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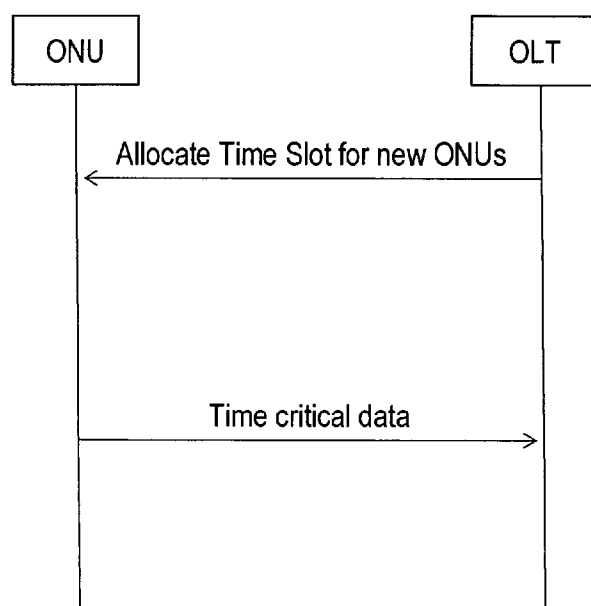
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[Continued on next page]

(54) Title: METHOD AND DEVICE FOR DATA PROCESSING IN AN OPTICAL NETWORK AND COMMUNICATION SYSTEM

Fig.1



(57) Abstract: A method and a device for data processing in an optical network are provided, wherein at least one dedicated time slot is used for transmitting time critical information from an Optical Network Unit towards an Optical Line Terminal.

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DescriptionMethod and device for data processing in an optical network and communication system

5

The invention relates to a method and to a device for data processing in an optical network and to a communication system comprising such a device.

10 Fibre to the Home (FTTH) deployment is gaining momentum and is increasingly deployed. Together with different Fibre to the Curb, Premises, Home etc. (FTTx) technologies, usually TV services are bundled with the bit stream offered.

15 In addition, long reach, long range, high speed Passive Optical Networks (PONs) with a large splitting factor are under development to significantly change future network architectures.

20 Digital TV, e.g., different digital video broadcasting (DVB) variants, Internet protocol television (IPTV) on demand, suffers from lasting channel switching times amounting to ca. 1 to 5 seconds. Such delay significantly reduces the quality of a user's experience, because with each channel change s/he
25 has to wait a significant amount of time for the subsequent channel to appear.

There is even an idea to show a commercial when the user switches from one channel to another. However, such approach
30 would be hardly deemed acceptable to the user.

The **problem** to be solved is to overcome the disadvantage of long delay when switching channels.

35 This problem is solved according to the features of the independent claims. Further embodiments result from the depending claims.

In order to overcome this problem, a method for data processing in an optical network is provided, wherein at least one dedicated time slot is used for transmitting time critical information from an Optical Network Unit towards an Optical Line Terminal.

In an embodiment, said at least one dedicated time slot comprises a time slot allocated by the Optical Line Terminal for new Optical Network Units to convey data.

In another embodiment, said at least one dedicated time slot is a ranging timeslot according to ITU-T Recommendation G.984.3 (see in particular Section 10, "PLOAM Messages and Flag Field").

In a further embodiment, the frequency of the dedicated time slot is adjusted.

In a next embodiment, time critical information comprises a user's request to change a channel.

It is also an embodiment that the user is connected to an IPTV application via the optical network.

The problem stated above is also solved by a device for data processing comprising a processor unit and/or a hard-wired circuit (e.g., an ASIC or an FPGA) that is equipped and/or arranged such that the method as described herein is executable thereon.

According to an embodiment, the device is a communication device, in particular a set-top-box or any device associated with or comprising an IPTV terminal functionality.

The problem stated supra is further solved by a communication system comprising the device as described herein.

Embodiments of the invention are shown and illustrated in the following figure:

Fig.1 shows a message chart comprising an Optical Network Unit and an Optical Line Terminal, wherein the Optical Network Unit utilizes at least one time slot for allocated by the Optical Line Terminal for new Optical Network Units to convey time critical data.

There are several steps to be processed in order to switch from one IPTV channel to another. One step is the transmission of the switching request from the user to the video server.

If the user is connected with a Passive Optical Network (PON), such a request is transmitted as follows (details can be found in the ITU-T Recommendations G.983.X - G.984.X): The Optical Line Terminal (OLT), the network element connected to the backbone (or metro) section of the network, polls each Optical Network Unit (ONU), which corresponds to the network element at the user side, 8000 times a second. This frequency is provided by a frame clock of the underlying backbone Synchronous Digital Hierarchy (SDH) network.

If an Optical Network Unit (ONU) wants to transmit data, it answers with a request to send data. The OLT then assigns a time slot for the respective ONU in which the ONU is allowed to transmit its data, e.g., a user's request to change a channel (see **Fig.1**).

If the ONU has additional data to transmit, this user's change request may be stored in a queue to be transmitted after some time, depending of the priority of the request.

Upcoming long reach PONs will have a splitting factor of up to 1024 and a reach of up to 100km. In case of a fully equipped PON with all ONUs active (e.g., during a popular sports event), each ONU is polled every $1024s/8000=128ms$. In

such a scenario, the complete signaling of a simple change request from an ONU to the OLT alone could aggregate to several 100s of milliseconds.

- 5 The approach provided allows to significantly shorten the time to process a user's request to change a channel.

A newly attached or switched ONU is detected in the PON according to the following mechanism: On a more or less
10 regular basis, the OLT allocates a time slot in which all new ONUs are allowed to send. A new ONU announces its existence within this time slot and it gets integrated into the PON according to a protocol as defined in G.984.3, "Gigabit-capable Passive Optical Networks (G-PON): Transmission
15 convergence layer specification".

The approach provided herein allows utilization of this time slot dedicated for the discovery of new ONUs also for the transmission of time critical data packets that are
20 preferably small in size and/or infrequently to be sent.

The frequency of this time slot can be enhanced to be available, e.g., from once every polling cycle to several times every polling every cycle.
25

Any change request from an arbitrary ONU will then be sent during this time slot, avoiding long negotiations about available time slots. The time for the transmission of a change request or other time critical short data packets can
30 be reduced from several 100s of milliseconds to a few 10s of milliseconds or even below 10ms.

If by chance two ONUs use the same time slot for their transmission, this collision can be detected by the OLT and
35 reassigned by means of the transmission protocol. In such a case, the switching may required some additional 100s of milliseconds. However, such collision is deemed a rather rare event.

An implementation of the approach may comprise an adjustment of the PON protocol. Hence, the time slots described may be assigned more frequently, e.g., 10 times per second, and a
5 new type of upstream message can be provided that may be sent during this discovery time slots.

Abbreviations:

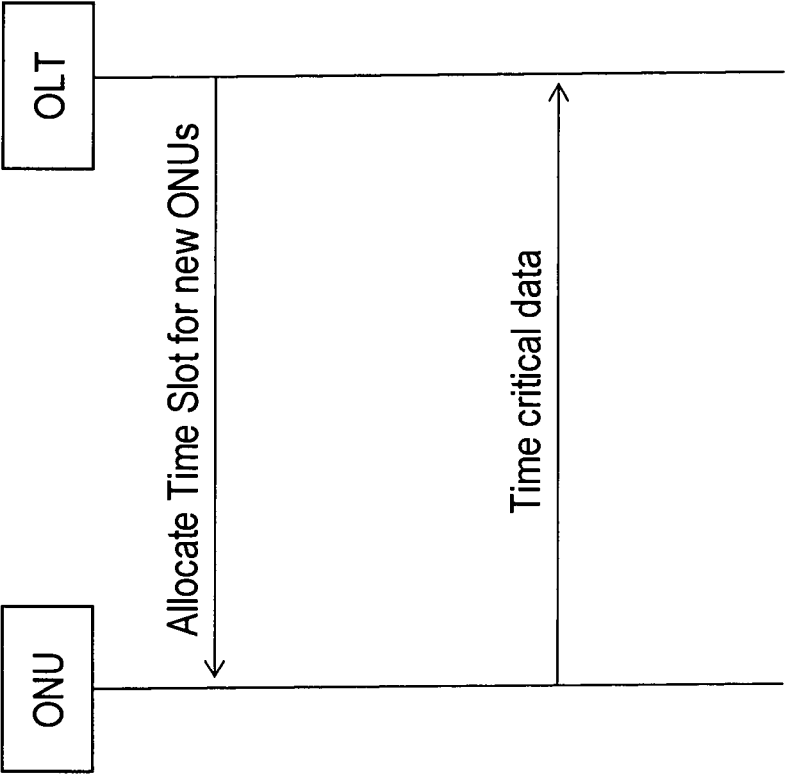
	DVB	Digital Video Broadcasting
	IPTV	Internet Protocol Television
5	OAM	Operation, Admission, Maintenance
	OLT	Optical Line Terminal
	ONU	Optical Network Unit
	PLOAM	Physical Layer OAM
	PON	Passive Optical Network
10	SDH	Synchronous Digital Hierarchy

Claims:

1. A method for data processing in an optical network,
wherein at least one dedicated time slot is used for
transmitting time critical information from an Optical
Network Unit towards an Optical Line Terminal.
2. The method according to claim 1, wherein said at least
one dedicated time slot comprises a time slot allocated
by the Optical Line Terminal for new Optical Network
Units to convey data.
3. The method according to any of the preceding claims,
wherein said dedicated time slot is a ranging timeslot
according to ITU-T Recommendation G.984.3.
4. The method according to any of the preceding claims,
wherein the frequency of the dedicated time slot is
adjusted.
5. The method according to any of the preceding claims,
wherein time critical information comprises a user's
request to change a channel.
6. The method according to claim 5, wherein the user is
connected to an IPTV application via the optical
network.
7. A device for data processing comprising a processor unit
and/or a hard-wired circuit that is arranged such that
the method according to any of the preceding claims is
executable thereon.
8. The device according to claim 7, wherein said device is
a communication device, in particular a set-top-box.

9. The device according to claim 7, wherein said device comprises or is associated with an IPTV terminal functionality.
- 5 10. Communication system comprising the device according to any of claims 7 to 9.

Fig.1



INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER
 INV. H04Q11/00 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)

H04Q 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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"Gigabit-capable Passive Optical Networks (G-PON): Transmission convergence layer specification; G.984.3 (02/04)" ITU-T STANDARD IN FORCE (I), INTERNATIONAL TELECOMMUNICATION UNION, GENEVA, CH, no. G.984.3 (02/04), 22 February 2004 (2004-02-22), XP017401196 cited in the application the whole document	1-4, 7-10
A	US 2007/230956 A1 (IKEDA HIROKI [JP] ET AL) 4 October 2007 (2007-10-04) abstract	1-10



Further documents are listed in the continuation of Box C.



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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007230956 A1	04-10-2007	CN 101048008 A JP 2007274695 A	03-10-2007 18-10-2007