TITLE OF THE INVENTION: METHOD AND SYSTEM FOR MONITORING AND OPTIMISING VOICE CALL QUALITY

TECHNICAL FIELD

[0001] The present disclosure relates to a method and system which are implementable by an intelligent outbound voice calling system for monitoring historical and/or current outbound voice calls and optimising voice call quality of current and/or future outbound voice calls.

BACKGROUND

[0002] Currently, internet-based intelligent outbound voice calling services have been widely used in customer service, sales promotion, product marketing, and other fields. However, outbound calling services are subject to adverse effects of network anomalies, which can reduce accuracy of outbound calling systems in recognising user speech, thus resulting in misunderstanding or inability to understand user intent and degradation of user experience. Therefore, it is necessary to monitor and optimise the voice call quality of outbound calling services.

[0003] To monitor network quality, existing solution(s) have been proposed to monitor the latency and packet loss rate of a certain number of outbound calling system server addresses using connection protocols. However, such solution(s) are not applicable to intelligent outbound voice calling services that use connectionless protocols, and it is also unable to distinguish whether network anomalies originate from underlying network issues or operator infrastructure service problems.

[0004] Accordingly, there is a need for voice quality monitoring and optimising method and system which address the above and other issues.

SUMMARY

[0005] In an aspect, the present disclosure provides a method of monitoring and optimising voice call quality, the method comprising:

performing monitoring of a plurality of voice calls associated with a plurality of media addresses, including:

acquiring a call record of each target voice call of the voice calls, wherein the call record includes a call quality score, an abnormal data packet information, and a target media address which corresponds to the each target voice call, wherein the media addresses include the target media address;

based on the call quality score, and the abnormal data packet information, ascertaining a status type information of the target media address;

based on the ascertained status type information of the media address, ascertaining a call routing status for the media address; and

selecting, from the media addresses, a particular media address for an outbound voice call based on a corresponding call routing status of the particular media address.

[0006] In an embodiment, the step of based on the call quality score, and the abnormal data packet information, ascertaining the status type information of the media address includes: based on the call quality score being less than a network anomaly threshold, ascertaining the status type information of the target media address as network anomaly.

[0007] In an embodiment, the preceding method comprises:

based on the call quality score being equal to or higher than the network anomaly threshold, performing:

based on a count of abnormal data packets during a plurality of voice periods, a count of abnormal data packet time points during a call period, and a total count of abnormal data packets during the call period, ascertaining a proportion of abnormal data packets during the voice periods, wherein the call period comprises the voice periods and a plurality of non-voice periods;

based on the total count of abnormal data packets during the call period and a total count of data packets during the call period, ascertaining a proportion of abnormal data packets during the call period; and

based on the proportion of abnormal data packets during the voice periods and the proportion of abnormal data packets during the call period, ascertaining the status type information of the target media address.

[0008] In an embodiment, the step of based on the proportion of abnormal data packets during the voice periods and the proportion of abnormal data packets during the call period, ascertaining the status type information of the target media address includes:

based on the proportion of abnormal data packets during the voice periods being greater than or equal to an abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being greater than or equal to a business abnormality threshold, ascertaining the status type information of the target media address as business-type fluctuation anomaly;

based on the proportion of abnormal data packets during the voice periods being greater than or equal to the abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being less than the business abnormality threshold, ascertaining the status type information of the target media address as normal state;

based on the proportion of abnormal data packets during the voice periods being less than the abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being greater than or equal to the business abnormality threshold, ascertaining the status type information of the target media address as network-type fluctuation anomaly; and

based on the proportion of abnormal data packets during the voice periods being less than the abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being less than the business abnormality threshold, ascertaining the status type information of the target media address as normal state.

[0009] In an embodiment, based on the call quality score being within a predetermined borderline range of a network anomaly threshold, the proportion of abnormal data packets during the voice periods being higher than a proportion of abnormal data packets during the non-voice periods by a predetermined margin, ascertaining the status type information of the target media address as business-type fluctuation anomaly.

[0010] In an embodiment, the step of based on the ascertained status type information of the media address, ascertaining a call routing status for the media address includes:

ascertaining a plurality of voice call counts during a predetermined time period which are respectively associated with the media addresses;

ascertaining at least a first one of the voice call counts as exceeding a predetermined monitoring threshold, wherein the at least first one of the voice call counts corresponds to at least a first one of the media addresses;

ascertaining, with respect to the first one of the media addresses, a plurality of occurrence counts corresponding to a plurality of status type information during the predetermined time period;

based on the occurrence counts, updating a routing control status of the first one of the media addresses.

[0011] In an embodiment, the occurrence counts corresponding to status type information during the predetermined time period includes a first occurrence count corresponding to network anomaly or business-type fluctuation or network-type fluctuation, wherein the step of based on the occurrence counts, updating a routing control status of the first one of the media addresses includes:

based on the first occurrence count and a total count of the occurrence counts corresponding to network anomaly or business-type fluctuation or network-type fluctuation, ascertaining a proportion of the first occurrence count during the predetermined time period;

based on the proportion of the first occurrence count being greater than a first predetermined proportion threshold corresponding to network anomaly or business-type fluctuation or network-type fluctuation, generating an alarm message and stopping or disallowing call routing to the first one of the media addresses.

[0012] In an embodiment, prior to acquiring the call record of each target voice call of the voice calls**,** the method further comprising:

storing call data of the voice calls; and

generating the call record of the each target voice call.

[0013] In an aspect, the present disclosure provides a non-transitory computer-readable medium comprising computer-executable instructions configured to direct at least one computer processor to perform the any of the preceding methods.

[0014] In an aspect, the present disclosure provides an outbound voice calling system configured to monitor and optimise voice call quality, the system comprising:

at least one memory for storing computer-executable instructions; and

at least one processor communicably coupled to the at least one memory, and configured to:

execute the computer-executable instructions to perform any of the preceding methods.

[0015] In an aspect, the present disclosure provides an outbound voice calling system configured to monitor and optimise voice call quality, the system comprising:

a monitoring module which is configured to:

perform monitoring of a plurality of voice calls associated with a plurality of media addresses, including:

acquire a call record of each target voice call of the voice calls, wherein the call record includes a call quality score, an abnormal data packet information, and a target media address which corresponds to the each target voice call, wherein the media addresses include the target media address;

based on the call quality score, and the abnormal data packet information, ascertain a status type information of the target media address;

based on the ascertained status type information of the media address, ascertain a call routing status for the media address; and

a soft switch communicably coupled to the monitoring module and configured to:

select, from the media addresses, a particular media address for an outbound voice call based on a corresponding call routing status of the particular media address.

[0016] In an embodiment, the monitoring module is further configured to: based on the call quality score being less than a network anomaly threshold, ascertain the status type information of the target media address as network anomaly.

[0017] In an embodiment, the monitoring module is further configured to:

based on the call quality score being equal to or higher than the network anomaly threshold, perform the following steps:

based on a count of abnormal data packets during a plurality of voice periods, a count of abnormal data packet time points during a call period, and a total count of abnormal data packets during the call period, ascertain a proportion of abnormal data packets during the

voice periods, wherein the call period comprises the voice periods and a plurality of non-voice periods;

based on the total count of abnormal data packets during the call period and a total count of data packets during the call period, ascertain a proportion of abnormal data packets during the call period; and

based on the proportion of abnormal data packets during the voice periods and the proportion of abnormal data packets during the call period, ascertain the status type information of the target media address.

[0018] In an embodiment, the monitoring module is further configured to:

based on the proportion of abnormal data packets during the voice periods being greater than or equal to an abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being greater than or equal to a business abnormality threshold, ascertain the status type information of the target media address as business-type fluctuation anomaly;

based on the proportion of abnormal data packets during the voice periods being greater than or equal to the abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being less than the business abnormality threshold, ascertain the status type information of the target media address as normal state;

based on the proportion of abnormal data packets during the voice periods being less than the abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being greater than or equal to the business abnormality threshold, ascertain the status type information of the target media address as network-type fluctuation anomaly; and

based on the proportion of abnormal data packets during the voice periods being less than the abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being less than the business abnormality threshold, ascertain the status type information of the target media address as normal state.

[0019] In an embodiment, the monitoring module is further configured to:

based on the call quality score being within a predetermined borderline range of a network anomaly threshold, the proportion of abnormal data packets during the voice periods being higher than a proportion of abnormal data packets during the non-voice periods by a predetermined margin, ascertain the status type information of the target media address as business-type fluctuation anomaly.

[0020] In an embodiment, the monitoring module is further configured to:

ascertain a plurality of voice call counts during a predetermined time period which are respectively associated with the media addresses;

ascertain at least a first one of the voice call counts as exceeding a predetermined monitoring threshold, wherein the at least first one of the voice call counts corresponds to at least a first one of the media addresses;

ascertain, with respect to the first one of the media addresses, a plurality of occurrence counts corresponding to a plurality of status type information during the predetermined time period;

wherein the soft switch is further configured to:

based on the occurrence counts, updating a routing control status of the first one of the media addresses.

[0021] In an embodiment, the monitoring module is further configured to:

based on the first occurrence count and a total count of the occurrence counts corresponding to network anomaly or business-type fluctuation or network-type fluctuation, ascertain a proportion of the first occurrence count during the predetermined time period;

based on the proportion of the first occurrence count being greater than a first predetermined proportion threshold corresponding to network anomaly or business-type fluctuation or network-type fluctuation, generate an alarm message;

wherein the soft switch is further configured to:

based on the alarm message, stop or disallow call routing to the first one of the media addresses.

[0022] In an embodiment, the soft switch is further configured to: store call data of the voice calls, wherein the monitoring module is further configured to: generate the call record of the each target voice call.

BRIEF DESCRIPTION OF DRAWINGS

Embodiments of the invention will be described in detail with reference to the accompanying drawings, in which:

[0023] Figure 1 shows a method for monitoring and optimising voice call quality of outbound voice calls according to an embodiment;

[0024] Figure 2 shows an example of block 200 of Figure 1;

[0025] Figure 3 shows an example of block 300 of Figure 1;

[0026] Figure 4 shows an example of block 240 of Figure 2;

[0027] Figure 5 shows an example of block 320 of Figure 3; and

[0028] Figure 6 shows an example of voice periods and non-voice periods within a call period.

DETAILED DESCRIPTION

[0029] In the following description, numerous specific details are set forth in order to provide a thorough understanding of various illustrative embodiments of the invention. It will be

understood, however, to one skilled in the art, that embodiments of the invention may be practiced without some or all of these specific details. It is understood that the terminology used herein is for the purpose of describing particular embodiments only, and is not intended to limit the scope of the invention. In the drawings, like reference labels or numerals refer to same or similar functionalities or features throughout the several views. In the drawings, directional arrows shown between features illustrate data or information transfer therebetween in accordance with description of some embodiments but are not limited as such. In other words, data or information transfer in reverse to the directional arrows and/or not shown by directional arrow among features may be envisaged and are not shown to avoid obscuring description of the embodiments.

[0030] Embodiments described in the context of one of the systems or methods are analogously valid for the other systems or methods. Similarly, embodiments described in the context of a system are analogously valid for a method, and vice versa.

[0031] Features that are described in the context of an embodiment or example may correspondingly be applicable to the same or similar features in the other embodiments or examples. Features that are described in the context of an embodiment or example may correspondingly be applicable to the other embodiments or examples, even if not explicitly described in these other embodiments or examples. Furthermore, additions and/or combinations and/or alternatives as described for a feature in the context of an embodiment or example may correspondingly be applicable to the same or similar feature in the other embodiments or examples.

[0032] It should be understood that the articles "a", "an" and "the" as used with regard to a feature or element include a reference to one or more of the features or elements. The term "and/or" includes any and all combinations of one or more of the associated feature or element. The terms "comprising", "including", "having", “involving” and any of their related terms, as used in description and claims, are intended to be open-ended and mean that there may be additional features or elements other than the listed ones. Identifiers such as "first", "second", "third", and so on, are used merely as labels, and are not intended to impose numerical requirements on their objects, nor construed in a manner imposing any relative position or time sequence between limitations.

[0033] An outbound calling system includes an intelligent outbound voice calling system, which is configured to make phone calls to predetermined receivers, recognize the receivers' voices, and interact with the receivers through voice. In an example, the intelligent outbound voice calling system can be configured with multiple media addresses for outbound calling, and the outbound calling system can conduct voice calls with receivers through these media addresses, where the media addresses include, but are not limited to, media internet protocol (IP) addresses or ports, etc. In an example, the outbound calling system may be configured

with multiple media IP addresses and configured to establish, manage, and terminate outbound calls based on media IP addresses according to the Session Initiation Protocol (SIP). The transmission of voice calls may be based on the Real-time Transport Protocol (RTP), and the audio of voice calls may be transmitted in the form of data packets. The data packets may include audio data of a fixed time length and may be sent continuously at fixed time intervals.

[0034] The outbound calling system may record voice calls with receivers and generate call records. The generated call records may include, but are not limited to, call quality scores, optional voice recognition information, abnormal data packet information, media addresses, etc., of the voice calls. The recorded information, data, and signals are all authorized by users or fully authorized by all parties, and the collection, use, and processing of relevant data would comply with relevant laws, regulations, and standards of relevant countries and regions.

[0035] A voice call that the outbound calling system successfully connects and communicates with a receiver may be referred to as a target voice call. However, the present disclosure is not limited to this voice call definition. For example, a voice call that is successfully connected or has a call duration greater than a duration threshold after being connected may also be determined as a target voice call.

[0036] Call records may be generated based on the call data recorded by the outbound calling system during voice calls, where the call data includes but is not limited to the start time and duration of voice calls, media addresses of both calling parties, data packet information transmitted during the calls, etc.

[0037] Figure 1 shows a flowchart relating to a voice call quality monitoring and optimising method in an outbound calling system according to an embodiment.

[0038] The flowchart may include block 80 in which call data of a plurality of voice calls is recorded and/or stored, followed by block 90 in which a plurality of call records are generated based on the call data of the voice calls. Block 80, which may be performed by a soft router of the outbound voice calling system. and block 90, which may be performed by a monitoring module of the outbound voice calling system, will be described in more detail later to avoid obscuring an understanding of block 100 to block 400 of the flowchart.

[0039] Block 100 and block 200 are performed with respect to the plurality of voice calls which are associated with a plurality of media addresses respectively. In other words, block 100 and block 200 may be performed for each of the voice calls (hereinafter each target voice call) which is associated with a corresponding one of the media addresses (hereafter target media address).

[0040] Block 100 includes: acquiring a call record of each target voice call, wherein the call record includes a call quality score, voice recognition information (optional), abnormal data

packet information, and a target media address, all of which correspond to the each target voice call. Block 100 may be performed by a monitoring module of the outbound voice calling system.

[0041] The call quality score may be ascertained based on a predetermined scoring standard. Non-limiting examples are provided in later paragraphs.

[0042] The voice recognition information may be generated by recognizing the target voice call using automatic speech recognition technology.

[0043] The abnormal data packet information may include a total count or number of abnormal data packets, time points of abnormal data packets, and a total count or number of data packets in the target voice call. For instance, during a call, if a data packet is not sent or received at the agreed time interval, or if data corruption occurs, these data packets would be considered abnormal.

[0044] Block 200 includes: based on the call quality score, the voice recognition information (optional), and the abnormal data packet information, ascertaining a status type information of the target media address. Block 200 may be performed by a monitoring module of the outbound voice calling system.

[0045] Non-limiting examples of status type information include network anomaly, service-type fluctuation anomaly, network-type fluctuation anomaly, business-type fluctuation anomaly, and normal. A network anomaly may refer to severe network issues caused by network infrastructure failures. A service-type fluctuation anomaly may refer to call quality fluctuations caused by carrier intermediate services or forwarding. A network-type fluctuation anomaly may refer to call quality fluctuations caused by random fluctuations or instabilities during network transmission. A business-type fluctuation anomaly may refer to a type of network issue that arises from operations of communication intermediaries, such as telecommunication operators or line providers. Such operations may include services like call forwarding, call waiting, and quality inspection provided by operators, as well as services like transit nodes, communication data routing, and transcoding handled by line providers. Business-type fluctuation anomaly can cause fluctuations in call quality.

[0046] Block 200 may include blocks 210, 220, 230, and 240 (see Figure 2) which may be performed by a monitoring module of the outbound voice calling system.

[0047] Block 210 includes: based on the call quality score being less than a network anomaly threshold, ascertaining the status type information of the target media address as network anomaly. The network anomaly threshold may be predetermined based on the predetermined call quality scoring standard. When the call quality score of the target voice call is less than the network anomaly score threshold, it indicates that the target voice call has severe network issues. Therefore, the status type information of the media address corresponding to the target

voice call is set to network anomaly. Network issues may include but are not limited to packet loss, delay, etc.

[0048] In an example, an outbound calling system uses the E-Model voice quality scoring standard to determine a call quality score R of the target voice call, where R ranges from 0 to 100. The network anomaly score threshold may be set as 90. A monitoring module of the outbound calling system may obtain the call quality score R from a soft switch. When R is less than 90, the monitoring module may set the status type information of the media address corresponding to the target voice call to network anomaly.

[0049] In another example, the E-Model voice quality scoring standard and the MOS voice quality scoring standard may be used in combination. The R value determined by the E-Model voice quality scoring standard may range from 0 to 100, while the MOS score determined by the MOS voice quality scoring standard may range from 1 to 5. Based on Table 1 below, the R value may be mapped to the MOS score, and thereafter according to the MOS scoring standard, the network anomaly score threshold may be determined to be 4. When the MOS score corresponding to the target voice call is less than 4, the status type information of the media address corresponding to the target voice call may be set to network anomaly.

Table 1: R Value and MOS Score Evaluation Criteria

R Value	User Satisfaction	MOS Score
90~100	Very Satisfied	4.3~5.0
80~90	Satisfied	4.0~4.3
70~80	Some Users Unsatisfied	3.6~4.0
60~70	Many Users Unsatisfied	3.1~3.6
50~60	Almost All Users Unsatisfied	2.6~3.1
0~50	Not Defined	1.0~2.6

[0050] Block 210 therefore provides an overall assessment of the voice call quality of various media addresses and filters out those media address(es) with severe network anomalies. However, for voice calls with a call quality score equal to or greater than the network anomaly threshold, their corresponding media addresses may possibly have certain network anomalies which may be distinguished using the methods of block 220 to block 240, which may be optional and performed based on the call quality score being equal to or higher than the network anomaly threshold.

[0051] Block 220 includes: based on a count of abnormal data packets during a plurality of voice periods, a count of abnormal data packet time points during a call period, and a total count of abnormal data packets during the call period, ascertaining a proportion of abnormal data packets during the voice periods, wherein the call period comprises the voice periods and a plurality of non-voice periods.

[0052] The proportion of abnormal data packets during the voice periods includes a proportion of a count or number of abnormal data packets occurring within the voice periods to a total count or number of abnormal data packets occurring within the call period.

[0053] In an example, block 220 may include: obtaining a count or number of abnormal data packets during the voice periods based on time point of each abnormal data packet, and calculating the proportion of abnormal data packets during the voice periods based on the count or number of abnormal data packets during the voice periods and a total count or number of abnormal data packets during the call period.

[0054] As shown in Figure 6, the audio of voice call A starts at time point t_0 and ends at time point t_9; accordingly, a call period of voice call A is defined by a period between t_0 and t_9. After Automatic Speech Recognition (ASR)-based voice separation, the voice periods P_1, P_2, P_3, P_4, P_5, in which human voice is present, are ascertained. According to the Real-Time Transport Protocol (RTP) statistical information in the Call Detail Record (CDR), it may be ascertained that a total count or number of abnormal RTP data packets in voice call A is 8, with corresponding time points t_1 to t_8. Among them, a count or number of data packets falling within the voice periods is 5, with corresponding time points t_1, t_3, t_4, t_5, t_8. The calculated proportion of abnormal data packets during the voice periods to abnormal data packets during the call period is $5 \div 8 \times 100\% = 62.5\%$. The proportion parameters may be expressed in percentages or otherwise.

[0055] Block 230 includes: based on the total count of abnormal data packets during the call period and a total count of data packets during the call period, ascertaining a proportion of abnormal data packets during the call period.

[0056] In an example, the outbound calling system may ascertain a total count of abnormal RTP data packets and a total count of transmitted RTP data packets based on the RTP statistical information in the CDR, and calculate the proportion of abnormal data packets as the total count of abnormal RTP data packets divided by the total count of RTP data packets and expressed as a percentage.

[0057] It is to be appreciated that block 220 and block 230 may take place in this sequence, or a reverse sequence, or may take place at the same time.

[0058] Block 240 includes: based on the proportion of abnormal data packets during the voice periods and the proportion of abnormal data packets during the call period, ascertaining the status type information of the target media address. Examples of block 240 are detailed in later paragraphs.

[0059] It is to be appreciated that the outbound calling system may, optionally, selectively generate voice recognition information based on the call quality score of the target voice call. In an example, when the call quality score of the target voice call is equal to or greater than the network anomaly threshold, the monitoring module of the outbound calling system may

generate voice recognition information based on an audio of the target voice call; otherwise, it may not obtain the audio of the target voice call and/or generate voice recognition data therefrom. In an example, when the call quality score of the target voice call is less than the network anomaly threshold, i.e., when the status type information of the media address corresponding to the target voice call has already been determined to be a network anomaly, the steps of obtaining the audio of the target voice call and recognition may be omitted. This is beneficial in reducing the operational load of the monitoring module of the outbound calling system and improving the efficiency of voice quality monitoring.

[0060] Voice recognition information includes voice periods containing human voice and non-voice periods having no human voice. This information may be used alone or in combination with other criteria, such as but not limited to abnormal data packet information, to further evaluate the status type information of the target media address.

[0061] In an example, an initial evaluation may be made based on whether there is a network anomaly at the target media address based on the call quality score, the proportion of abnormal data packets, etc. If there is a potential network anomaly, e.g., the call quality score is within a predetermined borderline range of the network anomaly threshold but does not meet the criteria for determining a network anomaly, e.g., is not less than the network anomaly threshold, further evaluation may be performed on the voice periods and non-voice periods based on the voice recognition information as well as the proportion of abnormal data packets during these periods. If the proportion of abnormal data packets during the voice periods is significantly higher than that during the non-voice periods, and satisfies a predetermined business-type fluctuation threshold condition, the status type information of the target media address may be ascertained as business-type fluctuation anomaly. The proportion of abnormal data packets during the voice periods may be ascertained based on a total count of abnormal data packets during the voice periods and a total count of data packets during the voice periods. Likewise, the proportion of abnormal data packets during the non-voice periods may be ascertained based on a total count of abnormal data packets during the non-voice periods and a total count of data packets during the non-voice periods.

[0062] Block 300 includes: based on the ascertained status type information of the target media address, ascertaining a call routing status for the target media address. Block 300 may be performed by a monitoring module of the outbound voice calling system.

[0063] The outbound call system continuously monitors voice calls via media addresses and stores information about the voice calls and media address status type information in the status type history of the media address. This status type history may include, but is not limited to, the media address, the start and end timestamps of voice calls via the media address, and the determined status type. A record in the status type history of media IP address A may

include: "IP address_111.111.1.1, call_2024-01-01_11:00:00-11:05:00, status type_normal". Adjustments to outbound calls for at least some media addresses can be made based on the determined status type information of at least some media addresses as described in blocks 310 to 320 (see Figure 3) which may be performed by a monitoring tool of the outbound voice calling system.

[0064] Block 310 includes: ascertaining a plurality of voice call counts during a predetermined time period which are respectively associated with the media addresses; ascertaining at least a first one of the voice call counts as exceeding a predetermined monitoring threshold, wherein the at least first one of the voice call counts corresponds to at least a first one of the media addresses; based on the first one of the voice call counts exceeding the predetermined monitoring threshold, ascertaining, with respect to the first one of the media addresses, a plurality of occurrence counts corresponding to a plurality of status type information during the predetermined time period.

[0065] In an example, when the outbound call system ascertains that a count of voice calls via a certain media address is greater than or equal to the monitoring threshold within a predetermined time period, the outbound call system retrieves a status type history of the media address and obtains a count of occurrences of various status type information for the media address within the predetermined time period based on this status type history. For example, the monitoring threshold may be set to 10, and the preset duration is 1 hour. The monitoring module of the outbound call system determines that a count of outbound calls for media IP address 111.111.1.1 equals 10 within 1 hour. The monitoring module reads the status type history of this media IP address and determines that the number of occurrences of various status type information for this media IP address in the past 1 hour is: network anomaly: 0, business-type fluctuation anomaly: 1, network-type fluctuation anomaly: 1, normal: 8.

[0066] Block 320 includes: based on the occurrence counts, updating a routing control status of the first one of the media addresses. In particular, call routing for a particular media address is based on the count occurrences of various status type information for the particular media address. In an example, a routing control status of media address IP3 is set to normal routing if this address has the highest normal status occurrence count among the various media IP address. In an example, a routing control status of media address IP4 may be set to stop routing if this address has the highest network anomaly occurrence count among the various media IP address regardless of its normal status occurrence count.

[0067] Block 400 includes: selecting, from the media addresses, a particular media address for an outbound voice call based on the routing control status of the particular media address. In an example, a media address with normal routing status may be selected for an outbound voice call, while another media address with stop routing status may not be selected for the

outbound voice call. Block 400 may be performed by a soft switch of the outbound voice calling system.

[0068] Variations to the flow chart may be envisaged.

[0069] For example, block 100 may be preceded by blocks 80 and 90 (see Figure 1).

[0070] Block 80 includes: recording or storing call data of a plurality of voice calls. In an example, the outbound calling system may include a soft switch configured to record call data of voice calls. Non-limiting examples of the soft switch include FreeSWITCH, Asterisk, OpenSIPS, etc. In an example, the soft switch FreeSWITCH may be used to record call data of voice calls, such as recording Call Detail Records (CDRs). The CDR may include Media IP, Media Port, Start Time, End Time, Duration, Codec, RTP Statistics, etc., and can be used to further generate call records.

[0071] Block 90 includes: generating call records based on call data of voice calls. Each call record may include but is not limited to call quality score, voice recognition information (optional), abnormal data packet information, and media address, all corresponding to the voice call.

[0072] In an example, the call quality score may be used to evaluate the overall quality of a voice call. The call quality score may be generated based on preset scoring criteria and the call data of the voice call recorded by the outbound calling system. In an example, the predetermined scoring criteria include but are not limited to the E-Model-based voice quality scoring criteria based on transmission network parameters, and/or the Mean Opinion Score (MOS) quality scoring criteria based on subjective voice evaluation.

[0073] Where the outbound calling system uses the E-Model-based voice quality scoring criteria, the soft switch ascertains the basic signal-to-noise ratio, end-to-end delay, codec factors, and packet loss rate of the target voice call based on the codec and RTP statistics in the recorded CDR, and determines the call quality score R based on the above information.

[0074] The abnormal data packet information may include a total count of abnormal data packets, timestamps of abnormal data packets, and a total count of data packets in the target voice call.

[0075] In an example, the soft switch of the outbound calling system may ascertain a total count and number and timestamps of abnormal data packets during the target voice call based on the RTP statistics in the CDR. The abnormal data packets may include lost data packets and delayed data packets during the target voice call. The lost data packets may include unsuccessfully transmitted data packets, while the delayed data packets may include data packets that are not sent/received at fixed time intervals.

[0076] The target voice call may be encoded and transmitted at a sampling rate of 8 kHz between the outbound calling system's media address IP1 and the customer's media address IP2. RTP data packets may be continuously sent in both directions between media addresses IP1 and IP2 at a fixed time interval of 20 ms, and each RTP data packet has a sequence number. The soft router SWITCH may ascertain, based on the RTP statistics in the CDR, that three consecutive data packets are received from IP2: "Packet_100, Reception Time_10:00:00.000, IP2", "Packet_102, Reception Time_10:00:00.040, IP2", "Packet_103, Reception Time_10:00:00.075, IP2". Since the sequence numbers of the adjacent packets, Packet_100 and Packet_102, are not consecutive, Packet 101 may be determined as an abnormal data packet (lost data packet). Although the sequence numbers of the adjacent packets, Packet_102 and Packet_103, are consecutive, the reception time interval is 35 ms, which does not match the fixed time interval of 20 ms, so Packet 103 may be determined as an abnormal data packet (delayed data packet). Other methods of obtaining abnormal package data packet information may be envisaged. For example, abnormal data packet information can also be obtained based on the information of received RTP data packets fed back from the customer's media address.

[0077] The voice recognition information may be generated by the outbound calling system through voice recognition of the audio of the target voice call. The voice recognition information may include voice time segments and non-voice time segments obtained by recognizing the target voice call. In an example, the outbound calling system may use Automatic Speech Recognition (ASR) technology to separate voices from the audio of the target voice call and ascertain the voice time segments and non-voice time segments within the target voice call period.

[0078] The outbound calling system may selectively generate voice recognition information based on the call quality score of the target voice call.

[0079] Block 240 may include block 241 to block 244 (see Figure 4) which may be performed by a monitoring module of the outbound voice calling system.

[0080] Block 241 includes: based on the proportion of abnormal data packets during the voice periods being greater than or equal to a predetermined abnormality threshold for voice data packets, and the proportion of abnormal data packets during the call period being greater than or equal to a predetermined business abnormality threshold, ascertaining the status type information of the target media address as business-type fluctuation anomaly.

[0081] Block 242 includes: based on the proportion of abnormal data packets during the voice periods being greater than or equal to the predetermined abnormality threshold for voice data packets, and the proportion of abnormal data packets during the call period being less than

the predetermined business abnormality threshold, ascertaining the status type information of the target media address as normal state.

[0082] When the proportion of abnormal data packets during the voice periods is greater than or equal to the abnormality threshold for voice data packets, it indicates that network fluctuations mainly occur during the time periods when the user is speaking, rather than being evenly distributed throughout the voice call. Such network fluctuations may originate from issues with the receiving device's performance or problems with the operator's intermediate business forwarding and processing. This can be judged by combining the proportion of abnormal data packets: when the proportion of abnormal data packets is greater than or equal to the predetermined business abnormality threshold, the status type information of the media address is set to business-type fluctuation anomaly; otherwise, it is set to normal state. The abnormality threshold for voice data packets may be set to 80%, and the business abnormality threshold may be set to 2%. However, it is understood that higher or lower abnormality thresholds may be set.

[0083] Block 243 includes: based on the proportion of abnormal data packets during the voice periods being less than the predetermined abnormality threshold for voice data packets, and the proportion of abnormal data packets during the call period being greater than or equal to the network abnormality threshold, ascertaining the status type information of the target media address as network-type fluctuation anomaly.

[0084] Block 244 includes: based on the proportion of abnormal data packets during the voice periods being less than the predetermined abnormality threshold for voice data packets, and the proportion of abnormal data packets during the call period being less than the predetermined network abnormality threshold, ascertaining the status type information of the target media address as normal state.

[0085] When the proportion of abnormal data packets during the voice periods is less than the abnormality threshold for voice data packets, it indicates that network fluctuations are evenly distributed throughout the voice call. Such network fluctuations may originate from random fluctuations occurring during network transmission and can be judged by combining the proportion of abnormal data packets: when the proportion of abnormal data packets is greater than or equal to the network abnormality threshold, the status type information of the target media address is set to a network-type fluctuation anomaly; otherwise, it is set to normal state.

[0086] The abnormality threshold for voice data packets may be set to 80%, and the network-type fluctuation abnormality threshold may be set to 5%. However, it is understood that higher or lower abnormality thresholds may be set.

[0087] For illustrative purposes and without limitation, in intelligent outbound voice calling services, business-type abnormal fluctuations caused by operators are less likely to occur, but

such abnormalities will impact the overall outbound calling service, while network-type fluctuation abnormalities usually concentrate in a certain time period or on certain media addresses. Therefore, optionally, the business abnormality threshold is less than or equal to the network abnormality threshold. The business abnormality threshold may be set to 2%, and the network abnormality threshold may be set to 5%.

[0088] Block 320 may include block 321 to block 323, which may be performed by a monitoring module and a soft switch of the outbound voice calling system.

[0089] Block 321 includes: based on a proportion of network anomaly occurrences, i.e., occurrence counts corresponding to network anomaly, during the predetermined time period being greater than a predetermined network anomaly proportion threshold, generating an alarm message and stopping or disallowing routing for the target media address. In block 321 to block 323, the step of generating the alarm message may be performed by the monitoring module, while the step of stopping or disallowing routing for the target media address may be performed by the soft switch.

[0090] The network anomaly occurrences proportion is calculated based on a count of network anomaly occurrences within the predetermined time period and a sum of the plurality of occurrence counts corresponding to the plurality of status type information during the predetermined time period. For example, a proportion of network anomaly occurrences = a count of network anomaly occurrences within the predetermined time period ÷ a total count of occurrences of various status type information within the predetermined time period.

[0091] The predetermined network anomaly proportion threshold may be set to 50%. The monitoring module of the outbound call system determines that a count of outbound calls for media IP address 111.111.1.1 equals 10 within 1 hour. The monitoring module starts reading the status type history of this media IP address and determines that the number of occurrences of various status type information for this media IP address in the past 1 hour is: network anomaly: 6, business-type fluctuation anomaly: 1, network-type fluctuation anomaly: 0, normal: 3. Thus, the calculated proportion of network anomaly occurrences = 6 ÷ 10 × 100% = 60% > 50%. At this point, an alarm message will be generated and routing for IP address 111.111.1.1 will be stopped.

[0092] Block 322 includes: based on a proportion of business-type fluctuation anomaly occurrences being greater than a predetermined business-type fluctuation proportion threshold, generating an alarm message and stopping or disallowing routing for the target media address.

[0093] The proportion of business-type fluctuation anomaly occurrences is calculated based on a count of business-type fluctuation anomaly occurrences within the predetermined time period and a sum of the plurality of occurrence counts corresponding to the plurality of status

type information during the predetermined time period. For example, proportion of business-type fluctuation anomaly occurrences = a count of business-type fluctuation anomaly occurrences within the predetermined time period ÷ a total count of occurrences of various status type information within the predetermined time period. In an example, the predetermined business-type fluctuation proportion threshold may be set to 20%.

[0094] Block 323 includes: based on a proportion of network-type fluctuation anomaly occurrences being greater than a predetermined network-type fluctuation anomaly threshold, generating an alarm message and stopping or disallowing routing for the target media address.

[0095] The proportion of network-type fluctuation anomaly occurrences is calculated based on a count of network-type fluctuation anomaly occurrences within the predetermined time period and a sum of the plurality of occurrence counts corresponding to the plurality of status type information during the predetermined time period. For example, a proportion of network-type fluctuation anomaly occurrences = a count of network-type fluctuation anomaly occurrences within the preset duration ÷ a total count of occurrences of various status type information within the predetermined time period. The predetermined network-type fluctuation anomaly threshold may be set to 30%.

[0096] It is to be understood that the numerical values of the proportion thresholds are provided as examples only, and a person skilled in the art may adjust the proportion thresholds according to requirements. This disclosure does not impose limitations in this regard.

[0097] If various counts of network anomaly occurrences, business-type fluctuation anomaly occurrences, and network-type fluctuation anomaly occurrences for a target media address within a predetermined time period, e.g., past 1 hour, are all less than the corresponding thresholds, no alarm message will be generated, and routing for the target media address will continue.

[0098] For media addresses that have not generated alarm messages, the outbound call system may continue to monitor the media addresses, calculate the number of occurrences of various status type information in the predetermined time period before the latest voice call for the media addresses, and control the call routing for the media addresses.

[0099] A monitoring duration threshold may be set. For media addresses that have not generated alarm messages during monitoring, the outbound call system may continue to monitor the media addresses within the monitoring duration threshold. If no alarm message is generated for the media addresses within the monitoring duration threshold, and the number of voice calls associated with the media addresses is less than the monitoring threshold within a preset time, monitoring of the media addresses can be stopped.

[0100] A monitoring duration threshold may be set. For media addresses that have not generated alarm messages during monitoring, the outbound call system may continue to

monitor the media addresses within the monitoring duration threshold. If no alarm message is generated for the media addresses within the monitoring duration threshold, and the number of voice calls associated with the media addresses is less than the monitoring threshold within a preset time, monitoring of the media addresses can be stopped.

[0101] A monitoring duration threshold may be set. For media addresses that have not generated alarm messages during monitoring, the outbound call system may continue to monitor the media addresses within the monitoring duration threshold. If no alarm message is generated for the media addresses within the monitoring duration threshold, and the number of voice calls associated with the media addresses is less than the monitoring threshold within a preset time, monitoring of the media addresses can be stopped.

[0102] An intelligent outbound voice calling system may include a user interface, a call controller, a soft switch, a media server, a speech recognition module, an alarm and routing control module, a database, network components and any other components. The user interface may be configured to receive call requests and inputs from users. The call controller, which may include a monitoring module, communicably coupled to the user interface, may be configured to process call requests, select appropriate media addresses for calling, and monitor the call process. The soft switch, e.g., soft router, communicably coupled to the call controller (monitoring module), may be configured to perform switching for calls, establish, manage, and terminate call connections. The soft switch may also be configured to record call data for voice calls, including Call Detail Records (CDRs), RTP statistics, and other information; and generate call records including ascertaining call quality scores. The soft switch is one of the core components of the system, responsible for recording call data for voice calls and providing this data to other components for analysis and processing. The media server, communicably coupled to the soft switch, may be configured to transmit and store media streams such as audio and video. The voice recognition module, which may be incorporated in the monitoring module, may be configured to use Automatic Speech Recognition (ASR) technology to separate and recognize human voices in the audio of target voice calls and generate speech recognition information. The alarm and routing control module, which may be incorporated in the monitoring module, may be configured to generate alarm information based on the status type information of media addresses and control the call routing for media addresses. If a media address has network anomalies or business-type fluctuation anomalies, this module will generate alarm information and stop the routing for that particular media address. Both the speech recognition module and the alarm and routing module are communicably coupled to the soft switch. The database, communicably coupled to the soft switch, may be configured to store information such as call records and historical status types of media addresses. The above components are configured to communicate and collaborate through an internal network connection, such as a local area network, to

collectively implement the operations or steps of the outbound call system as described in the present disclosure. The outbound voice call system is configured to cooperate with an external network, which includes the Internet, telephone networks, etc., to transmit calls to the target recipients. It is to be appreciated that other outbound voice call configurations and connections may be envisaged and capable of implementing the methods described in the present disclosure.

[0103] In some examples, the call controller (monitoring module), soft switch (soft router), media server, speech recognition module, and the alarm and routing control module may be implemented by at least one processor which is communicably coupled to at least one memory which stores computer-executable instructions for performing various operations or steps as described in the present disclosure, including the flowcharts.

[0104] The above-mentioned processor may be any type of computer processor, such as a Central Processing Unit (CPU), a Graphics Processing Unit (GPU), a quantum processor, a machine learning processor, an artificial intelligence processor, a neural network processor, an artificial intelligence accelerator, an application specific integrated circuit (ASIC), an analog signal processor, an analog computer, a microprocessor, a digital signal processor, a field programmable gate array (FPGA), a tensor processing unit (TPU), a data processing unit (DPU), etc., or other device configured to execute code or computer-executable instructions to perform or implement the flowcharts, algorithms, processes, or operations detailed herein. The memory may be a non-transitory computer readable medium or machine readable medium for storing or comprising the code or computer-executable instructions. Examples include, but are not limited to, volatile memory, e.g., DRAM), nonvolatile memory, e.g., read-only memory (ROM), high bandwidth memory (HBM), flash memory, solid state memory, and/or a hard drive).

[0105] It is to be appreciated that the flow charts showing logic flows are representative of exemplary methodologies for performing novel aspects of the invention. While, for purposes of simplicity of explanation, the one or more methodologies shown herein are shown and described as a series of acts, those skilled in the art will understand and appreciate that the methodologies are not limited by the order of acts. Some acts may, in accordance therewith, occur in a different order and/or concurrently with other acts from that shown and described herein. For example, those skilled in the art will understand and appreciate that a methodology could alternatively be represented as a series of interrelated states or events, such as in a state diagram. Moreover, not all acts illustrated in a methodology may be required for a novel implementation.

[0106] The flow charts showing logic flow and the described modules may be implemented in software, firmware, hardware, or any combination thereof. In software and firmware

embodiments, the logic flow and modules may be implemented by computer executable instructions or code stored on a non-transitory computer-readable medium or machine readable medium, such as an optical, magnetic or semiconductor storage. The computer-executable instructions are configured to direct at least one computer processor to perform the logic flow. The embodiments are not limited in this context.

[0107] Embodiments of the present disclosure are advantageous at least in that disclosed methods and systems enable monitoring of call quality of outbound voice calls at the media transmission level and are widely applicable to outbound calling systems based on connection protocols or connectionless protocols. By comprehensively analyzing the call quality score, voice recognition information, and abnormal data packet information, specific types of network anomalies for media addresses can be identified or distinguished while media addresses with good network conditions can be selected for outbound calling, thereby optimising the voice call quality of the outbound calling system and enhancing user experience.

[0108] It is to be understood that the embodiments and features described above should be considered exemplary and not restrictive. Many other embodiments will be apparent to those skilled in the art from consideration of the specification and practice of the invention. Furthermore, certain terminology has been used for the purposes of descriptive clarity, and not to limit the disclosed embodiments of the invention.

CLAIMS

[Claim 1] A method of monitoring and optimising voice call quality, the method comprising:

performing monitoring of a plurality of voice calls associated with a plurality of media addresses, including:

acquiring a call record of each target voice call of the voice calls, wherein the call record includes a call quality score, an abnormal data packet information, and a target media address which corresponds to the each target voice call, wherein the media addresses include the target media address;

based on the call quality score, and the abnormal data packet information, ascertaining a status type information of the target media address;

based on the ascertained status type information of the media address, ascertaining a call routing status for the media address; and

selecting, from the media addresses, a particular media address for an outbound voice call based on a corresponding call routing status of the particular media address,

wherein the step of based on the call quality score, and the abnormal data packet information, ascertaining the status type information of the media address includes:

based on the call quality score being less than a network anomaly threshold, ascertaining the status type information of the target media address as a network anomaly;

wherein based on the call quality score being equal to or higher than the network anomaly threshold, performing:

based on a count of abnormal data packets during a plurality of voice periods, a count of abnormal data packet time points during a call period, and a total count of abnormal data packets during the call period, ascertaining a proportion of abnormal data packets during the voice periods, wherein the call period comprises the voice periods and a plurality of non-voice periods;

based on the total count of abnormal data packets during the call period and a total count of data packets during the call period, ascertaining a proportion of abnormal data packets during the call period; and

based on the proportion of abnormal data packets during the voice periods and the proportion of abnormal data packets during the call period, ascertaining the status type information of the target media address; and

wherein based on the call quality score being equal to or higher than the network anomaly threshold and within a predetermined borderline range of the network anomaly threshold, the proportion of abnormal data packets during the voice periods being higher than a proportion of abnormal data packets during the non-voice periods by a predetermined margin,

ascertaining the status type information of the target media address as business-type fluctuation anomaly.

[Claim 2] The method of claim 1, wherein the step of based on the proportion of abnormal data packets during the voice periods and the proportion of abnormal data packets during the call period, ascertaining the status type information of the target media address includes:

based on the proportion of abnormal data packets during the voice periods being greater than or equal to an abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being greater than or equal to a business abnormality threshold, ascertaining the status type information of the target media address as business-type fluctuation anomaly;

based on the proportion of abnormal data packets during the voice periods being greater than or equal to the abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being less than the business abnormality threshold, ascertaining the status type information of the target media address as normal state;

based on the proportion of abnormal data packets during the voice periods being less than the abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being greater than or equal to the business abnormality threshold, ascertaining the status type information of the target media address as network-type fluctuation anomaly; and

based on the proportion of abnormal data packets during the voice periods being less than the abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being less than the business abnormality threshold, ascertaining the status type information of the target media address as normal state.

[Claim 3] The method of claim 1 or claim 2, wherein the step of based on the ascertained status type information of the media address, ascertaining a call routing status for the media address includes:

ascertaining a plurality of voice call counts during a predetermined time period which are respectively associated with the media addresses;

ascertaining at least a first one of the voice call counts as exceeding a predetermined monitoring threshold, wherein the at least first one of the voice call counts corresponds to at least a first one of the media addresses;

ascertaining, with respect to the first one of the media addresses, a plurality of occurrence counts corresponding to a plurality of status type information during the predetermined time period;

based on the occurrence counts, updating a routing control status of the first one of the media addresses.

[Claim 4] The method of claim 3, wherein the occurrence counts corresponding to status type information during the predetermined time period includes a first occurrence count corresponding to network anomaly or business-type fluctuation or network-type fluctuation, wherein the step of based on the occurrence counts, updating a routing control status of the first one of the media addresses includes:

based on the first occurrence count and a total count of the occurrence counts corresponding to network anomaly or business-type fluctuation or network-type fluctuation, ascertaining a proportion of the first occurrence count during the predetermined time period;

based on the proportion of the first occurrence count being greater than a first predetermined proportion threshold corresponding to network anomaly or business-type fluctuation or network-type fluctuation, generating an alarm message and stopping or disallowing call routing to the first one of the media addresses.

[Claim 5] The method of any one of claim 1 to claim 4, wherein prior to acquiring the call record of each target voice call of the voice calls**,** the method further comprising:

storing call data of the voice calls; and

generating the call record of the each target voice call.

[Claim 6] A non-transitory computer-readable medium comprising computer-executable instructions configured to direct at least one computer processor to perform the method according to any one of claim 1 to claim 5.

[Claim 7] An outbound voice calling system configured to monitor and optimise voice call quality, the system comprising:

at least one memory for storing computer-executable instructions; and

at least one processor communicably coupled to the at least one memory, and configured to:

execute the computer-executable instructions to perform the method according to any one of claim 1 to claim 5.

[Claim 8] An outbound voice calling system configured to monitor and optimise voice call quality, the system comprising:

a monitoring module which is configured to:

perform monitoring of a plurality of voice calls associated with a plurality of media addresses, including:

acquire a call record of each target voice call of the voice calls, wherein the call record includes a call quality score, an abnormal data packet information, and a target media address which corresponds to the each target voice call, wherein the media addresses include the target media address;

based on the call quality score, and the abnormal data packet information, ascertain a status type information of the target media address;

based on the ascertained status type information of the media address, ascertain a call routing status for the media address; and

a soft switch communicably coupled to the monitoring module and configured to:

select, from the media addresses, a particular media address for an outbound voice call based on a corresponding call routing status of the particular media address;

wherein the monitoring module is further configured to:

based on the call quality score being less than a network anomaly threshold, ascertain the status type information of the target media address as a network anomaly;

wherein the monitoring module is further configured to:

based on the call quality score being equal to or higher than the network anomaly threshold, perform the following steps:

based on a count of abnormal data packets during a plurality of voice periods, a count of abnormal data packet time points during a call period, and a total count of abnormal data packets during the call period, ascertain a proportion of abnormal data packets during the voice periods, wherein the call period comprises the voice periods and a plurality of non-voice periods;

based on the total count of abnormal data packets during the call period and a total count of data packets during the call period, ascertain a proportion of abnormal data packets during the call period; and

based on the proportion of abnormal data packets during the voice periods and the proportion of abnormal data packets during the call period, ascertain the status type information of the target media address; and

wherein the monitoring module is further configured to:

based on the call quality score being equal to or higher than the network anomaly threshold and within a predetermined borderline range of the network anomaly threshold, the proportion of abnormal data packets during the voice periods being higher than a proportion of abnormal data packets during the non-voice periods by a predetermined margin, ascertain the status type information of the target media address as business-type fluctuation anomaly.

[Claim 9] The system of claim 8, wherein the monitoring module is further configured to:

based on the proportion of abnormal data packets during the voice periods being greater than or equal to an abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being greater than or equal to a business abnormality threshold, ascertain the status type information of the target media address as business-type fluctuation anomaly;

based on the proportion of abnormal data packets during the voice periods being greater than or equal to the abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being less than the business abnormality threshold, ascertain the status type information of the target media address as normal state;

based on the proportion of abnormal data packets during the voice periods being less than the abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being greater than or equal to the business abnormality threshold, ascertain the status type information of the target media address as network-type fluctuation anomaly; and

based on the proportion of abnormal data packets during the voice periods being less than the abnormality threshold for voice data packets and the proportion of abnormal data packets during the call period being less than the business abnormality threshold, ascertain the status type information of the target media address as normal state.

[Claim 10] The system of claim 8 or claim 9, wherein the monitoring module is further configured to:

ascertain a plurality of voice call counts during a predetermined time period which are respectively associated with the media addresses;

ascertain at least a first one of the voice call counts as exceeding a predetermined monitoring threshold, wherein the at least first one of the voice call counts corresponds to at least a first one of the media addresses;

ascertain, with respect to the first one of the media addresses, a plurality of occurrence counts corresponding to a plurality of status type information during the predetermined time period;

wherein the soft switch is further configured to:

based on the occurrence counts, updating a routing control status of the first one of the media addresses.

[Claim 11] The system of claim 10, wherein the monitoring module is further configured to:

based on the first occurrence count and a total count of the occurrence counts corresponding to network anomaly or business-type fluctuation or network-type fluctuation, ascertain a proportion of the first occurrence count during the predetermined time period;

based on the proportion of the first occurrence count being greater than a first predetermined proportion threshold corresponding to network anomaly or business-type fluctuation or network-type fluctuation, generate an alarm message;

wherein the soft switch is further configured to:

based on the alarm message, stop or disallow call routing to the first one of the media addresses.

[Claim 12] The system of claim 8 to claim 11, wherein the soft switch is further configured to: store call data of the voice calls, wherein the monitoring module is further configured to: generate the call record of the each target voice call.