the servers, a heat generation amount, flow rates of the primary-side refrigerant and the secondary-side refrigerant, and total power of the cooling system for supplying the primary-side refrigerant and the secondary-side refrigerant to the servers, a first predicted value of power of the cooling system corresponding to job assignment by the first assignment unit and a second predicted value of power of the cooling system corresponding to job assignment by the second assignment unit, and

a determination unit configured to determine, based on the first predicted value and the second predicted value, whether to adopt the job assignment by the first assignment unit or the job assignment by the second assignment unit.

[Claim 5]

The control system according to any one of claims 1 to 3,

wherein the facility has a plurality of floors on which the server groups are installed, and

the first assignment unit is configured to concentratedly assign the jobs to the server groups on some of the floors so that the number of floors in operation is minimized.

[Claim 6]

A control method of controlling, in a facility in which a plurality of server groups, each composed of a plurality of servers arranged in a first horizontal direction, are installed at intervals in a second horizontal direction orthogonal to the first horizontal direction, a cooling system configured to cool the servers, and the servers,

in which the cooling system includes

a cooling device configured to cool a primary-side refrigerant,

a primary-side pipe provided with a primary-side pump configured to deliver the primary-side refrigerant cooled by the cooling device,

a heat exchanger configured to perform heat exchange between the primary-side refrigerant cooled by the cooling device and a secondary-side refrigerant used for cooling the servers,

a secondary-side pipe provided with a secondary-side pump configured to deliver the secondary-side refrigerant cooled by the heat exchanger, the secondary-side pipe having, for each server group, a flow path composed of a main pipe, a plurality of first branch pipes branching from the main pipe at branch positions corresponding to the respective server groups, and a plurality of second branch pipes branching from the first branch pipes to the respective servers, and

on-off valves provided in each of the plurality of second branch pipes of the secondary-side pipe,

the control method comprising:

a step of concentratedly assigning, based on schedule information for jobs to perform computational processing on the servers and server information including arrangement of the servers, the jobs to the server groups in order from the server group having a shorter flow-path distance; and

a step of changing opening degrees of the on-off valves in accordance with a processing load of the server.