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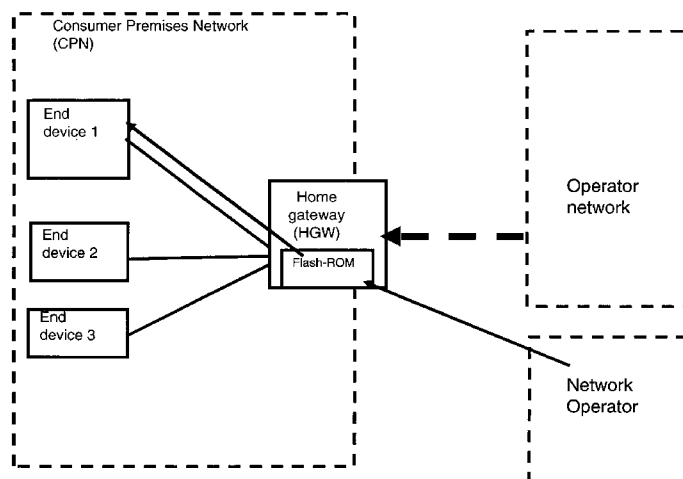


Fig.

(57) Abstract: A method for providing error indication information at an end device, said end device being connected to a customer premises network (CPN) and being capable in receiving and handling data flows from said CPN, wherein - during normal operation - said CPN is connected to an operator network via a home gateway (HGW), and wherein - during normal operation - a media data flow is received by said end device, said media data flow being transmitted on a communication path spanning at least parts of said operator network, said HGW and at least parts of said CPN, is characterized by the steps of determining a status indicator representative of the status of communication on said communication path, determining the presence of an error case based on said status indicator, replacing said media data flow with an error data flow by said HGW, said error data flow containing error indication information based on the determined error case, and directing said error data flow to said end device.

METHOD FOR PROVIDING ERROR INDICATION INFORMATION AT AN END DEVICE

The present invention relates to a method for providing error indication information at an end device, said end device being connected to a customer premises network (CPN) and being capable in receiving and handling data flows from said CPN, wherein – during normal operation – said CPN is connected to an operator network via a home gateway (HGW), and wherein – during normal operation – a media data flow is received by said end device, said media data flow being transmitted on a communication path spanning at least parts of said operator network, said HGW and at least parts of said CPN.

In recent years several network based services evolved at which media data flows are transmitted to an end device, like TV sets, computers, telephones, or stereo equipment. Examples for such services are IPTV (Internet Protocol Television) as defined in ETSI TS 182 027, Internet radio, or IP (Internet Protocol) telephony. At these services, a certain quality of service (QoS) has to be provided in order to offer satisfying user experience for the users of the services. QoS comprises the availability of a certain bandwidth for the media data flow, certain delay or jitter.

At a general application scenario, the end device is connected to a customer premises network (CPN). The CPN is generally a network within the user's home, a company, an area or a city, or the like. The CPN might have various topologies and may include different wireless and cable based network technologies, like W-LAN (Wireless Local Area Network), UMTS (Universal Mobile Telecommunication System), WiMAX (Worldwide interoperability for Microwave Access), Ethernet, or power line communication.

During normal operation, the CPN is connected to an operator network, via a Home Gateway (HGW). The operator network provides access to the Internet and/or remote services provided by a service provider. The link to the operator network is generally established by a DSL (Digital Subscriber Line), cable TV connection, or fibre optics. The HGW routes data packets between the operator

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network and the end device for which the data packets are destined. The HGW is generally transparent for the transmitted data packets.

In normal operation, a communication session between the end device within the CPN and a remote server which can be accessed via the operator network is established. After session setup, a media data flow is generated by the server and is transmitted on a communication path to the end device. The communication path covers at least parts of the operator network, the HGW and at least parts of the CPN. The media data flow is received and handled by the end device. For instance, at an IPTV environment, the media data flow contains video data which are displayed on a video screen connected to or being part of the end device.

In each next generation network based solution with IP based communication there is a probability that content delivery may become impossible due to problems within different parts of the networks that are involved in communication. Indicating and communicating such failures to the end user has an impact on the user experience and thus is of high interest to the service and network providers.

In first place, failures on the communication path resulting from insufficient QoS are avoided. Therefore signalling mechanisms are specified to ensure a certain level of QoS for audio/video stream content delivery to the HGW. This signalling is carried out before audio/video content is delivered to the end device. Its general purpose is to reserve resources on the different network entities which are involved on the communication path. However, in some situations the signalling might result in an error due to insufficiently available resources or other network specific problems. When such an error is detected, the end device, the HGW and the operator network has to cope with it. Error indication is generally performed by displaying messages as "server not available" at the end device. Such messages offer little help for the user to solve problems from his/her side. Sometimes a network operator of the operator network can provide help using special, network immanent detection mechanisms. These detection mechanisms work well as long as the operator has full control on the communication path to the end device. Problems arise, when the end device is connected to the operator network via a CPN and a HGW. Generally, the CPN is not under control of the operator of the

operator network. Problems on the communication path may result from problems within the CPN and cannot be detected by the network operator.

It is therefore an object of the present invention to improve and further develop a method of the initially described type that offers error indication information to the users which supports in evaluating the failure or error.

In accordance with the invention, the aforementioned object is accomplished by a method comprising the features of claim 1. According to this claim, such a method is characterized by the steps of determining a status indicator representative of the status of communication on said communication path, determining the presence of an error case based on said status indicator, replacing said media data flow with an error data flow by said HGW, said error data flow containing error indication information based on the determined error case, and directing said error data flow to said end device.

According to the invention, it has first been recognized that in general error and failure scenarios a connection between the end device and the HGW – even in error cases – is still available. This connection might have pure quality or might offer low QoS, but it is generally suitable for exchanging at least some data. It has further been recognized that this connection may be used for transmitting error indication information to the end device. Therefore, according to the invention, the error indication information is not generated at the end device but at a central device within the CPN. The HGW is such a central device which may be used for generation of error indication information.

According to the invention, the HGW generates an error data flow which contains error indication information and which is transmitted to the end device. In order to generate a correct error data flow, a status indicator representative of the status of communication on the communication path is determined. This status indicator might be each different kind of information which is capable in representing a status. It might be an error code, a piece of text, a protocol message, or the like. By evaluating the status indicator, the presence or absence of an error case is determined. In an error case, the HGW replaces the media data flow, which should

be transmitted from the operator network via the HGW and the CPN to the end device, with an error data flow. The error data flow is directed to the end device instead of the media data flow and is handled by the end device in the same way like the media data flow. In case of an IP-TV, the end device may display the error indication information transmitted with the error data flow on a display of the end device.

The error indication information might be represented in different ways. One possibility is a text message which is displayed at the end device. This offers the benefit of low amount of data which has to be transmitted. Another possibility comprises an audio representation of the error indication information. This audio representation might be output at the sound system of the end device. This kind of error representation might be suitable in cases where the end device is a sound system which plays an internet radio program. Preferably, the error indication information is represented as audiovisual content in the error data flow. This content may be displayed on a video screen which is part of the end device or which is connected to the end device and may be output to the user by the sound system of the end device. The audiovisual content might be a video, animated content with text displayed like a ticker, or the like.

Preferably, the error data flow is generated based on an error message. Advantageously, the error messages are stored in a non-volatile memory. The non-volatile memory may be contained in the HGW. The non-volatile memory is preferably implemented by a flash-ROM or another low-cost memory device. However, the non-volatile memory may also be formed by a hard disc. It may even be formed by a RAM (Random Access Memory) which is buffered by an associated power supply like a battery. The used memory device should keep information even if external power supply is disconnected.

In order to provide a method which is highly adaptable, the error messages may be updated or customized using remote configuration means. With changes in the infrastructure of the operator network, the possible errors might change as well. During maintenance works, certain failures and errors get more likely. New error messages may be transmitted to the HGW during normal operation of the system

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and may be stored in the non-volatile memory. In an error case, new error messages, which for instance indicate maintenance works, may be determined and may be transmitted to the end device. This error message may also include information about the kind of maintenance and the duration of the shutdown of the network entities under maintenance.

The remote configuration means may be controlled by an operator of the operator network. However, the remote configuration means may also be used by an administrator of the CPN to provide error information about failures within the CPN. This might include maintenance works within the CPN or cases, where only a restricted bandwidth is available for the end device.

There are different failures and errors which may result in generation and transmission of error indication information to the end device. One error case may be determined in cases of an unavailable network connection to the operator network. This may be an unavailable DSL signal or a disturbed connection on the DSL. It may also result from a router breakdown in the operator network. An inaccessible communication partner within the operator network may also cause an error case. This may for instance be the case, if a server streaming content via the media data flow is inaccessible, shutdown, or has to handle too many connections. Another error cases may comprise insufficient QoS provided on the communication path or on parts of the communication path. Constraints may be located in the operator network or in the CPN. This kind of error case might comprise a congested operator network or a congested CPN. A congested CPN may result from another end device occupying a high bandwidth at the CPN. Another error case may be determined, when problems with the end device occur. This may result from a wrongly configured network interface or from a low quality of an access link to the end device (e.g. due to low signal quality of the W-LAN connecting the end device to the CPN).

Advantageously, an error case may be reported back to the operator network. This may be performed by transmitting an error reporting message to the operator network. The error reporting message may help the network operator to discover and solve problems at communication with a certain CPN or certain end devices.

In many cases, in particular at IPTV, the HGW is provided by the network operator for providing their services. In such cases, the network operator can trust the HGW and can also trust the messages which are transmitted by the HGW. The error reporting messages may also be transmitted on a secure channel.

Preferably, the error reporting messages are used at the operator network for triggering error handling mechanisms. Some errors might be solved automatically using standard error handling mechanisms. For instance, in cases of an inaccessible media server, the request of end device might be directed to another media server providing the same content. In cases of limited QoS, error handling mechanisms may comprise reducing quality of the media data flow and transmitting contents on a reduced resolution as long as constraints exist.

In cases of an unavailable connection between the HGW and the operator network, the error reporting messages may be transmitted to the operator network as soon as the connection is available again. It is also possible that only in certain error cases error reporting messages are generated and transmitted. In cases of a breakdown of a router within the operator network, a error reporting message rather burdens the operator network than offering any benefit, as the error is generally already known to the network operator.

At determining the status indicator, signalling messages and/or signalling sequences which are transmitted on the communication path may be monitored and evaluated. Also the media data flow may be monitored in order to determine an error case. If for instance many interruptions in the media data flow are detected or if many data packets has to be discarded due to bit errors, communication on the communication path just offers poor quality. Instead of displaying a media data flow with poor quality, it might be beneficial for the user experience to direct an error data flow to the end device which informs about the kind of error case.

Additionally or alternatively, the status of single network entities which are involved in communication on the communication path may be queried or monitored. This may provide information about the kind of error or may indicate ways how the error

could be solved. This may include sending a querying message to a DSL modem for getting information about the status of DSL. Such kind of querying messages may be send periodically or if an error case is detected. In this way, information about the reason of the failure might be collected and may be used for generating the error message.

The error data flow may replace the media data flow completely. However, it is also possible that the content of the media data flow is included in the error data flow. This may be used if a interrupted media data flow is available or if the media data flow was reduced in its quality. The error data flow may then contain the media data and display additional information about the reason of the reduced quality.

In cases of encrypted media data flows, the media data flow may be decrypted by the HGW. If the HGW is a trusted device, the operator network may reply to queries of the HGW for transmitting the key(s) used at the media data flow and may sent the key(s) to the HGW. With knowing the key(s), the HGW can also monitor signalling messages, signalling sequences and/or the media data flow for encrypted data flows. Further the key(s) may be used to encrypt the error data flow transmitted to the end device. No new session has to be established between the end device and the HGW, but the HGW "hijacks" the data flow and replaces the media data flow by the error data flow. As the HGW is a trusted device, this kind of session snooping does not compromise security of the system.

For further improving the benefit of the method concerning the invention, the method may also be used for transmitting warning messages. This for instance allows transmitting information about future maintenance works. In these cases, the HGW may be triggered to transmit an error data flow which contains the content of the media data flow as well as additional error indication information. In this case the error indication information is replaced by the warning message. This warning message may be displayed as a ticker which may be displayed at the bottom of the picture.

Preferably the step of determining the status indicator and the step of determining the presence of an error case are performed by the HGW. Thus, there is a central unit which is under control of the complete error indication mechanism provided by the method concerning the invention. This is beneficial to that extent that no communication with other entities is necessary. However, the HGW may also control other network entities in order retrieve information about the status of the communication on the communication path.

Preferably, the method concerning the invention is used in connection with IPTV (Internet Protocol Television).

Advantageously, the method concerning the invention is independent to the signalling used between the end device and its respective communication partner, e.g. a media streaming server. Examples for signalling protocols comprise multicast IGMP (Internet Group Management Protocol), SIP (Session Initiation Protocol) or RTSP (Real Time Streaming Protocol). At determining the status indicator, error messages of the session initiation signalling may be used. For providing advanced error indication information to the HGW, the session protocol may be extended. This allows transmitting special error indication information to the HGW in different error cases.

It should be understood, that the method concerning the invention is independent to the used network technology. Although CPN or HGW is commonly used in connection with TISPN, the present invention should not be regarded as being limited to the usage of certain network technologies, topologies or protocols. Each technology which supports the method concerning the invention may be used.

There are several ways how to design and further develop the teaching of the present invention in an advantageous way. To this end it is to be referred to the patent claims subordinate to patent claim 1 on the one hand and to the following explanation of preferred embodiments of the invention by way of example, illustrated by the figure on the other hand. In connection with the explanation of the preferred embodiments of the invention by the aid of the figure, generally preferred

embodiments and further developments of the teaching will be explained. In the drawing the only

Fig. is a schematic view of an example of an application scenario of a method according to the present invention.

The only Fig. shows a schematic view of an example of an application scenario of a method according to the invention. A Customer Premises Network (CPN), which is symbolized by the left dashed box comprises a home gateway (HGW) which is connected to several end devices. The Fig. shows three end devices which can be connected to the HGW in different ways. One possibility might be a connection via W-LAN or other wireless techniques. The connection between end device and HGW may also be cable based, like at Ethernet. The HGW is connected to an operator network via DSL. The DSL and the operator network provide connection to the internet and/or remote services.

The HGW comprises a flash-ROM which stores error messages for use at generating error indication information. This flash-ROM can be programmed, updated, or customized using remote configuration means.

For example reason, we suppose that an error case resulting from disturbed DSL occurs. The HGW continuously monitors the quality of connection to the operator network using different means. For this reason, the HGW monitors the media data flow which is – in normal operation – transmitted from the operator network via the HGW to end device 1. From this information, the HGW determines a status indicator which is representative of the status of the communication on the communication path. Using this status indicator, the HGW determines the presence of an error case. If an error case is determined, the HGW replaces the media data flow which may be still transmitted to the end device 1 in poor quality with an error data flow. This error data flow is generated by the HGW based on error messages stored in the flash-ROM on the HGW. Using this error data flow, end device 1 can display an audiovisual message to its user which indicates the presence of an error case. This error indication information may contain details like

certain suggestions for error recovery or – if the error results from problems within the operator network – how long the failure is expected to continue.

Using the method concerning the invention, high quality error indication information can be provided to the user without reducing interoperability of single end devices. The end device does not have to provide its own error indication mechanisms, but only has to provide capability to display a media data flow. In error cases, the end device does not have to detect the error and does not have to provide certain error indication mechanisms. The error indication information is generated by the HGW and is displayed on the end device like a standard media data flow. Each future deployment of IPTV or other services can be combined with a method concerning the invention. End users can connect new end devices to the HGW and can use the benefits of present invention without exhausting configurations of the end device. Thus the end devices work instantaneously with services “out of the box”. Complexity of the end device signalling logic is reduced by providing an “intelligent” HGW which provides the error indication information. Using the flash-ROM which can be configured using remote configuration means, the error messages can be adapted to each kind of error.

Many modifications and other embodiments of the invention set forth herein will come to mind the one skilled in the art to which the invention pertains having the benefit of the teachings presented in the foregoing description and the associated drawings. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

Claims

1. Method for providing error indication information at an end device, said end device being connected to a customer premises network (CPN) and being capable in receiving and handling data flows from said CPN,

wherein – during normal operation – said CPN is connected to an operator network via a home gateway (HGW), and

wherein – during normal operation – a media data flow is received by said end device, said media data flow being transmitted on a communication path spanning at least parts of said operator network, said HGW and at least parts of said CPN,

characterized by the steps of

determining a status indicator representative of the status of communication on said communication path,

determining the presence of an error case based on said status indicator,

replacing said media data flow with an error data flow by said HGW, said error data flow containing error indication information based on the determined error case, and

directing said error data flow to said end device.

2. Method according to claim 1, wherein said error indication information is represented as audiovisual content in said error data flow.

3. Method according to claim 1 or 2, wherein said error data flow is generated based on error messages stored in a non-volatile memory, said non-volatile memory preferable being contained in said HGW.

4. Method according to claim 3, wherein said error messages are updated or customized using remote configuration means.

5. Method according to any of claims 1 to 4, wherein an error case is determined in cases of an unavailable network connection, an inaccessible communication partner within said operator network, an insufficient quality of

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service (QoS) provided on said communication path or on parts of said communication path, or problems with said end device.

6. Method according to any of claims 1 to 5, wherein an error case is reported back to said operator network transmitting an error reporting message.

7. Method according to claim 6, wherein said error reporting message is used for triggering error handling mechanisms within said operator network.

8. Method according to any of claims 1 to 7, wherein, at the step of determining said status indicator, signalling messages and/or signalling sequences and/or said media data flow is monitored.

9. Method according to any of claims 1 to 8, wherein, at the step of determining said status indicator, the status of network entities being involved in communication on said communication path is queried or monitored.

10. Method according to any of claims 1 to 9, wherein contents of said media data flow are included in said error data flow.

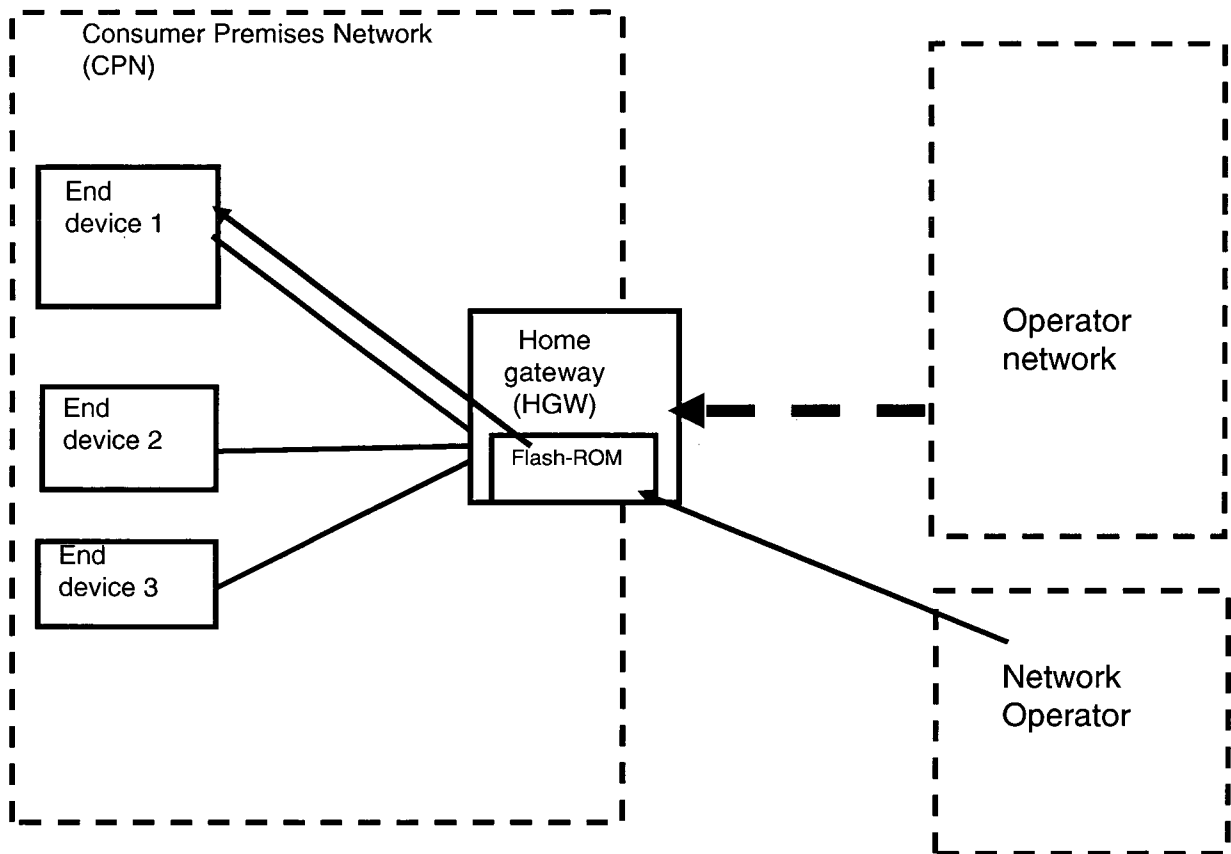
11. Method according to any of claims 1 to 10, wherein, at encrypted media data flows, said media data flow is decrypted by said HGW and the error data flow is encrypted using the key(s) used at said media data flow.

12. Method according to any of claims 1 to 11, wherein said error data flow is additionally used for warning messages.

13. Method according to any of claims 1 to 12, wherein the step of determining said status indicator and the step of determining the presence of an error case are performed by said HGW.

14. Method according to any of claims 1 to 12, wherein said method is used in connection with IPTV (Internet Protocol Television).

1/1

**Fig.**

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L12/24 H04L12/28 H04L29/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2009/007343

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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