Appeal decision

Appeal No. 2018-14162

Appellant International Business Machines Corporation

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The case of appeal against the examiner's decision of refusal of Japanese Patent Application No. 2015-562451, entitled "Scalable Flow and Congestion Control in Network" (International Publication No. WO 2014/141006 published on September 18, 2014, National Publication of International Patent Application No. 2016-516333 published on June 2, 2016, number of claims: (10)) has resulted in the following appeal decision.

Conclusion

The examiner's decision is revoked.

The Invention of the present application shall be granted a patent.

Reason

No. 1 History of the procedures

The present application was filed on March 5, 2014 as an International Patent Application (Priority Claim received by the foreign receiving office under the Paris Convention on March 15, 2013, the United States), a written amendment was submitted on October 20, 2015, a notice of reasons for refusal was issued on March 8, 2018, a written amendment was submitted on June 6, 2018, and an examiner's decision of refusal (Examiner's decision) was issued on June 15, 2018. Against this, an appeal against the examiner's decision of refusal was made on October 25, 2018.

No. 2 Outline of the examiner's decision

The outline of the Examiner's decision (examiner's decision of refusal dated June 15, 2018) is as follows.

The inventions according to Claims 1 to 10 of the present application could have

been easily invented by a person ordinarily skilled in the art of the invention (hereinafter referred to as "a person skilled in the art") on the basis of the following Cited Documents 1 to 3. Thus, an appellant should not be granted a patent under the provisions of Article 29(2) of the Patent Act.

List of Cited Documents, etc.
1. Chakchai So-In, and two others, Enhanced Forward Explicit Congestion Notification (E-FECN) Scheme for Datacenter Ethernet Networks, performance Evaluation of Computer and Telecommunication Systems, 2008. SPECTS 2008. International Symposium, June 16, 2008, pp. 542-546
2. Japanese Unexamined Patent Application Publication No. 2012-49674
3. Japanese Unexamined Patent Application Publication No. 2013-38570

No. 3 The Invention

The Inventions according to Claims 1 to 10 of the present application (hereinafter referred to as "Invention 1" to "Invention 10", respectively) are inventions specified by the matters described in Claims 1 to 10 of the Scope of Claims amended by the written amendment dated June 6, 2018, as follows.

"[Claim 1]

A method of performing congestion management in a network, the method comprising:

monitoring, by a processing circuit, a congestion status at a switch, in the network including the processing circuit, with a switch logic and a congestion notification logic;

determining, by the processing circuit, at the switch, that the congestion status indicates that there is congestion at the switch, by examining a flag in a header field of an entry in a flow table, the flag including a forward congestion flag which indicates that a source of data for a data flow associated with the entry is sending data more quickly than the switch can process the data and a backward congestion flag which indicates that a destination of data requests for the data flow is requesting the data more quickly than the switch can process the data requests;

transmitting, by the processing circuit, a first message requesting the source to send the data at a second rate that is slower than a first rate from the switch to the source, based on the congestion status being related to the data received at the switch from the source at the first rate and the forward congestion flag being set; and

transmitting, by the processing circuit, a second message requesting the destination to send the data requests at a fourth rate that is slower than a third rate from the switch to the destination, based on the congestion status being related to the data requests received at the switch from the destination at the third rate and the backward congestion flag being set.

[Claim 2]

The method described in Claim 1, further comprising:

based on transmitting the first message:

monitoring, by the processing circuit, the congestion status at the switch in the network; and

based on determining that the congestion status indicates that there is no longer congestion at the switch related to data received at the switch from the source, transmitting, by the processing circuit, a third message from the switch to the source requesting the source to send the data at a fifth rate that is faster than the second rate.

[Claim 3]

The method described in Claim 1 or Claim 2, further comprising:

based on transmitting the second message:

monitoring, by the processing circuit, the congestion status at the switch in the network; and

based on determining that the congestion status indicates that there is no longer congestion at the switch related to data requests received at the switch from the destination, transmitting, by the processing circuit, a fourth message from the switch to the destination requesting the destination to send the data requests at a sixth rate that is faster than the fourth rate.

[Claim 4]

The method described in any of Claim 1 to Claim 3, wherein the switch is an OpenFlow switch and the network is an OpenFlow network.

[Claim 5]

The method described in Claim 4, wherein the source and destination are OpenFlow switches.

[Claim 6]

A computer program for congestion management in a network, the computer program comprising instructions to be executed by a computer for performing the method described in one of Claim 1 to Claim 5.

[Claim 7]

A system for performing congestion management in a network, the system

comprising:

a switch configured to connect to the network, the switch comprising:

a memory having computer readable computer instructions; and

a processor for executing the computer readable instructions to:

monitor a congestion status at the switch;

determine that the congestion status indicates that there is congestion at the switch; by examining a flag in a header field of an entry in a flow table at the switch, the flag including a forward congestion flag which indicates that a source of data for a data flow associated with the entry is sending data more quickly than the switch can process the data and a backward congestion flag which indicates that a destination of data requests for the data flow is requesting the data more quickly than the switch can process the data requests,

based on the congestion being related to data received at the switch from a source at a first rate and the forward congestion flag being set, transmitting a first message to the source requesting the source to send the data at a second rate that is slower than the first rate, and

based on the congestion being related to data requests received at the switch from a destination at a third rate and the backward congestion flag being set, transmitting a second message to the destination requesting the destination to send the data requests at a fourth rate that is slower than the third rate.

[Claim 8]

The system described in Claim 7, wherein the instructions further include:

based on transmitting the first message:

monitoring the congestion status; and

based on determining that the congestion status indicates that there is no longer congestion at the switch related to data received at the switch from the source, transmitting a third message to the source requesting the source to send the data at a fifth rate that is faster than the second rate.

[Claim 9]

The system described in Claim 7 or Claim 8, wherein the instructions further include:

based on transmitting the second message:

monitoring the congestion status; and

based on determining that the congestion status indicates that there is no longer congestion at the switch related to data requests received at the switch from the destination, transmitting a fourth message to the destination requesting the destination

to send the data requests at a sixth rate that is faster than the fourth rate.
[Claim 10]
The system described in any of Claim 7 to Claim 9, wherein the switch, source, and destination are OpenFlow switches and the network is an OpenFlow network."

No. 4 Cited Documents, Cited Invention
1. Regarding Cited Document 1
Cited Document 1 cited in the reasons for refusal stated in the examiner's decision includes the following matters together with drawings.

(1) page 1 right column l. 30-l. 39
"As shown in Fig. 1, rate regulators at the sources are used to adjust the rate of individual flows according to BCN messages received from switches. The switches are called congestion points (CPs) while the sources are the reaction points (RPs). The switches monitor their buffer utilization and send BCN messages back to the source based on the status and variation of the buffer queue. Two thresholds Qeq (equilibrium queue length) and Qsc (severe congestion queue length) are used to trigger BCN messages."

(2) page 2 left column l. 20-l. 33
"It has been shown that BCN achieves only proportional fairness, not max-min fairness [6]. Furthermore, BCN is slow in convergence to a fair state and has large oscillations in throughput. FECN was proposed to deal with the fairness and oscillation issues [7]. As shown in Fig.2, FECN is a close-loop explicit rate feedback control mechanism. The sources periodically send probe messages that pass through the switches and are returned back to the sources from the destination. On the forward path, switches reduce the rate field in the probe, and when the probes return to the sources, they contain the exact rate that the flow should follow. Therefore, the sources change their rate to that in the probes. The switches advertise the same rate to all flows passing through the switch. This ensures that all flows are treated fairly."

(3) page 3 left column l. 6-l. 12
"As shown in Fig. 3, in E-FECN, in addition to the normal probing mechanism of FECN, the switches are allowed to send BCN messages under severe congestion. E-EFCN allows sources to start sending the data at full rate (Fast Start) without a rate regulator. If this results in congestion on any switch, the switch sends a BCN00

message that requires the source to reduce to a low initial rate."

(4) Cited Invention

Accordingly, Cited Document 1 describes the following invention (hereinafter referred to as "Cited Invention").

"A rate feedback control mechanism configured to

adjust the rate of individual flows according to BCN messages received from switches by using rate regulators at the sources, wherein

the switches monitor their buffer utilization and send BCN messages back to the source based on the status and variation of the buffer queue,

FECN is a close-loop explicit rate feedback control mechanism,

the sources periodically send probe messages,

the probe messages pass through the switches and are returned back to the sources from the destination,

the switches reduce the rate field in the probe, and when the probes return to the sources, they contain the exact rate that the flow should follow,

the sources change their rate to that in the probes,

in E-FECN, in addition to the normal probing mechanism of FECN, the switches are allowed to send BCN messages under severe congestion."

2. Regarding Cited Document 2

The following descriptions are included in paragraphs [0018], and [0027] to [0028] of Cited Document 2 cited in the reasons for refusal stated in the examiner's decision.

"[0018]

In the first embodiment, OpenFlow is applied to the system. Accordingly, the switches operate as OFS, and the controller 30 operates as OFC, respectively."

"[0027]

The flow table 102 stores, as described in the background, a set of a condition (flow key) to be collated with a packet header, an action (Action) that defines processing contents, and flow statistical information, as one entry. The details of the flow table 102 are described later.

[0028]

A port link information management part 103 manages communication status of links to which the ports connects. When communications from the ports are successful,

the Link value is set to 1. When a failure or congestion or the like occurs, the Link value is set to 0."

3. Regarding Cited Document 3

The following descriptions are included in paragraphs [0021] and [0050] of Cited Document 3 cited in the reasons for refusal stated in the examiner's decision.

"[0021]

Descriptions will now be made of modes for carrying out the present invention in accordance with the drawings. Before this, descriptions will be made of the basic configuration of a packet relay device which includes a congestion notification function of the present invention. The basic configuration of the packet relay device of the present invention includes a plurality of input lines and output lines, and detects a flow including a set of packets that are identified by at least one or more items of information of an input physical line number of a packet received from an input line, an input logical line number, or packet header information. When it is determined that the flow is in a congestion state, the field representing the congestion state of the network is rewritten into a value representing that it is in a congestion state, in the packet header of a response packet received subsequently, for the corresponding flow."

"[0050]

FIG. 12 shows one configuration example of the congestion state management table for each bandwidth monitoring entry 541 of this embodiment. The congestion state management table for each bandwidth monitoring entry 541 is composed of a plurality of congestion state management entries for each bandwidth monitoring entry 5411 to 541n corresponding to the respective flow search entries of the flow search table 41. Each of the congestion state management entries 5411 to 541n includes a congestion state flag 5410 representing the congestion state of each flow defined by the flow search entry. The congestion state flag 5410 has a value representing that it is not in a congestion state in the initial state. Upon input of the information representing the congestion state from the monitoring result determining circuit 530 and the hit address, the congestion state management unit 54 writes information representing the congestion state into the congestion state flag 5410 of the congestion state management entries for each bandwidth monitoring entry 5411 to 541n of the congestion state management table for each bandwidth monitoring entry 541, using the hit address as a write address, in accordance with the congestion state management table control unit for each bandwidth monitoring entry 540."

No. 5 Comparison / Judgment

1. Regarding Invention 1

(1) Comparison

A The "switch" in the Cited Invention executes transmitting a message and monitoring congestion by "monitoring buffer utilization". Thus, it is obvious that the "switch" in the Cited Invention "includes a processing circuit with a switch logic and a congestion notification logic" and corresponds to the "switch" "monitoring, by a processing circuit, a congestion status at the switch".

Therefore, it is obvious that the "switch" which transmits/receives "a message" over a network, to/from "a source" or "a destination", and "monitors buffer utilization" is configured to correspond to "monitoring, by a processing circuit, a congestion status at a switch, in the network, including the processing circuit with a switch logic and a congestion notification logic" in Invention 1.

B The "rate" represented by the "rate field" in the Cited Invention corresponds to the "rate" of communication in Invention 1.

Since the "rate field" in the "probe" is reduced and transmitted from the "switch" to the "source", the "rate" in the "rate field" before the reduction corresponds to the "first rate" in Invention 1, and the "rate" in the "rate field" after the reduction corresponds to the "second rate".

The "probe" to which the "rate field" is fed back via the "destination" to be transmitted to the source corresponds to the "first message" in Invention 1.

Accordingly, it can be said that, the configuration in the Cited Invention that "sources" "periodically send probe messages", that the "switches" "reduce the rate field in the probe and when the probes return to the sources, they contain the exact rate that the flow should follow", and that the "sources" "change their rate to that in the probes", is identical with the configuration in Invention 1, "transmitting, by the processing circuit, a first message requesting the source to send the data at a second rate that is slower than a first rate from the switch to the source, based on the congestion status being related to the data received at the switch from the source at the first rate and the forward congestion flag being set", in the point, "transmitting, by the processing circuit, a first message requesting the source to send the data at a second rate that is slower than a first rate from the switch to the source, based on the congestion status being related to the data received at the switch from the source at the first rate".

C The configuration that the "switches" in the Cited Invention perform "control" of

the "rate" of a network and "send BCN messages under severe congestion" corresponds to the configuration of "performing congestion management in a network" in Invention 1.

Therefore, the corresponding feature and different features between Invention 1 and the Cited invention are as follows.

[Corresponding Feature]

A method of performing congestion management in a network, the method comprising:

monitoring, by a processing circuit, a congestion status at a switch, in the network including the processing circuit with a switch logic and a congestion notification logic; and

transmitting, by the processing circuit, a first message requesting the source to send the data at a second rate that is slower than a first rate from the switch to the source, the congestion status being related to the data received at the switch from the source at the first rate.

[Different Feature 1]

Invention 1 is configured to "determine, by the processing circuit, at the switch, that the congestion status indicates that there is congestion at the switch, by examining a flag in a header field of an entry in a flow table, the flag including a forward congestion flag which indicates that a source of data for a data flow associated with the entry is sending data more quickly than the switch can process the data and a backward congestion flag which indicates that a destination of data requests for the data flow is requesting the data more quickly than the switch can process the data requests", while the Cited Invention is not configured to "determine that the congestion status indicates that there is congestion at the switch by examining the flag".

[Different Feature 2]

Invention 1 is configured to transmit a first message to the source "based on the forward congestion flag being set", while the Cited Invention does not include a "forward congestion flag".

[Different Feature 3]

Invention 1 is configured to "transmit, by the processing circuit, a second

message requesting the destination to send the data requests at a fourth rate that is slower than a third rate from the switch to the destination, based on the congestion status being related to the data requests received at the switch from the destination at the third rate and the backward congestion flag being set", while the Cited Invention does not transmit a "message" regarding the "rate" of "data request" to a "destination".

(2) Judgment

Regarding [Different Feature 3]

In light of the case, Different Feature 3 is examined first.

Among Cited Documents 1 to 3, only Cited Document 1 describes or indicates a point of transmitting a message regarding the rate of communication from a switch to a "destination".

Cited Document 2, which pertains to a system that "applies OpenFlow", discloses a system in which a "flow table 102" "stores a set of a condition (flow key) to be collated with a packet header, an action (Action) that defines processing contents, and flow statistical information, as one entry" and a "port link information management part 103" "manages communication status of links to which the ports connect", but does not describe a point of transmitting a message regarding the rate of communication from a switch to a "destination".

Cited Document 3, which is a "packet relay device which includes a congestion notification function", discloses a technology that "when it is determined that the flow is in a congestion state, the field representing the congestion state of the network is rewritten into a value representing that it is in a congestion state, in the packet header of a response packet received subsequently, for the corresponding flow" and that congestion is managed by "each of the congestion state management entries 5411 to 541n" which "includes a congestion state flag 5410 representing the congestion state of each flow defined by the flow search entry", but does not describe a point of transmitting a message regarding the rate of communication from a switch to a "destination".

A In the Cited Invention, the BCN message to be transmitted in addition to the probe of FECN is a notification to the "source", as with the FECN, and is different from a "message" regarding the "rate" of "data request" to a "destination". In the Cited Invention, there is no cause or motivation for a configuration to transmit a "message" regarding the "rate" of "data request" to a "destination" in Different Feature 3, in place of (or in addition to) the BCN message.

B Regarding the "processing circuit" of the "switch" including a "flow table", it cannot be acknowledged that "the processing circuit transmitting a second message requesting the destination to send the data requests at a fourth rate that is slower than a third rate from the switch to the destination, based on the congestion status being related to the data requests received at the switch from the destination at the third rate and the backward congestion flag being set" is a well-known art.

Thus, even a person skilled in the art would not easily conceive of a configuration of "transmitting, by the processing circuit, a second message requesting the destination to send the data requests at a fourth rate that is slower than a third rate from the switch to the destination, based on the congestion status being related to the data requests received at the switch from the destination at the third rate and the backward congestion flag being set" relating to Different Feature 3 of Invention 1, on the basis of the Cited Invention and technical matters described in Cited Documents 2 and 3.

Therefore, it cannot be said that Invention 1 could have been easily invented by a person skilled in the art on the basis of the Cited Invention and technical matters described in Cited Documents 2 and 3, without there being need to examine other different features.

2. Regarding Inventions 2 to 6

Inventions 2 to 6, which are inventions obtained by restricting Invention 1, also include the same configuration as "transmitting, by the processing circuit, a second message requesting the destination to send the data requests at a fourth rate that is slower than a third rate from the switch to the destination, based on the congestion status being related to the data requests received at the switch from the destination at the third rate and the backward congestion flag being set" relating to Different Feature 3 of Invention 1. Thus, for the same reasons as those of Invention 1, it cannot be said that Inventions 2 to 6 could have been easily invented by a person skilled in the art on the basis of the Cited Invention and technical matters described in Cited Documents 2 and 3.

3. Regarding Invention 7

Invention 7, which is an invention of a system corresponding to Invention 1, includes the same configuration as "transmitting a second message requesting the

destination to send the data requests at a fourth rate that is slower than a third rate" "based on the congestion status being related to the data requests received at the switch from the destination at the third rate and the backward congestion flag being set" relating to Different Feature 3 of Invention 1. Thus, for the same reasons as those of Invention 1, it cannot be said that Invention 7 could have been easily invented by a person skilled in the art on the basis of the Cited Invention and technical matters described in Cited Documents 2 and 3.

4. Regarding Inventions 8 to 10

Each of Inventions 8 to 10, which are inventions obtained by restricting Invention 7, also includes the same configuration as "transmitting, by the processing circuit, a second message requesting the destination to send the data requests at a fourth rate that is slower than a third rate from the switch to the destination, based on the congestion status being related to the data requests received at the switch from the destination at the third rate and the backward congestion flag being set" relating to Different Feature 3 of Invention 1. Thus, for the same reasons as those of Invention 1, it cannot be said that Inventions 8 to 10 could have been easily invented by a person skilled in the art on the basis of the Cited Invention and technical matters described in Cited Documents 2 and 3.

No. 6 Regarding the examiner's decision

The examiner's decision is that the appellant should not be granted a patent under the provisions of Article 29(2) of the Patent Act since the inventions of Claims 1 to 10 could have been easily invented by a person skilled in the art based on Cited Documents 1 to 3.

However, Claim 1 amended by the written amendment dated June 6, 2018 includes a configuration of "transmitting, by the processing circuit, a second message requesting the destination to send the data requests at a fourth rate that is slower than a third rate from the switch to the destination, based on the congestion status being related to the data requests received at the switch from the destination at the third rate and the backward congestion flag being set" relating to Different Feature 3. As described above, the invention of Claim 1 is not an invention which could have been easily invented by a person skilled in the art based on the Cited Invention and technical matters described in Cited Documents 2 and 3.

Therefore, the examiner's decision cannot be maintained.

No. 7 Closing

The application cannot be rejected due to the reasons of the examiner's decision.
In addition, beyond that, no reasons for refusal were found.
Therefore, the appeal decision shall be made as described in the conclusion.

January 28, 2020

Chief administrative judge: INABA, Kazuo
Administrative judge: IWATA, Akirahiko
Administrative judge: ODA, Hiroshi