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European Patent Application 19160813.2
SERVICE CHAIN FAULT DETECTION METHOD AND APPARATUS
HUAWEI TECHNOLOGIES CO., LTD.

On the communication pursuant to R. 69 EPC and the publication of the European Search Report, the examination fee and designation fee are paid by debit order.

It is requested to start with the examination on the basis of new claims 1 to 27 replacing all claims previously on file, new description pages 1, 2, 2a and 71 replacing description pages 1, 2 and 71 to 85 on file, and the remaining documents as currently on file.

I. AMENDMENTS

Newly filed claim specifies that "the service chain comprises a plurality of service function nodes, and a packet passes through according to an order of the plurality of service function nodes", as disclosed on p. 21, l. 21 to 23 of the translated original description. Moreover, the method is specified as fault detection method, as disclosed e.g. on page 27, l. 24 of the description.

Analogous amendments are introduced into independent claims 9, 14 and 22.

Reference signs are introduced into all claims where appropriate.

Further, prior art document D1, cited in the European search report, is now duly acknowledged on new description p. 2, and repeated claim language is deleted from pages 71 to 85.

II. OBJECTIONS UNDER ART. 84 EPC

In response to the request for two-part form, it is submitted that the subject matter of new claims 1 and 9 relates to a method whose method steps are interrelated with each other, while the inventive step concerns changes in several of these interrelated method steps. Further, the subject matter of claim 14 and 22 relates to a complex apparatus of functionally inter-related parts, while the inventive step concerns changes in several of these parts of the apparatus. Therefore, the use of the two-part form is considered to be inappropriate, since it would give a distorted picture of the claimed invention and would lead to an artificial lack of clarity of the respective claim. Hence, it is requested to allow the one-part form in the present case.

The Search Division take the view that the expression "service chain" used in independent claims 1, 9, 14 and 22 would be vague and fail to define any technical features. However, independent claims 1, 9, 14 and 22 are herewith amended to specify that "the service chain comprises a plurality of service function nodes, and a packet passes through according to an order of the plurality of service function nodes" thereby clarifying the expression "service chain". It is now clear that a service chain is to be understood as a chain comprising a plurality of service function nodes that a packet passes through.

The Search Division also expressed doubts about the clarity of the use of the term "fault" in the expressions "service chain fault detection", "fault tracing detection" and "initiating fault detection". In words of the Search Division, it would allegedly be unclear which faults are exactly to be detected or traced and how such a service chain fault detection is actually achieved only by obtaining IDs and addresses.

The term "fault" of claims 1, 9, 14 and 22 is related to a difference between an order of the service function nodes that a service packet passes through the service chain and a planned processing order of the service function nodes. Thus, as described on p. 20, l. 27 to page 21, l. 1 of the present description with reference to Fig. 1, the invention aims at implementing an improvement in conventional detection methods that are not able to detect an abnormality, i.e. fault, causing a service packet to be transmitted over a set of service function nodes in an order different from that originally foreseen. As explained with respect to Fig. 1, if a service processing order planned on a service chain specifies that a packet forwarded on the service chain should first pass the service function node 121 and then pass the service function node 122, and an abnormality causes the service packet to instead pass service function node 122 first and then service function node 121, a conventional detection device is not able to detect such a fault related to the abnormal order of the service function nodes passed by the service packet.

The invention proposes a solution to solve this problem based on the use of fault tracing detection request packets, the fault tracing detection request packets detect service function entities and service function nodes connected within a service chain, and the solution allows determining the locations of the service function nodes according to an order of sending fault tracing detection request packets comprising identifiers of the paths and service function nodes (cf. p. 21, l. 1 to 6 and p. 27, l. 24 to p. 28, l. 3 of the present description). Specifically, the SFE of claim 1 obtains an ID of the SF node after determining the SFE communicates with the SF node, and the SFE sends the ID of the SF node by sending a first fault tracing detection response packet (1032) to the device for initiating fault detection, and the first fault tracing detection response packet (1032) includes the ID of the SF node. According to the ID of the SF node, the device for initiating fault detection can obtain the result of fault detection.

The applicant submits that the wordings of newly filed claims 1, 9, 14 and 22 now define the terms that had been objected to in a clear manner and in terms of technical features. It is hence believed that newly filed claims 1, 9, 14 and 22 now fulfils the requirements of Art. 84 EPC.

The Search Division also expressed doubts about the clarity of the definition of "determining, by the device for initiating fault detection, that forwarding between the SFE and the SF node is normal".

The invention proposes a solution to solve this problem based on the use of fault tracing detection request packets, the fault tracing detection request packets detect service function entities and service function nodes connected within a service chain, and the solution allows determining the locations of the service function nodes according to an order of sending fault tracing detection request packets comprising identifiers of the paths and service function nodes (cf. p. 21, l. 1 to 6 and p. 27, l. 24 to p. 28, l. 1 of the present description). Specifically, paragraph [0230] to paragraph [0232], the SFE 112 can communicates with the SF node 123 by transmitting the fault tracing detection request packet, and then determine the forwarding between the SFE 112 and the SF node 123.

It is hence believed that the application now fulfils the requirements of Art. 84 EPC.

III. NOVELTY (ART. 54 EPC)

In the European Search Opinion, claim 1 previously on file was objected to for lacking novelty over D1. However, the subject-matter of newly filed claim 1 differs from D1 at least by the following distinguishing feature:

(i) determining to communicate with a service function, SF, node (121), wherein the first fault tracing detection request packet comprises a path identifier, ID, and the path ID is used to identify a path of a service chain.

(ii) sending, by the SFE (111), a first fault tracing detection response packet to a device for initiating fault detection, wherein the first fault tracing detection response packet comprises the path ID and the ID of the SF node (121).

The Search Division refers to the disclosure in paragraphs 65 to 88 of D1 holding that the ring identity disclosed therein to be included in a detection request packet would be equivalent to a path identifier according to claim 1. However, D1 defines a ring identity as the identifier of a ring label switched path, LSP:

> "*Ring ID refers to a ring identity, and is used to determine a detected ring LSP. The ring identity in the MPLS ring network is unique. That is, every ring LSP is unique.*" (cf. [0021] of D1)

Further, D1 defines a "ring LSP" to be a group of nodes, e.g. of label switch routers, LSR, "*forming a closed ring, wherein each node is connected through a bidirectional communication facility to two adjacent nodes*" (cf. [0002] of D1). For example, as disclosed in par. [0030] with respect to Fig. 3, the ring LSP shown therein is formed by the eight LSRs LSR1 to LSR8.

Thus, contrary to claim 1, D1 does not disclose a path ID identifying a path of a service chain. Instead, the ring ID disclosed in D1 identifies a group of LSR, i.e. a group of nodes, that form a closed ring structure.

In view of this, the subject-matter of amended claim 1 is new over D1.

The subject matter of claim 9, 14 or 22 corresponds to that of claim 1, hence, it is also novel.

IV. INVENTIVE STEP (ART. 56 EPC)

D1 is considered to be the closest prior art.

By means of distinguishing features (i) and (ii), the invention achieves the technical effect of allowing detecting faults that cause a service packet to be transmitted over a service chain, the service chain passes service function nodes in an order deferring from the order foreseen in a planned processing order. This is achieved by the use of a fault tracing detection request packet, and the fault tracing detection request packet may be sent over a particular path of a service chain identified by a corresponding path identifier. This is further achieved by obtaining an identifier of a service function node reached by the fault tracing detection request packet over the aforesaid particular path. This allows that each fault tracing detection request packet provided by a service classifier is used to obtain an identifier of one service function node of the service chain (cf. p. 27, l. 29 to 31). A device for initiating fault detection may thereby learn

information about the service function nodes that the service chain passes through and about the order thereof (cf p. 21, l. 1 to 7 of the present description).

In view of this, the objective technical problem addressed by the present invention can be defined as how to improve the detection of faults in a network of service nodes.

The question to be answered is hence whether a person skilled in the art would be prompted to modify the method and an apparatus disclosed in D1 according to distinguishing features (i) and (ii). This is believed not to be the case, since a skilled person wanting to improve the detection of faults in the multi-protocol label switching LSP transport ring network disclosed in D1 would not even take into consideration the problem of finding out the order of the nodes passed by a service package. D1 only describes methods applied to nodes forming a ring structure in which the order passed by a service packet transmitted over the network is fixed and determined by the sequence of nodes along the ring structure.

For example, a service packet transmitted over the node network illustrated in Fig. 3 of D1 is sent out from LSR1 either clockwise or anticlockwise. If the packet is transmitted in the clockwise direction, it first reaches LSR2, then LSR3 and so on, whereas if it is transmitted in the anticlockwise direction, it first goes from LSR1 to LSR8, then to LSR7 and so on. D1 does in particular not disclose the possibility of sending a service packet from a particular node to one of a plurality of nodes connected to the aforesaid node over corresponding paths.

Therefore, a skilled person, in face of D1, would not consider the inclusion of path identifiers into the packets disclosed therein, as these would only provide redundant information that may already be contained in a ping command (cf. "Direction" in a ping command as disclosed in par. [0032] and [0033]) and fail to contribute to any technical improvement in the detection of faults at all. D1 deals with a fundamentally different network structure and would not guide a skilled person to the present invention.

It is further submitted that, even in view of the common general knowledge of a skilled person, he or she would not be prompted to implement the distinguishing features (i) and (ii) to solve the objective technical problem mentioned above.

Thus, the subject-matter of amended claims 1 is not only new, but further involves an inventive step.

The subject matter of claim 9, 14 or 22 corresponds to that of claim 1, hence, it also involves an inventive step.

V. CONCLUSION

Hence, the documents now on file meet all requirements of the EPC. However, if the Examining Division still sees deficiencies in the documents now on file, a communication under Art. 94(3) EPC is expected, or, if appropriate, a telephone conversation with the applicant's representative can be conducted. Only as a measure of precaution, the applicant requests for

oral proceedings

if the Examining Division intends to reject the application. In this event, it is further requested that the Oral Proceedings be either held in Munich, or by videoconference.

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Enclosures:
- New claims 1 to 27, clean copy and with marked-up amendments
- New description pages1, 2, 2a and 71 to 85, clean copy and with marked-up amendments