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(54) Title: METHOD FOR RESTORING CONFIGURATION SETTINGS OF A CPE DEVICE TO FACTORY DEFAULT SETTINGS, AND CPE DEVICE USING THE METHOD

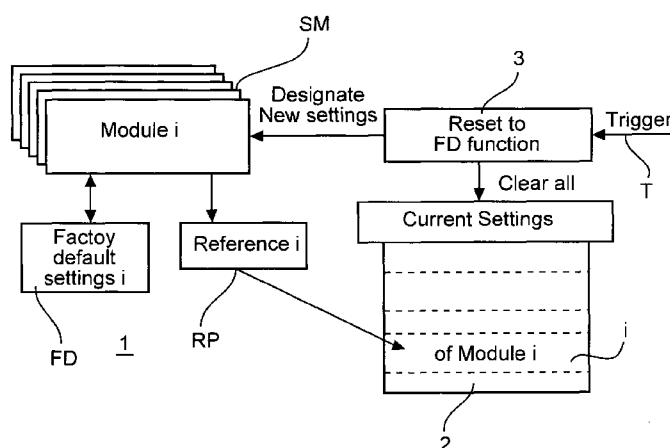


Fig. 1

(57) Abstract: The method for restoring configuration settings of software modules of a customer-premises equipment device to factory default settings comprises the steps of arranging the software modules together with its factory default settings in a first non-volatile memory, storing current configuration settings of the software modules in a second non-volatile memory, providing a reference pointer for each software module pointing to the respective location of the current configuration settings of a respective software module, and in case of a reset trigger, clearing the current configuration settings in the second non-volatile memory, and utilizing the pointer to store the factory default settings of each software module at the location of the current configuration settings of each software module in the second non-volatile memory. A customer premises equipment device utilizing the method comprises a first non-volatile memory (1), a second non-volatile memory (2) and a reset to factory default function (3).

**METHOD FOR RESTORING CONFIGURATION SETTINGS OF A CPE
DEVICE TO FACTORY DEFAULT SETTINGS, AND CPE DEVICE USING
THE METHOD**

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TECHNICAL FIELD

The invention relates to the field of customer-premises equipment devices, in particular to residential gateways coupled via a digital subscriber line or via an optical transmission line to a service provider delivering broadband services to a customer.

BACKGROUND OF THE INVENTION

Residential gateways are widely used to connect devices in a home of a customer to the Internet or any other wide area network (WAN). Residential gateways use in particular digital subscriber line (DSL) technology that enables a high data rate transmission over copper lines. During the years, several DSL standards have been established differing in data rates and in range, for example ADSL and VDSL, which are referred to in this context as xDSL. But also optical transmission for Internet services is well known, for example fiber-to-the-home (FTTH) and fiber-to-the premises (FTTP). Residential gateways, also other devices such as routers, switches, telephones and set-top boxes, are understood in this context as customer premises equipment (CPE) devices.

In case of an unreliable or deteriorated operation of a CPE device, a multitude of methods may be applied for recovery. The problems may arise in particular from an undefined or any other unknown software state. Some of these methods are listed here according to their applicability and according to an increasing level of

system degradation, their acceptable severity and/or service interruption:

1. Stopping and then (re-)starting an application of the
5 CPE device with current configuration settings while maintaining all its persistent data that represent the intended services.
2. Resetting all data specific of an application to a default state while restarting the application. Then
10 provisioning the application according to the intended service.
3. Uninstalling the application and clearing all its persistent current configuration settings. Then installing and provisioning the application according
15 to the intended service.
4. Rebooting the system.
5. Resetting all system data to factory default settings while restarting the system. Then provisioning of the system as if it was deployed for the first time for
20 the intended service. This includes installing and provisioning applications for the intended service.
6. Bringing the device in a rescue mode for installing the software while clearing and formatting its data storage for restoring the software to a well known
25 initial state. Then provisioning of the system as if it was deployed for the first time for the intended service.
7. Replacing the system by a new or refurbished device that is in a well known state of hardware, start-up
30 and identification software and system software. Then provisioning of the device as if it was deployed for the first time for the intended service.

A scenario may happen that the owner of a residential
35 gateway is having a problem with the Internet service provided by a network service provider via the gateway.

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The gateway is deployed and installed and provisioned for the intended service and was working reliably for some time. The owner calls the help service of the network service provider. The Service Provider first level help
5 service has instructed the gateway owner to apply a power-on cycle for the device, but this doesn't resolve the problem.

As a result, the gateway owner is required to escalate the
10 problem and to call the Service Provider's Support Desk.
> The Support Desk goes through a number of basic troubleshooting checks together with the gateway owner. One of the checks confirms the gateway is no longer accessible for the Support Desk's remote management
15 facility. The Support Desk concludes that the most likely cause of the problem is that the gateway is in an unreliable or other unknown software state. The Support Desk's standard procedure for that case dictates triggering the recovery from that state by instructing the
20 gateway owner to apply the Reset-To-Factory-Defaults procedure. Consequently, the gateway owner is requested to operate the reset button on his gateway and to report the outcome by telling the Support Desk about the status of the visual indicators on the device.
25 > Further to the standard recovery procedure, the Support Desk applies and monitors the complete provisioning process of the gateway as if it was deployed for the first time for the intended service.
> The Support Desk leaves the gateway owner with a gateway
30 that is recovered from an unreliable or other unknown software state and on which the intended service is again available for use.

A mechanism for restoring an apparatus to factory default
35 is described in US 2009/0031122. A reset mechanism is provided in the apparatus which can be activated or

pressed when the apparatus is powered off. When the apparatus is powered-on, a detection circuit is configured to detect whether the reset mechanism has been activated when the apparatus was powered-off, and if it is
5 determined that the reset mechanism was activated, the detection circuit activates a resetting process that sets the apparatus back to the factory default status. In a first embodiment, the resetting mechanism generates all types of signals necessary to cause all changeable
10 statuses back to the original default values. In a second embodiment, the reset mechanism generates the default values to restore all customer-changeable values. In a third embodiment, the resetting mechanism generates a command signal that activates a firmware reloading process
15 that reloads a copy of original firmware to overwrite whatever that may have been changed. In any case, all factory default values and statuses are restored before the normal operation starts.

20 US 2009/0193215 describes a computer system comprising a system restoration control module which includes an erasure module. The system restoration control module allows a user to erase personally identified information from the computer system without concern that the
25 information will be subsequently retrieved, by restoring the computer system to its original factory settings.

SUMMARY OF THE INVENTION

30 The method for restoring configuration settings of software modules of a customer-premises equipment device to factory default settings comprises the steps of arranging the software modules together with its factory default settings in a first non-volatile memory, storing
35 current configuration settings of the software modules in a second non-volatile memory, providing a reference

pointer for each software module pointing to the respective location of the current configuration settings of a respective software module, and in case of a reset trigger, clearing the current configuration settings in the second non-volatile memory, and utilizing the pointer to store the factory default settings of each software module at the location of the current configuration settings of each software module in the second non-volatile memory.

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The customer-premises equipment device is in a preferred embodiment a residential gateway, a router, a switch, a set-top box or any other remotely controlled customer premises equipment device, and the software modules are for example applications for a DSL interface, a USB interface, a Wi-Fi interface, a DLNA interface a POTS interface and/or any other application of the remotely controlled customer premises equipment device.

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A customer premises equipment device utilizing a method for restoring configuration settings of software modules comprises a first non-volatile memory, in which factory default settings of the customer-premises equipment device are stored, a second non-volatile memory, in which current configuration settings of the customer-premises equipment device are stored, and a reset to factory default function.

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In a further aspect of the invention, a customer premises equipment device comprises a first non-volatile memory, in which factory default settings of the customer-premises equipment device are stored, a second non-volatile memory, in which current configuration settings of the customer-premises equipment device are stored, and a reset to factory default function, wherein

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the reset to factory default function clears the current configuration settings in the second non-volatile memory, when a reset trigger is received by the reset to factory default function,

5 the reset to factory default function informs the software modules that a reset to factory default has been made, or each software module recognizes the condition that its current settings are cleared or removed in the second non-volatile memory,

10 the reset to factory default function designates the locations for the configuration settings in the second non-volatile memory to the software modules,

each software module uses its reference pointer to store its factory default settings at the respective
15 location of the second non-volatile memory, and

the customer-premises equipment device resumes operation with the factory default settings, when each of the software modules have stored its factory default settings in its reserved location of the second non-
20 volatile memory.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are explained in
25 more detail below by way of example with reference to a schematic drawing, which shows:

Fig. 1 a mechanism for restoring current configuration settings of software modules of a customer-
30 premises equipment device to factory default settings.

Detailed Description of Preferred Embodiments

35 In the following description, example methods for restoring configuration settings of software modules of a

customer-premises equipment device are described. For purposes of explanation, various specific details are set forth in order to provide a thorough understanding of preferred embodiments. It will be evident, however, to one skilled in the art that the present invention may be practiced without these specific details.

A customer premises equipment (CPE) device according to the invention includes in a preferred embodiment a microprocessor, a first and a second non-volatile memory, e.g. a read-only memory (ROM) and/or a flash memory, in which an operating system and configuration settings are stored, and a volatile memory, e.g. a random access memory (RAM), for the operation of the CPE device. CPE devices of this kind are in particular residential gateways, routers, switches, settop boxes and so on. The operating system of the CPE device is for example a LINUX operating system and a CPE device-specific middleware, which is an execution environment including a large number of applications for providing for example a DSL modem function, gateway and switching functions, FXS functions for POTS and DECT-telephones, VoIP functionality, WI-FI operation, USB-ports for providing video streaming from a connected digital media server, also management handling, quality of service handling, internal maintenance control, performance measuring, security handling and other internal system function. The applications and services are called in this context software modules, because they are separate modules within the middleware.

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A preferred embodiment of the invention is depicted in figure 1, which shows a CPE device, for example a residential gateway, including a multitude of software modules SM, e.g. N software modules, which are stored together with its factory default settings FD in the first non-volatile memory 1; current configuration settings of

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each of the software modules SM, which are stored at respective locations within the second non-volatile memory 2; and a reset to factory default function 3. Each software module i of the N software modules includes its factory default settings i and a respective reference pointer i. For each of the software modules SM, current configuration settings are stored in the second non-volatile memory 2 for example such that current configuration settings i of each software module i are stored at a reserved location i of the second non-volatile memory 2. Correspondingly, for all the software modules 1 - N, a respective location i is provided in the second non-volatile memory 2 for the current configuration settings of each software module. The location i within the second non-volatile memory 2 is known to the corresponding software module i by means of the reference pointer i, or is designated to each of the software modules SM by the reset to factory default function 3, in case a reset to factory default has been made. The current configuration settings of a software module can be the same as its factory default settings or can be different and are used during the operation of the CPE device. The CPE device may include also software modules, which do not have any factory default settings.

The reset to factory default function 3 can be initiated by a reset trigger T. The reset trigger can be either a hardware solution: e.g. a button on the CPE device, or a software trigger, which can be operated for example remotely by a network service provider. The reset to factory default function 3 is for example a software component of the middleware of the CPE device. The first non-volatile memory 1 and the second non-volatile memory 2 are for example either a ROM memory and/or a flash memory.

In a preferred embodiment, the reset to factory default function 3 knows the locations where the current configuration settings for each of the software modules SM in the first non-volatile memory 1 are stored, and in a case of a reset trigger T, the reset to factory default function 3 first clears all current configuration settings in the second non-volatile memory 2. In further steps, the reset to factory default function 3 informs the software modules SM that a reset to factory default has been triggered, and the reset to factory default function 3 designates the locations i for each software module SM: i , where its factory default settings have to be stored in the second non-volatile memory 2. In further steps, each (i) of the 1-N software modules SM recognizes the condition that its current settings 2: i are cleared or removed from the second non-volatile memory 2, fetches its factory default settings FD: i and stores its factory default settings FD: i in the respective location 2: i of the second memory 2 by using its reference pointer RP: i . Alternatively, the reset to factory default function 3 informs the software modules SM that a reset to factory default has been made. Finally, the CPE device includes a new set of configuration settings in the second non-volatile memory 2 and is resuming operation with its new configuration settings configured with the factory default settings.

The invention is in particular addressing a solution for CPE devices which have a large set of software modules. These software modules do not have to coordinate the state of their configuration data, nor have they to coordinate with a centralized function that must be aware of each module that has configuration data being subject to resetting. The mechanism for resetting current configuration settings to factory default settings within

a CPE device complies therefore in particular with scalability requirements of a modular software system.

Also other embodiments of the invention may be utilized by
5 one skilled in the art without departing from the scope of
the present invention. The method as described may be used
in particular for all kinds of CPE devices, e.g.
residential gateways, routers, switches, telephones and
set-top boxes, including also cell phones, tablet PCs and
10 other remotely controlled CPE devices. The invention
resides therefore in the claims herein after appended.

Claims

1. Method for restoring configuration settings of a multitude of software modules (SM) of a customer-premises equipment device to factory default settings (FD), **comprising the steps of**
 - arranging the software modules (SM) together with its factory default settings in a first non-volatile memory (1),
 - storing current configuration settings of the software modules (SM) in a second non-volatile memory (2),
 - providing a reference pointer (RP:i) for each software module (SM:i) pointing to the location (2:i) of the current configuration settings of that software module (SM:i), and
 - in case of a reset trigger (T), clearing the current configuration settings in the second non-volatile memory (2), and utilizing the pointer to store the factory default settings of each software module (SM) at the location of the current configuration settings (2:i) of each software module (SM) in the second non-volatile memory (2).
2. The method of claim 1, comprising the steps of copying the factory default settings (i) for each of the software modules (SM) to said location (i) of the second non-volatile memory (2) by means of the reference pointer (RP:i) of that software module (SM:i).
3. The method of claim 1 or 2, wherein the location (2:i) within the second non-volatile memory (2), where its factory default settings (FD:i) have to be stored, is designated to each of the software modules (SM) by the

reset to factory default function (3), in case a reset to factory default is made.

4. The method of claim 1, comprising the steps of

5 clearing the current configuration settings in the second non-volatile memory (2) by the reset to factory default function (3), when the reset trigger (T) is received by the reset to factory default function (3),

10 the reset to factory default function (3) informing the software modules (SM) that a reset to factory default has been made,

 the reset to factory default function (3) designating the locations (2:i) for the configuration settings in the second non-volatile memory (2) to the software modules (SM), or each software module (SM:i) recognizing the condition that its current settings (2:i) are cleared or removed in the second non-volatile memory (2),

20 each software module (SM:i) using its reference pointer (RP:i) to store its factory default settings (FD:i) at the respective location (2:i) of the second non-volatile memory (2), and

 resuming operation of the customer-premises equipment device with the factory default settings stored in the second non-volatile memory (2).

5. The method of one of the preceding claims, wherein the software modules (SM) are applications for a DSL modem function, a USB function, a Wi-Fi function, a DLNA function and/or an FXS function for POTS and DECT telephones, voice over internet function, management functions, quality of service handling functions, security functions and/or internal maintenance control functions.

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6. The method of one of the preceding claims, wherein the customer-premises equipment device is a residential gateway, a router, a switch, a set-top box or any other remotely controlled customer premises equipment device.
7. Customer premises equipment device, utilizing a method according to one of the preceding claims.
8. Customer premises equipment device, comprising a first non-volatile memory (1), in which a multitude of software modules and factory default settings of the customer-premises equipment device are stored, a second non-volatile memory (2), in which current configuration settings of the customer-premises equipment device are stored, and a reset to factory default function (3), wherein
- the reset to factory default function (3) clears the current configuration settings in the second non-volatile memory (2), when a reset trigger is received by the reset to factory default function (3),
- the reset to factory default function (3) informs the software modules (SM) that a reset to factory default has been made, or each software module (SM:i) recognizes the condition that its current settings (2:i) are cleared or removed in the second non-volatile memory (2),
- the reset to factory default function (3) designates the locations (2:i) for the configuration settings in the second non-volatile memory (2) to the software modules (SM),
- each software module (SM:i) uses its reference pointer (RP:i) to store its factory default settings (FD:i) at the respective location (2:i) of the second non-volatile memory (2), and

the customer-premises equipment device resumes operation with the factory default settings, when each of the software modules have stored its factory default settings in its reserved location of the second non-volatile memory (2).

9. The customer premises equipment device of claim 7 or 8, being a residential gateway, router, switch, set-top box or any other remotely controlled customer premises equipment device.

10. The customer premises equipment device of claim 7, 8 or 9, wherein the software modules are applications for a DSL modem function, a USB function, a Wi-Fi function, a DLNA function and/or an FXS function for POTS and DECT telephones, voice over internet function, management functions, quality of service handling functions, security functions and/or internal maintenance control functions.

11. The customer premises equipment device of one of the claims 7-10, wherein the customer-premises equipment device is remotely controlled by a network service provider via xDSL or an optical transmission line.

12. The customer premises equipment device of one of the claims 7-11, wherein the first memory (1) is either a flash memory or a ROM memory.

13. The customer premises equipment device of one of the claims 7-12, wherein the second non-volatile memory (2) is a flash memory.

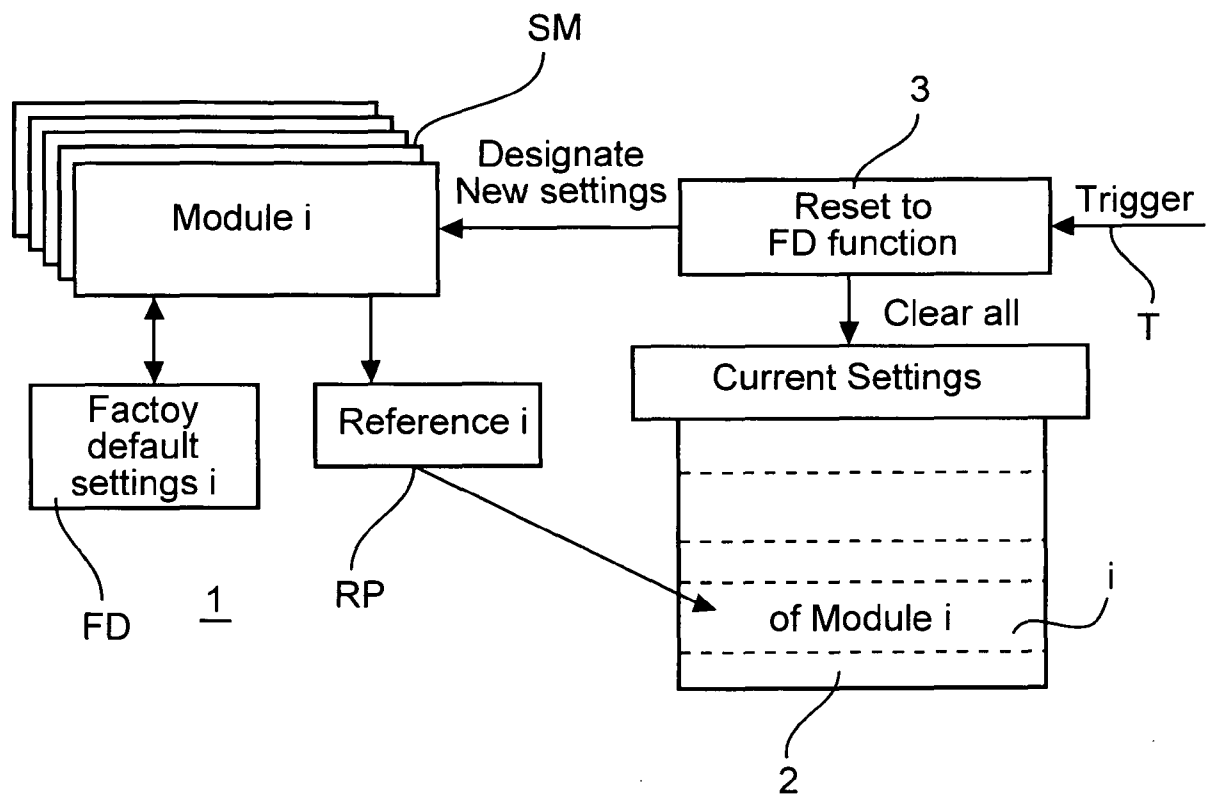


Fig. 1

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F9/44
ADD.

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)
G06F

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 practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Anonymous: "Courier 56K Corporate Modem Command Reference", Internet citation, 22 December 2002 (2002-12-22), pages 1-3, XP002680705, Retrieved from the Internet: URL:http://web.archive.org/web/20021222165141/http://www.usr.com/support/3453/3453-command-ref/chap%206-working%20with%20memory.htm [retrieved on 2012-07-24] pages 1,3 ----- -/-	1-13



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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2012/061705

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2009/031122 A1 (HODZIC EDIN [US] ET AL) 29 January 2009 (2009-01-29) cited in the application abstract paragraph [0004] paragraph [0019] -----	1-13
A	US 2005/031108 A1 (ESHUN KOBI [US] ET AL) 10 February 2005 (2005-02-10) paragraphs [0057] - [0064] -----	1-13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2012/061705

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009031122	A1	29-01-2009	NONE
US 2005031108	A1	10-02-2005	NONE