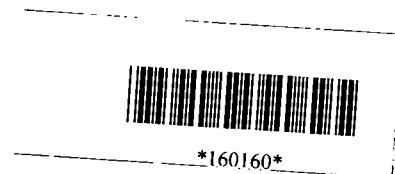


# HOME GATEWAY AND METHOD FOR ANALYZING NETWORK ACCESSING BEHAVIOR OF USER AND MONITORING NETWORK QUALITY

## BACKGROUND



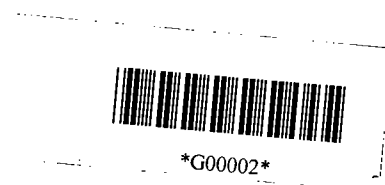
### 5 Technical Field

The present invention relates to a home gateway, and in particular, to a home gateway and a method for analyzing user online behavior and monitoring network quality.

### Related Art

10 With the popularity of fiber to the home, a variety of Internet-based data services become increasingly diverse, and the services are inseparable from a home gateway. The home gateway is an intelligent home network interface unit, achieves interoperability between an external access network and multiple Internet devices in a household, so that a user can obtain a variety of services (including existing services and possible future services).

15 With rapid development of Internet and the rise of a variety of network applications, more and more business information and business activities are released and performed on the Internet, therefore click to visit frequency of online users, to some extent, may reflect potential business values of the Internet. When some information is more frequently clicked by a user, it indicates that the information is more popular and has greater potential  
20 business opportunities. To this end, the business information may be obtained by analyzing user online behavior and be utilized to summarize market trends, mine business hotspots, thereby contributing to rapid and stable growth of the market economy. In the meantime, with the rapid development of the Internet, users demand increasingly high network quality, which brings about various pressures on network providers. To solve the  
25 network quality problem, the provider is required to real-time monitor network quality and make a corresponding adjustment on the network according to a monitoring result, so that



users can enjoy the best service.

The foregoing business information and network quality are reflected based on a home gateway, and the home gateway is becoming increasingly prominent. Currently, a home gateway based on PON uplink has gradually replaced a home gateway based on LAN uplink, therefore, how to use a home gateway to achieve analysis of user online behavior is very important for a provider, which is also an urgent problem.

## SUMMARY

The technical problem to be solved by the present invention is how to use a home gateway to achieve analysis of user online behavior.

To solve the foregoing technical problem, the technical solution adopted by the present invention is to provide a method for analyzing user online behavior and monitoring network quality in a home gateway, and the method includes the following steps.

A10. Collect user online data, specifically: analyze a data packet arriving at a home gateway according to characteristics of an object to be monitored, and generate a corresponding online behavior CSV file according to analyzed data and upload the file to an FTP server.

A20. Monitor network quality, specifically: simulate periodically, by the home gateway, PPPOE dial-up, actively initiate TCP, DNS, HTTP and FTP service availability detection, generate a corresponding network quality CSV file according to a detection result and upload the file to the FTP server.

A30. Analyze the online behavior CSV file and the network quality CSV file, to obtain user online behavior and network quality results.

In the foregoing solution, in step A10 and step A20, the online behavior CSV file and the network quality CSV file are uploaded to a specified FTP server according to an upload cycle delivered by an integrated terminal management system.

In the foregoing solution, in step A30, the statistical analysis is implemented by a WEB client.

5 In the foregoing solution, in step A10, a hook point is mounted at NF\_PREROUTING\_HOOK in a Netfilter frame of a Linux kernel of the home gateway, the data packet is analyzed in a hook function according to characteristics of objects to be monitored, valid information is uploaded to an application layer by means of Netlink communication, and the application layer further collates the valid information, to obtain a result of the user online behavior.

10 In the foregoing solution, the process of analyzing the data packet in the home gateway is as follows.

A101. Analyze an IP address, a port and a protocol of the data packet in the hook point at NF\_PREROUTING\_HOOK in the Netfilter frame when the data packet passes through the Linux kernel.

15 A102. Determine whether the protocol of the data packet is IPPROTO\_TCP, if yes, the process proceeds to A103, and otherwise, the process skips to A104.

A103. Execute QQ analysis to determine whether a destination port is 80, if yes, the process proceeds to A105, and otherwise, the process skips to A106.

A104. Determine whether the data packet is IPPROTO\_ICMP, if yes, adding 1 to the number of icmp packets, and otherwise, the process skips to A116.

20 A105. Execute HTTP protocol analysis.

A106. Determine whether the destination port is 25, if yes, the process proceeds to A107, otherwise, the process skips to A108.

A107. Analyze a sent mail.

A108. Determine whether the destination port is 110, if yes, the process proceeds to

A109, and otherwise, the process skips to A110.

A109. Analyze a received mail.

A110. Determine whether the destination port is 1863, if yes, the process proceeds to A111, and otherwise, the process skips to A112;

5       A111. Analyze MSN login.

A112. Determine whether the destination port is 1863, if yes, the process proceeds to A113, and otherwise, the process skips to A114;

A113. Analyze MSN logout.

10       A114. Determine whether the destination port is 16000, if yes, the process proceeds to A115, and otherwise, the process goes back to A102 to analyze next data packet.

A115. Analyze AliWangWang.

A116. Determine whether protocol of the data packet is IPPROTO\_UDP, if yes, the process proceeds to A117, and otherwise, the process goes back to A102 to analyze next data packet.

15       A117. Perform QQ analysis.

In the foregoing solution, when QQ protocol analysis is performed, analysis is performed for data packets with all UDP data packet data field starting byte being 0x02, login and logout states and account information are obtained through analysis according to data packet characteristics of QQ login and logout.

20       When MSN protocol analysis is performed, analysis is performed for data packets with all source ports and destination ports being 1863, login and logout states and account information are obtained through analysis according to data packet characteristics of MSN login and logout.

When AliWangWang protocol analysis is performed, analysis is performed for data packets with all source ports and destination ports being 16000, login and logout states and account information are obtained through analysis according to data packet characteristics of AliWangWang login and logout.

- 5        In the foregoing solution, the network quality includes time delay, jitter, packet loss rate and HTTP/FTP service availability.

In the foregoing solution, the network quality monitoring includes the following steps.

- A201. Obtain an SN number, a ping server address, a DNS destination address, an FTP server address, a user name, a password and other information of a gateway device by  
10        reading a configuration file config.

A202. Creat a net\_monitor child thread.

A203. Perform step A204 if the net\_monitor child thread is successfully created, and otherwise, perform step A205.

- A204. Execute the net\_monitor child thread, set a timer cycle sequence in the  
15        net\_monitor child thread to execute the following tests: obtain user basic information, destination address ping test, FTP server availability test, HTTP server availability test, DNS time delay and jitter test.

A205. Monitor the net\_monitor child thread.

- A206.Determine whether the net\_monitor child thread exits in a normal manner, if yes,  
20        the process proceeds to A202, and otherwise, end the network quality monitoring.

- In the foregoing solution, in step A10 and step A20, according to upload periods at different intervals in the configuration file, the online behavior CSV file and the network quality CSV file generated are uploaded to a specified FTP server in batch, the corresponding online behavior CSV file and the network quality CSV file in the gateway  
25        are deleted.

In the foregoing solution, in step A30, communication between the integrated terminal management system and the home gateway comprises communication when the home gateway starts and communication when the home gateway is operating.

When the home gateway starts, the integrated terminal management system first reads  
5 a switching value related to user online behavior in the configuration file beh.conf, if the switching value is 0, no processing is performed; otherwise, whether user online data collection process collect\_data and network quality monitoring process net\_monitor exist simultaneously are determined, if yes, the two processes are killed first and then restarted to enter the procedure that the home gateway is operating; otherwise, if neither collect\_data  
10 nor net\_monitor exists, the two processes are started; if one of collect\_data and net\_monitor exists, the process that exists is killed and the other process is started; a signal sent by the agent process is received and a signal processing function is executed.

When the home gateway is operating, the integrated terminal management system performs uniform configurations and delivers the configurations, the home gateway is  
15 responsible for writing the configurations into a configuration file of user online behavior, sets a switching value to indicate the configurations are valid after the writing, and sends a signal to a process itms\_control; the process itms\_control, after receiving the signal, reads the configuration file to determine whether a switch of a user online behavior analysis function is turned on, determines whether a user online data collection process and a  
20 network quality monitoring process exist if the switch is turned on, kills a process that exists and restarts if either the user online data collection process or the network quality monitoring process exists, and starts the two processes if neither the user online data collection process nor the network quality monitoring process exists.

The present invention further provides a home gateway, and the home gateway  
25 includes a user online data collecting module and a network quality monitoring module. The user online data collecting module analyzes a data packet arriving at the home gateway according to characteristics of an object to be monitored, and generates a corresponding online behavior CSV file according to analyzed data and uploads the file to an FTP server;

the network quality monitoring module periodically simulates PPPOE dial-up, actively initiates TCP, DNS, HTTP and FTP service availability detection, generates a corresponding network quality CSV file according to a detection result and uploads the file to the FTP server.

- 5       The present invention analyzes user online behavior in a home gateway, thereby effectively obtaining corresponding business information, utilizes the business information to summarize market trends and mine business hotspots, thereby contributing to rapid and stable growth of the market economy, and makes a corresponding adjustment on a network according to a network quality monitoring result through monitoring network quality,  
10       thereby providing different services and giving the best service quality to users.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a schematic structural diagram of a user online data collecting module in the present invention;

FIG. 2 is a flow chart of user online data collection in the present invention;

- 15       FIG. 3 is a flow chart of HTTP protocol analysis in the present invention;

FIG. 4 is a flow chart of implementing a network quality monitoring function in the present invention;

FIG. 5 is a diagram of implementing user basic information collection in the present invention;

- 20       FIG. 6 is a diagram of implementing HTTP service availability in the present invention;

FIG. 7 is a flow chart of implementing DNS time delay attainment rate in the present invention;

FIG. 8 is a diagram of interaction between a home gateway and a home gateway

management system when the gateway starts in the present invention; and

FIG. 9 is a diagram of interaction between a home gateway and a home gateway management system when the gateway operates in the present invention.

### DETAILED DESCRIPTION

5       The present invention provides a home gateway and a method for analyzing user online behavior and monitoring network quality, sets a user online data collecting module and a network quality monitoring module in the home gateway, controls execution of the two modules through a process itms\_control in the home gateway, generates according to data that interests a user a corresponding online behavior CSV file and a network quality CSV  
10   file after execution of the user online data collecting module and the network quality monitoring module, uploads the files to a specified FTP server according to an upload cycle delivered by an Integrated Terminal Management System (ITMS), performs statistical analysis on the corresponding online behavior CSV file and network quality CSV file in the FTP server on a WEB client, and outputs an analysis result, so that a provider may have a  
15   clear and direct understanding of user online behavior and network quality.

The method for analyzing user online behavior and monitoring network quality in a home gateway provided by the present invention includes the following steps.

A10. Collect user online data, specifically: analyze a data packet arriving at a home gateway according to characteristics of an object to be monitored (including various instant  
20   messaging software and game software), generate a corresponding online behavior CSV file according to analyzed data in accordance with a specific format and upload the file to an FTP server.

A20. Monitor network quality, specifically: simulate periodically, by the home gateway, PPPOE dial-up, actively initiate TCP, DNS, HTTP and FTP service availability  
25   detection, generate a corresponding network quality CSV file according to a detection result and upload the file to the FTP server.

A30. Analyze the online behavior CSV file and the network quality CSV file, to obtain user online behavior and network quality results.

The present invention is described below in detail in combination with accompanying drawings.

5       (1) Collect user online data.

FIG. 1 is a schematic structural diagram of a user online data collecting module in the present invention and FIG. 2 is a flow chart of user online data collection in the present invention.

User online data collection is implemented by mounting a hook point at a Netfilter  
10 frame of a Linux kernel, a data packet arrives at the hook point, i.e., enters a hook function, data packets of different types to be monitored are analyzed in the hook function to obtain effective monitoring information, the valid information is forwarded to an application layer by means of NetLink communication, and the application layer further filters the information to obtain data that interests a user, generates a corresponding online behavior  
15 CSV file and uploads the file to the FTP server. User online data collection mainly includes the following content.

(a) Record all URLs accessed by a user and time, analyze HTTP protocols (top-level domain name and fully qualified domain name), extract HTTP information, including: searching engine (google, baidu, youdao, and so on) and search key words under the search  
20 engines and consumption website domains (ALI, taobao, and so on);

(b) Analyze mails received and sent by a mail client, extract mail information such as recipients, senders and mail subjects; and

(c) Analyze applications such as QQ, MSN, AliWangWang and Feixin, and extract application information such as application name and access time.

25       The process of analyzing a data packet in a home gateway is illustrated in the

following.

A101. Analyze an IP address, a port and a protocol of the data packet in the hook point at NF\_PREROUTING\_HOOK in the Netfilter frame when the data packet passes through the Linux kernel.

- 5        A102. Determine whether the protocol of the data packet is IPPROTO\_TCP, if yes, the process proceeds to A103, and otherwise, the process skips to A104.

A103. Execute QQ analysis to determine whether a destination port distport is 80, if yes, the process proceeds to A105, and otherwise, the process skips to A106.

- 10       A104. Determine whether the data packet is IPPROTO\_ICMP, if yes, execute icmppkg++ (adding 1 to the number of icmp packets), and otherwise, the process skips to A116.

A105. Execute HTTP protocol analysis (the analysis process is as shown in FIG. 3).

A106. Determine whether the destination port distport is 25, if yes, the process proceeds to A107, otherwise, the process skips to A108.

- 15       A107. Analyze a sent mail.

A108. Determine whether a source port srcport is 110, if yes, the process proceeds to A109, otherwise, the process skips to A110.

A109. Analyze a received mail.

- 20       A110. Determine whether the source port srcport is 1863, if yes, the process proceeds to A111, and otherwise, the process skips to A112.

A111. Analyze MSN login.

A112. Determine whether the destination port distport is 1863, if yes, the process proceeds to A113, and otherwise, the process skips to A114.

A113. Analyze MSN logout.

A114. Determine whether the destination port distport is 16000, if yes, the process proceeds to A115, and otherwise, the process goes back to A102 to analyze next data packet.

5        A115. Analyze AliWangWang.

A116. Determine whether protocol of the data packet is IPPROTO\_UDP, if yes, the process proceeds to A117, and otherwise, the process goes back to A102 to analyze next data packet.

A117. Perform QQ analysis.

10       In the foregoing solution, when QQ protocol analysis is performed, analysis is performed for data packets with all UDP data packet data field starting byte being 0x02, login and logout states and account information are obtained through analysis according to data packet characteristics of QQ login and logout.

15       When MSN protocol analysis is performed, analysis is performed for data packets with all source ports and destination ports being 1863, login and logout states and account information are obtained through analysis according to data packet characteristics of MSN login and logout.

20       When AliWangWang (ALI) protocol analysis is performed, analysis is performed for data packets with all source ports and destination ports being 16000, login and logout states and account information are obtained through analysis according to data packet characteristics of AliWangWang login and logout.

As shown in FIG. 3, the process of HTTP protocol analysis is as follows.

A1051. Determine whether a data packet has GET, the process proceeds to A1052 if yes, and otherwise, the process skips to A1055.

A1052. Determine whether an obtained link is a common URL, if yes, the process proceeds to A1053, and otherwise, the process skips to A1055.

A1053. Determine whether the data packet has HOST, the process skips to A1052 if yes, and otherwise, the process skips to A1055.

5       A1054. Indicate that the protocol is not a http protocol, and return to 0.

A1055. Indicate that the protocol is a http protocol, and return to 1.

(2) Network quality monitoring.

The network quality monitoring module mainly monitors quality conditions of the network operation environment, the network quality indicators include TCP connection,  
10   DNS time delay, HTTP service availability and FTP service availability, and other network monitoring data. FIG. 4 is a flow chart of monitoring network quality, including the following major steps:

A201. Obtain an SN number, a ping server address, a DNS destination address, an FTP server address, a user name, a password and other information of a gateway device by  
15   reading a configuration file config.

A202. Create a net\_monitor child thread.

A203. Perform step A204 if the net\_monitor child thread is successfully created, and otherwise, perform step A205.

A204. Execute the net\_monitor child thread, set a timer cycle sequence in the  
20   net\_monitor child thread to execute the following tests: obtain user basic information, destination address ping test, FTP server availability test, HTTP server availability test, DNS time delay and jitter test.

A205. Monitor the net\_monitor child thread.

A206. Determine whether the net\_monitor child thread exits in a normal manner, if yes,

the process proceeds to A202, and otherwise, end the network quality monitoring.

After the network quality monitoring module in a home gateway obtains the unique SN of the home gateway, the module executes child thread `net_monitor` of the network quality monitoring module, the main function of the child thread `net_monitor` is to periodically and cyclically execute sub modules for implementing network quality monitoring (a user basic information obtaining module, a destination address ping test module, an FTP server availability test module, a HTTP server availability test module, and a DNS time delay test module), and program execution efficiency is improved by executing the sub-modules in the child thread `net_monitor`.

10 The function for obtaining user basic information is `get_user_basic_info()`, the process is as shown in FIG. 5, related parameters are read from an XML file of a terminal, corresponding parameters are obtained through system commands, online duration is obtained through a time conversion function, and all are written into a CSV file and uploaded to an FTP server.

15 The step of obtaining corresponding parameters and online duration is as follows.

A20411. Read corresponding parameters from an XML file of a terminal, determine whether there is a command of reading power-up time, if yes, the process skips to A20416, otherwise, the process proceeds to A20412.

A20412. Determine whether there is a command of displaying an MAC address, if yes, the process skips to A20416, and otherwise, the process proceeds to A20413.

A20413. Determine whether there is a command of reading online time, if yes, the process skips to A20416, and otherwise, the process proceeds to A20414.

A20414. Determine whether there is a command of reading offline time, if yes, the process skips to A20416, and otherwise, the process proceeds to A20415.

25 A20415. Determine whether there is a command of displaying the current time, if yes,

the process proceeds to A20416, and otherwise, the process exits.

A20416. Convert the related parameters according to a specified format.

5 A main function for implementing HTTP server availability is `http_service_test_entry()`, the process is as shown in FIG.6, the number of times of request is read in the configuration file `config`, the number of times of request, the number of times of success, the number of times of unavailability, and the number of times of threshold exceeding are initialized, `url` is then analyzed, a HTTP client sends a connection request to a server to obtain user basic information, and the user information is written into a CSV file and is uploaded to an FTP server.

10 The step of analyzing the `url` and sending, by the HTTP client, a connection request to a server to obtain user basic information are as follows.

A20421. Perform a HTTP request for server connection after initializing and analyzing the URL.

15 A20422. Determine whether the number of times of request is less than a preset number of times of request, if yes, perform A20423, and otherwise, perform A20427.

A20423. Determine whether host information is obtained, if yes, the process proceeds to A20424, and otherwise, the process exits.

A20424. Determine whether connection is successful, if yes, the process proceeds to A20425, and otherwise, the process exits.

20 A20425. Determine whether a HTTP state is 302, if yes, the process skips to A20427, and otherwise, the process proceeds to A20426.

A20426. Determine whether the HTTP state is 200, if yes, the process goes back to A20422, and otherwise, the process proceeds to A20427.

A20427. Determine whether the number of times of try is greater than 5, if yes, the

process exits, and otherwise, the process goes back to A20423.

A main function for implementing TCP connection data obtaining is ping\_test\_entry().

A main function for implementing DNS time delay and jitter is dns\_test\_entry(), the process is as shown in FIG. 7, parameters (including the number of times of DNS test, a  
5 DNS test destination domain or a destination IP) are initialized in the configuration file config, a traceroute result is obtained through a pipeline command popen, analysis and statistics are performed on the traceroute result, the result is written into a CSV file, and the CSV file is finally uploaded to the FTP server.

A main function for implementing FTP server availability (FTP upload/download rate)  
10 is FTP\_service\_test(), print the size of a file uploaded each time and get upload time and upload rate through obtaining FTP upload time and file size.

Uploading the online behavior CSV file and the network quality CSV file to the FTP server in batch is implemented as follows:

A default route needs to be added when uploading the online behavior CSV file and the  
15 network quality CSV file, the file is then uploaded, therefore an interface that generates FTP upload script needs to include two functions: adding a default route and uploading files in batch. To this end, the present invention designs two interfaces.

1) An initialization interface: restart the home gateway after the home gateway has no power supply, and perform initialization; or perform initialization after ITMS delivers an IP,  
20 a user/password related to FTP. If initialization is successfully performed, an initialization success flag is set as 1, scripts of get tr069 are deleted, only upload scripts shell are retained; if initialization is not successfully performed, the initialization success flag is set as 0, in this way, whether initialization is successfully performed may be determined through the flag when uploading.

25 2) An upload interface: first determine whether an initialization flag indicates success, if yes, directly execute upload scripts; if the initialization flag indicates not success,

initialization is performed again, if initialization is performed successfully, the flag is set as 1, scripts of get tr069 information are deleted, only upload scripts are retained; if initialization is not performed successfully, the flag is set as 0, generated files are deleted.

5 According to experimental statistics, it takes 30s from the first operation to obtaining the IP and node of tr60 wan link. If initialization or generating scripts are not successfully performed in initialization, initialization or generating scripts may be executed again when executing FTP uploading.

10 Data that interests a user generated by the user online data collecting module and the network quality monitoring module is stored in a path of the home gateway in the form of a CSV file, the present invention reads cycles at different intervals in the configuration file config and uploads the generated online behavior CSV file and network quality CSV file in batch to the specified FTP server according to the upload cycles at different intervals in the configuration file, deletes the corresponding online behavior CSV file and network quality CSV file in the gateway, so that consumption and impact on performance of storage space  
15 in the home gateway is reduced to the lowest level.

(3) Perform statistical analysis on the online behavior CSV file and network quality CSV file on a WEB client.

Communication between ITMS and the home gateway is implemented as follows:

20 The present invention separately establishes in the home gateway process itms\_control which is exclusively responsible for opening and closing the user online behavior analysis function according to requirements of uniform configuration, instant deliver and taking effect instantly, so as to avoid the user online behavior analysis function occupies memory for a long time to affect gateway performance. Semaphore is one manner for communication between processes, and is suitable for communication between  
25 itms\_control and the home gateway because of advantages such as transmission of less information and instant messaging.

When the home gateway is just started, the process of communication between ITMS and the home gateway is as shown in FIG. 8:

A switching value related to user online behavior in the configuration file beh.conf is read, if the value indicates no opening, no processing is performed; otherwise, whether user  
5 online data collection process collect\_data and network quality monitoring process net\_monitor exist simultaneously are determined, if yes, the two processes are killed first and then restarted to enter the procedure that the home gateway is operating; otherwise, if neither collect\_data nor net\_monitor exists, the two processes are started; if one of collect\_data and net\_monitor exists, the process that exists is killed and the other process is  
10 started; a signal sent by the agent (the agent process is responsible for communication between the terminal management system and the home gateway) process is received and a signal processing function is executed.

When the home gateway is operating, interaction between ITMS and the home gateway is as shown in FIG. 9, the ITMS performs uniform configurations and delivers the  
15 configurations, the home gateway is responsible for writing the configurations into a configuration file of user online behavior, sets a switching value to indicate the configurations are valid after the writing, and sends a signal to a process itms\_control; the process itms\_control learns that ITMS delivers the configuration after receiving the signal, reads the configuration file to determine whether the switch of user online behavior  
20 analysis function is turned on, determines whether a user online data collection process and a network quality monitoring process exist if the switch is turned on, kills a process that exists and restarts if either the user online data collection process or the network quality monitoring process exists, and starts the two processes if neither the user online data collection process nor the network quality monitoring process exists.

25 The present invention is not limited to the preferred embodiments, any one should know that any structural change inspired by the present invention, and any technical solution that is identical with or similar to the present invention should fall within the protection scope of the present invention.

## CLAIMS

What is claimed is:

1. A method for analyzing user online behavior and monitoring network quality in a home gateway, comprising:

5       A10. collecting user online data, specifically: analyzing a data packet arriving at a home gateway according to characteristics of an object to be monitored, generating a corresponding online behavior CSV file according to analyzed data and uploading the file to an FTP server;

10       A20. monitoring network quality, specifically: simulating periodically, by the home gateway, PPPOE dial-up, actively initiating TCP, DNS, HTTP and FTP service availability detection, generating a corresponding network quality CSV file according to a detection result and uploading the file to the FTP server; and

      A30. analyzing the online behavior CSV file and the network quality CSV file, to obtain user online behavior and network quality results.

15       2. The method for analyzing user online behavior and monitoring network quality in a home gateway according to claim 1, wherein in step A10 and step A20, the online behavior CSV file and the network quality CSV file are uploaded to a specified FTP server according to an upload cycle delivered by an integrated terminal management system.

20       3. The method for analyzing user online behavior and monitoring network quality in a home gateway according to claim 1, wherein in step A30, the statistical analysis is implemented by a WEB client.

      4. The method for analyzing user online behavior and monitoring network quality in a home gateway according to claim 1, wherein in step A10, a hook point is mounted at NF\_PREROUTING\_HOOK in a Netfilter frame of a Linux kernel of the home gateway,  
25       the data packet is analyzed in a hook function according to characteristics of objects to be

monitored, valid information is uploaded to an application layer by means of Netlink communication, and the application layer further collates the valid information, to obtain a result of the user online behavior.

- 5        5. The method for analyzing user online behavior and monitoring network quality in a home gateway according to claim 4, wherein the process of analyzing the data packet in the home gateway is as follows:

A101. analyzing an IP address, a port and a protocol of the data packet in the hook point at NF\_PREROUTING\_HOOK in the Netfilter frame when the data packet passes through the Linux kernel;

- 10        A102. determining whether the protocol of the data packet is IPPROTO\_TCP, if yes, the process proceeds to A103, and otherwise, the process skips to A104;

A103. executing QQ analysis to determine whether a destination port is 80, if yes, the process proceeds to A105, and otherwise, the process skips to A106;

- 15        A104. determining whether the data packet is IPPROTO\_ICMP, if yes, adding 1 to the number of icmp packets, and otherwise, the process skips to A116;

A105. executing HTTP protocol analysis;

A106. determining whether the destination port is 25, if yes, the process proceeds to A107, otherwise, the process skips to A108;

A107. analyzing a sent mail;

- 20        A108. determining whether the destination port is 110, if yes, the process proceeds to A109, and otherwise, the process skips to A110;

A109. analyzing a received mail;

A110. determining whether the destination port is 1863, if yes, the process proceeds to A111, and otherwise, the process skips to A112;

A111. analyzing MSN login;

A112. determining whether the destination port is 1863, if yes, the process proceeds to A113, and otherwise, the process skips to A114;

A113. analyzing MSN logout;

5       A114. determining whether the destination port is 16000, if yes, the process proceeds to A115, and otherwise, the process goes back to A102 to analyze next data packet;

A115. analyzing AliWangWang;

A116. determining whether protocol of the data packet is IPPROTO\_UDP, if yes, the process proceeds to A117, and otherwise, the process goes back to A102 to analyze next  
10   data packet; and

A117. performing QQ analysis.

6. The method for analyzing user online behavior and monitoring network quality in a home gateway according to claim 5, wherein

when QQ protocol analysis is performed, analysis is performed for data packets with  
15   all UDP data packet data field starting byte being 0x02, login and logout states and account information are obtained through analysis according to data packet characteristics of QQ login and logout;

when MSN protocol analysis is performed, analysis is performed for data packets with  
all source ports and destination ports being 1863, login and logout states and account  
20   information are obtained through analysis according to data packet characteristics of MSN login and logout; and

when AliWangWang protocol analysis is performed, analysis is performed for data packets with all source ports and destination ports being 16000, login and logout states and account information are obtained through analysis according to data packet characteristics

of AliWangWang login and logout.

7. The method for analyzing user online behavior and monitoring network quality in a home gateway according to claim 1, the network quality comprises time delay, jitter, packet loss rate and HTTP/FTP service availability.

- 5        8. The method for analyzing user online behavior and monitoring network quality in a home gateway according to claim 1, wherein the network quality monitoring comprises:

A201. obtaining an SN number, a ping server address, a DNS destination address, an FTP server address, a user name, a password and other information of a gateway device by reading a configuration file config;

- 10       A202. creating a net\_monitor child thread;

A203. performing step A204 if the net\_monitor child thread is successfully created, and otherwise, performing step A205;

- 15       A204. executing the net\_monitor child thread, setting a timer cycle sequence in the net\_monitor child thread to execute the following tests: obtain user basic information, destination address ping test, FTP server availability test, HTTP server availability test, DNS time delay and jitter test;

A205. monitoring the net\_monitor child thread; and

A206. determining whether the net\_monitor child thread exits in a normal manner, if yes, the process proceeds to A202, and otherwise, ending the network quality monitoring.

- 20       9. The method for analyzing user online behavior and monitoring network quality in a home gateway according to claim 1, wherein in step A10 and step A20, according to upload periods at different intervals in the configuration file, the online behavior CSV file and the network quality CSV file generated are uploaded to a specified FTP server in batch, the corresponding online behavior CSV file and the network quality CSV file in the gateway  
25       are deleted.

10. The method for analyzing user online behavior and monitoring network quality in a home gateway according to claim 1, wherein in step A30, communication between the integrated terminal management system and the home gateway comprises communication when the home gateway starts and communication when the home gateway is operating;

5       when the home gateway starts, the integrated terminal management system first reads a switching value related to user online behavior in the configuration file beh.conf, if the switching value is 0, no processing is performed; otherwise, whether user online data collection process collect\_data and network quality monitoring process net\_monitor exist simultaneously are determined, if yes, the two processes are killed first and then restarted to  
10       enter the procedure that the home gateway is operating; otherwise, if neither collect\_data nor net\_monitor exists, the two processes are started; if one of collect\_data and net\_monitor exists, the process that exists is killed and the other process is started; a signal sent by the agent process is received and a signal processing function is executed; and

15       when the home gateway is operating, the integrated terminal management system performs uniform configurations and delivers the configurations, the home gateway is responsible for writing the configurations into a configuration file of user online behavior, sets a switching value to indicate the configurations are valid after the writing, and sends a signal to a process itms\_control; the process itms\_control, after receiving the signal, reads the configuration file to determine whether a switch of a user online behavior analysis  
20       function is turned on, determines whether a user online data collection process and a network quality monitoring process exist if the switch is turned on, kills a process that exists and restarts if either the user online data collection process or the network quality monitoring process exists, and starts the two processes if neither the user online data collection process nor the network quality monitoring process exists.

25       11. A home gateway, comprising:

      a user online data collecting module, configured to analyze a data packet arriving at a home gateway according to characteristics of an object to be monitored, generate a corresponding online behavior CSV file according to analyzed data and upload the file to

an FTP server; and

- a network quality monitoring module, configured to simulate periodically PPPOE dial-up, actively initiate TCP, DNS, HTTP and FTP service availability detection, generate a corresponding network quality CSV file according to a detection result and upload the file
- 5 to the FTP server.