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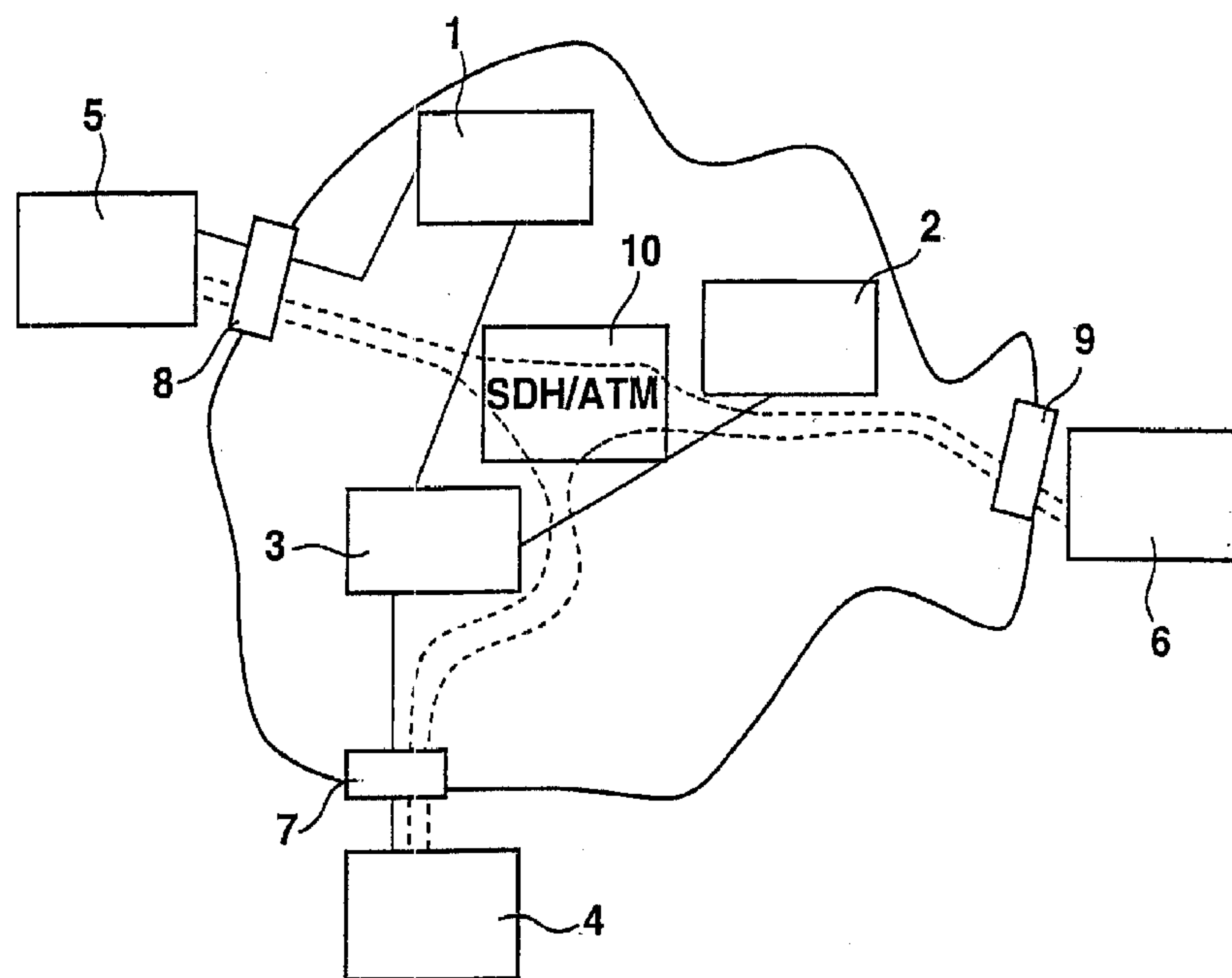
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(54) **METHODE ET DISPOSITIF DE FOURNITURE DE SERVICES
INTERNET DE GRANDE QUALITE**

(54) **A METHOD AND DEVICE FOR PROVIDING HIGH-QUALITY
INTERNET SERVICES**



(57) A method of transmitting Internet information between at least some of a plurality of physical nodes of a network is characterised by the following features: - in the case of at least some physical nodes formed by user devices (user telecommunications devices), in each case at least one logic node is set up for non-time-critical information (= non-time-critical data traffic) and at least one logic node is set up for time-critical information, - suitable data paths are made available for each of the two types of information to be transmitted and, depending upon the requirements of the information to be transmitted, the information is transmitted on the data path suited to these requirements. It is advantageous that Internet services of the high quality required for time-critical data transmission can be provided without intervention into the Internet protocol and with a low outlay.

Abstract

A method of transmitting internet information between at least some of a plurality of physical nodes of a network is characterised by the following features:

- in the case of at least some physical nodes formed by user devices (user telecommunications devices), in each case at least one logic node is set up for non-time-critical information (= non-time-critical data traffic) and at least one logic node is set up for time-critical information,
- suitable data paths are made available for each of the two types of information to be transmitted

and, depending upon the requirements of the information to be transmitted, the information is transmitted on the data path suited to these requirements.

It is advantageous that internet services of the high quality required for time-critical data transmission can be provided without intervention into the internet protocol and with a low outlay.

A Method and Device for Providing High-Quality
Internet Services

The invention relates to a method of transmitting internet information between at least some of a plurality of physical nodes of a network. In normal, present-day internet traffic, the data are transmitted in accordance
5 with the "store and forward" method. The individual data packets are thus firstly received in an internet router, whereupon the address field is evaluated and then the packet is forwarded. The internet architecture does not provide for signalling in the sense of communications
10 protocols, in particular in respect of the type of message to be transmitted. However, IP data packets contain priority- and service type identifications and recently also a flag requesting cheap connections among a number of options. Such connections are only available however
15 between internet nodes which are already set up.

On the basis of the configuration of the IP nodes and the connection lines between them, the internet nodes learn the configuration of their environment. The routing tables are
20 created and updated in this way. If a node or transmission line fails, new connections are automatically searched for and found. All connections between users and between users and content providers routed across a pair of nodes dynamically share the bandwidth between the nodes.

25 Here it is advantageous for the user that the individual connections incur low telecommunications costs and that for all IP services to be conducted by a user with a specific other user, it is possible to use the same address of the
30 other user.

It is disadvantageous:

- that the number of internet nodes between two users or
35 between a user and a content provider is unknown,

- that the data transmission quality (speed, insusceptibility to faults) of the nodes is load-dependent and can change considerably within a very short time,
- 5 - that speech and video transmission undergo a variable delay, whereby the quality of these services is greatly impaired and finally
- 10 - that the standards for moving image- and speech transmission are not yet stable since they are frequently changed.

In contrast, public telecommunications networks offer on
15 the one hand

- switched connections with known and verifiable quality standards, and on the other hand
- 20 - ATM transmission with guaranteed quality and performance.

These networks also offer a number of additional service features such as world-wide availability, transmission
25 based on international standards and, when ATM transmission is used, transmission also with a variable bit rate.

The use of such public telecommunications networks for example by an internet user when he wishes to transmit
30 time-critical data would however impede the handling and set-up of such a data transmission connection and would not be comparable with data transmission via the internet, which is extremely simple for the user.

35 The object of the invention is to provide a method and a device by which internet services of the high quality required for time-critical data transmission can be made

available with the lowest possible outlay and without intervention in the internet protocol.

This object is achieved by the method according to the
5 characterising clause of Claim 1 in that:

- in the case of at least some physical nodes formed by user devices (user telecommunications devices), in each case at least one logic node is set up for non-
10 time-critical information (= for non-time-critical data traffic), and at least one logic node is set up for time-critical information,
- suitable data paths are made available for each of the
15 two types of information to be transmitted,

and, depending upon the requirements of the information to be transmitted, the information is transmitted on the data path suited to these requirements.

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In this way it is provided that in each case two neighbouring physical nodes form a "pair of physical nodes",

- 25 - that a plurality of logic nodes exist in each physical node, whereby pairs of logic nodes are formed,
- that the "pair of physical nodes" shares the available guaranteed transmission capacity between the "pairs of
30 logic nodes".

Due to the configuration of the pairs of logic nodes, logic networks are formed which can utilize the existing internet protocol without modification and without restriction.

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A physical node is a three-dimensional, technical device, for example the telecommunications device of an internet

user. A plurality of logic (or abstract) nodes are formed in the device by its control means (e.g. computer program) so that the device behaves differently depending upon whether time-critical data or non-time-critical data are to be transmitted.

The corresponding device which fulfils the object of the invention is, in accordance with Claim 10, an internet node characterised by the following features:

10

- it comprises devices for connecting in different operating modes depending upon whether the information to be transmitted is time-critical or not;
- 15 - it comprises a processing unit (CPU) for the formation of logic nodes for potential connections.

Here advantageously

- 20 - individual "virtual channels" (see ETSI specification of the term "virtual channel": Transmission and Multiplexing (TM); Terms and Definitions in Transport Networks; Part 1: Core Networks) are assigned to a logic node and permit a guaranteed data throughput,
- 25 - the number of virtual channels used during the operating time of the logic node can vary,
- the virtual channel can either be connected point-to-point or replaces a part of the internet connection.

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An internet user who can conduct non-time-critical data traffic via the internet in the hitherto normal manner, additionally has the possibility, when his technical equipment is designed in accordance with the invention, of conducting time-critical data traffic via data paths which are not normally used by the normal non-time-critical data

traffic and which are reserved for, and well suited to, time-critical data traffic. Here embodiments of the invention require no changes to the ISP network nodes (or to other nodes serving only for data forwarding, such as routers). The choice of data path taken by the message to be transmitted can in the simplest case be manually preset by the user (selection of proxies, gateways, service-dependent user profile etc). Another user, with whom a first user exchanges data, can then be reached for normal internet traffic under a normal internet address and can be reached for time-critical traffic under another address provided for time-critical data traffic. The technical equipment of the user establishing the connection is advantageously designed such that, on the basis of the selected address number, it in each case selects the correct data path, thus for example the data path for time-critical traffic. In embodiments of the invention, the program which establishes the connection to another user is designed such that it selects one data path of the two described different types depending upon the requirements. It is also advantageous that only one of the users must effect the division into logic nodes (i.e. the transmission of the message by means of the logic node suitable therefor) to ensure that the better connection is used.

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Conversely, in the case of reception, the technical equipment detects the channel via which the data are incoming (channel for non-critical data or for time-critical data) with the result that, also in the local node, the data can be further processed in accordance with the relevant requirements, namely in the conventional way with lining-up at the end of the queue or with priority and at high speed.

35 The last-mentioned feature is also important for network nodes arranged between users, if one or more of the normal internet network nodes are formed by additional technical

devices also for the transmission of time-critical data. Data traffic incoming on a channel provided for time-critical data is then forwarded with maximum priority by these networks nodes to a channel, outgoing in the
5 direction of the destination, likewise for time-critical data.

The internet transmits messages in the form of data packets. Each data packet bears a unique address which
10 enables this data packet to be forwarded to the destination. The transmission takes place asynchronously, i.e. the transmission of the individual packets of a single message does not take place in a strict time cycle. In internet traffic, substantially fluctuating propagation
15 delays can occur (which exceed the anyhow unavoidable propagation delay due to the distance between sender and receiver); the fluctuations in transmission time are in the region of a few seconds in the most favourable case and up to several minutes in an unfavourable case. The delays in
20 the internet traffic are relatively long because a data packet sent to a network node is firstly queued therein (queued: sorted into a queue) whereupon its address is evaluated and finally the data packet is forwarded as a function of the address, it is necessary to wait in the
25 event that the outgoing channel of a node is busy, and also because the data packet must possibly pass through a large number of network nodes in which the delay accumulates.

Another form of asynchronous data transmission is specified
30 as ATM (ATM = asynchronous transfer mode). ATM uses data packets (cells) of fixed length (5 byte header, 48 byte payload) and reserves the transmission capacity for individual virtual channels. ATM uses communications protocols to establish and disestablish the virtual
35 channels. ATM was specified by the ETSI, ITU and ATM Forum. ATM can guarantee a point-to-point performance.

ATM also uses data packets with address information. In contrast to the internet, the ATM address is not assigned to a user node but can be multiply re-used. The ATM header also contains only the destination address and not, as in
5 the case of the IP header, both sender and destination address.

The examples described in the following always refer to ATM as transmission mode for the time-critical data. The ATM
10 cells can be transmitted for example via SDH or any other suitable transmission technique. However, the description is to be understood such that, without departing from the essence of the invention, in place of ATM where necessary it is also possible to use another type of transmission of
15 guaranteed performance suitable for, or adaptable to, the provided purpose, for example a synchronous transmission of the required high quality. ATM is thus merely one example, albeit an example which is currently preferred and is considered as the easiest to implement option. Thus for
20 example, in the access networks ADSL or SDSL technology could also be used for the transport of the ATM cells or IP packets could be directly transmitted via ADSL or SDSL to a plurality of logic access nodes.

25 Further features and advantages of the invention are set forth in the following description of exemplary embodiments of the invention making reference to the drawing which illustrates details essential to the invention, and in the claims. The individual features can in each case be
30 implemented individually or jointly in any combination in an embodiment of the invention.

In the drawing:

35 Figure 1 illustrates a network according to the invention in which only user devices are designed to select different

data paths for time-critical and non-time-critical information;

Figure 2 schematically illustrates a computer of a user
5 device according to the invention;

Figure 3 illustrates a network according to the invention in which a node, which is not a user device but the device of an ISP or content provider, additionally is designed to
10 select different data paths for time-critical and non-time-critical information.

Figure 1 illustrates an example of a network structure according to the invention. The network comprises nodes
15 1, 2 and 3 which are ISP nodes (internet service provider nodes). These are normal internet nodes with the described delay in the forwarding of data. The network also comprises user devices (local nodes) 4, 5 and 6 for data, speech, video, audio etc., and in the example these last
20 mentioned nodes are each assigned to a user of the network and provide the user with access to the internet (to be more precise to the first ISP node of the user's internet provider).

25 The routing (switch-through) of the data services between the nodes has a decisive influence upon the quality of the services. Thus:

- the smaller the number of IP nodes between the users,
30 the shorter is the queuing delay and the smaller also is the variance in the queuing delay;
- the smaller the number of IP nodes (ISP nodes) between the users, the shorter is the transmission delay;
- 35 - the smaller the number of IP nodes between the users, the smaller is the likelihood of collisions between

packets (data loss, possibly compensatable by re-transmission).

Therefore it is advantageous to minimise the number of IP nodes in a connection (i.e. the number of jumps or hops). It is particularly advantageous:

- for the number of hops across the public network to be reduced to 1;
- for the compatibility with the IP protocol to be maintained without restriction.

The IP nodes are also to be able to communicate with the public network via a plurality of logic external connections in order to be capable of simultaneously using different data sources (content providers) and communicating with different users, for example to download a data file or application during a video telephone call.

The above described reduction in the number of hops for specific types of data traffic via the internet avoids a restructuring of the internet and therefore can be rapidly implemented. The forementioned reduction in hops by means of additional measures in the subscriber equipment can easily be achieved, as shown in Figure 1.

In Figure 1, devices 7, 8 and 9 which in the present example are ADSL devices but could also be SDSL devices, are shown at the boundary of the network. These devices are connected to the local nodes 4, 5, 6. Figure 1 shows a further node 10 which is referenced SDH/ATM node. In the case of smaller networks this can be one single ATM node (exchange for ATM traffic), whereas in the case of larger networks this node 10 represents an ATM network which can contain a plurality of ATM nodes (a plurality of ATM exchanges).

In the exemplary embodiment, ADSL technology is used between the nodes 4, 5 and 6 and the ATM network 10. ADSL technology enables ATM traffic to be transmitted at a high bit rate and also provides the required routing

5 flexibility, i.e. provided it is not fully utilized, the high transmission capacity enables more data traffic to be handled by the individual channels.

10 In Figure 1 broken lines indicate ATM connections for time-critical traffic, while continuous lines indicate point-to-point connections to the ISP for non-time-critical traffic (normal internet traffic). The traffic along the broken lines does not contact the ISP nodes 1, 2 and 3 in the example according to Figure 1.

15

Table 1 defines the neighbourhood of the individual nodes shown in Figure 1.

**Table 1: Neighbourhood Table for IP Connections
and IP via ATM Connections**

Node	Neighbours via IP Connections	Neighbours via ATM
1	5, 3	2, 3, 4, 5, 6
2	3, 6	1, 3, 4, 5, 6
3	1, 2, 4	1, 2, 4, 5, 6
4	3	1, 2, 3, 5, 6
5	1	1, 2, 3, 4, 6
6	2	1, 2, 3, 4, 5

The nodes 1 and 2, and 2 and 3 are in each case connected in pairs by point-to-point connections (continuous lines). (The node 1 is not connected to the node 2 by such a connection). Table 2 compares the routing tables exclusively using the permanent data connections (indicated by the continuous line) for IP data traffic on the one hand and using the data connections provided for ATM data traffic (indicated by the broken lines) on the other hand.

Table 2: Comparison of Routing Tables

From	To	via IP Connections		via IP by ATM	
		Path	# Hops	Path	# Hops
4	5	4-3-1-5	3	4-5	1
4	6	4-3-2-6	3	4-6	1
5	6	5-1-3-2-6	4	5-6	1
5	4	5-1-3-4	3	5-4	1
6	5	6-2-3-1-5	4	6-5	1
6	4	6-2-3-4	3	6-4	1

Whereas in the case of IP connections, the number (#) of hops, i.e. jumps, to the particular following node amounts to 3 or 4, the connection between the nodes 4 to 6 by-passing the normal internet, i.e. using ATM, is possible with in each case only one single hop. This reduction is made possible in that the local node selects the shortest connection in its own routing table or, via a proxy access, requests the required information on a direct connection (this routing table can be configured and in the past existed exclusively for the local network, whereas today it

has been replaced by a proxy access). This routing table is extended, in accordance with the invention, by permanent, semi-permanent and signalled ATM connections or other access, e.g. via ISP for prioritized traffic or ISDN
5 or ADSL etc.

It can be seen from Table 1 that the linking of the nodes via ATM generates a very much larger quantity of neighbourhood relationships, and Table 2 shows that in the
10 example the number of hops between the nodes attains the theoretical minimum.

To be able to utilize these advantages, the computer nodes of the user devices are modified in accordance with the
15 invention compared to the previously normal user nodes.

These modifications consist in that:

- each physical user node (= user device) is assigned at
20 least two addresses (and specifically at least one normal IP address for non-time-critical data traffic and at least one other address for time-critical data traffic);
- 25 - the routing table for the permanent ATM links is statically set-up locally, i.e. these connections between the individual users are planned from the start and switched through when necessary, provided they are not already existing connections.

30

The purpose of this measure is to take into account the likely data traffic by appropriate planning and to ensure the shortest possible delay time and least possible fluctuations in the transmission time. This measure also
35 ensures that, when the need for such a connection arises, the data traffic is not potentially conducted on a channel already being used to a high capacity, which in turn, for

example due to an increasing risk of collision, could lead to transmission delays or data loss.

Synchronous transmission ensures the least possible delays.

- 5 However, the advantages of the invention are also achieved in the case of asynchronous transmission if transmission capacity is reserved for the connection. The reservation of the transmission capacity is assured by the ATM network.
- 10 It can be expedient for the data traffic transmitted in accordance with the invention via ATM to be transmitted via SDH (synchronous digital hierarchy), i.e. synchronously, over larger distances.
- 15 Figure 2 schematically illustrates a computer 20 of a user device which physically differs from a conventional computer for communication with the internet in that it contains more than one single network card, namely one normal network card 22 for the internet, on which however
- 20 only non-time-critical data is output and received under the control of the computer program, and a second network card 24 to which the computer program directs time-critical data. In the example, the forementioned network cards are ADSL or ISDN cards, which establish the connection of the
- 25 computer to the public telephone network and, via the latter, to the internet service provider (via the network card 22 for non-time-critical traffic and via the network card 24 for time-critical traffic to the ATM node 10). The computer 20 contains a processor (CPU) and a mass memory
- 30 and working memory (M). The memory M also contains data and a program for making available a proxy service, the normal address conversion (as known in the case of the normal internet) and the conversion of internet addresses into permanent virtual channels and into information for
- 35 switched connections, which is useful for the transmission of time-critical data.

The ATM network can comprise a plurality of ATM network nodes. The ATM network is seen by the user as a unit. To the internet user, the granularity of the ATM network remains hidden, whereas the granularity of the internet is perceptible (trace, ping etc.) To the user, the ATM network appears as one single node 10 since, irrespective of the number of ATM nodes, the internet user experiences no disturbing additional delay compared to the presence of only one single ATM exchange.

10

In this way, an additional logic internet is superimposed on the normal internet without the need to influence the construction and programming of the existing internet nodes and the programs by which these are operated. Rather, in 15 the example the time-critical traffic is thereby withheld from the internet nodes of the normal internet so that the time-critical traffic is forwarded direct to the ATM network and ATM nodes by the user (nodes 4 to 6).

20 However the invention is also to include procedures and networks in which at least one normal internet node is designed to additionally transmit time-critical messages, in the example ATM data. In the network shown in Figure 3, the node 1' corresponding to the node 1 in Figure 1 25 additionally is modified in accordance with the invention in that a user can send time-critical data to this internet node via an additional virtual ATM channel, that this internet node receives these time-critical data at a separate logic input (logically separate from the non-time-critical data traffic), further processes said data with a 30 high priority, thus with the least possible delay, and then forwards it on an ATM channel reserved for time-critical traffic. In one embodiment of the invention this forwarding takes place to an ATM node, whereas in another embodiment of the invention the forementioned internet node 35 sends this ATM data direct to another user; in the latter case (optionally also in the former case) simultaneously to

its normal internet function, this internet node forms the function of an ATM node or ATM exchange. Such a node, suitable for non-time-critical internet traffic and for time-critical traffic, can also be formed in that the
5 functionality of a normal internet node is added to an existing ATM exchange and integration into the internet is provided.

The devices 7, 8 and 9 can be designed in accordance with
10 ADSL or SDSL technology. They can be incorporated into the computers of the subscriber equipment in the form of plug-in cards or can be externally connected to the computer and conduct ATM traffic on data channels provided for this purpose. These devices permit a data rate of up to 8 MBits
15 per second. Without such ADSL devices, the ATM data rate in the ISDN network set up in Germany amounts to approximately 64 kBits per second.

Claims

1. A method of transmitting internet information between
at least some of a plurality of physical nodes of a
5 network, characterised by the following features:

- in the case of at least some physical nodes formed by
user devices (user telecommunications devices), in
each case at least one logic node is set up for non-
10 time-critical information (= for non-time-critical
data traffic) and at least one logic node is set up
for time-critical information,
- suitable data paths are made available for each of the
15 two types of information to be transmitted

and, depending upon the requirements of the information to
be transmitted, the information is transmitted on the data
path suited to these requirements.
20

2. A method according to Claim 1, characterised in that a
local routing table is used

- which, in addition to the "normal" internet access,
25 also supports permanent virtual channels and/or
- supports switched connections.

3. A method according to Claim 1 or 2, characterised in
30 that a proxy service is used

- which, in addition to the "normal" address conversion,
also supports the conversion of internet addresses
into permanent virtual channels and/or
35
- supports the conversion into information for switched
connections.

4. A method according to one of the preceding claims, characterised in that

- 5 - time-critical information is transmitted with priority on data paths intended for time-critical information and
- 10 - only as much information is allowed to be transmitted as can be transmitted without losses and adhering to the permissible delay.

5. A method according to one of the preceding claims, characterised in that different address numbers are assigned to different logic nodes of the same physical
15 node.

6. A method according to one of the preceding claims, characterised in that ATM is used for the transmission of time-critical information.
20

7. A method according to Claim 6, characterised in that ADSL is used.

8. A method according to one of the preceding claims,
25 characterised in that one or more ISDN B-channel(s) is/are used for time-critical information.

9. A method according to one of the preceding claims, characterised in that a modem connection is used for time-
30 critical information.

10. An internet node, characterised by the following features:

- 35 - it comprises devices for connecting in different operating modes, depending upon whether the information to be transmitted is time-critical or not;

- it comprises a processing unit (CPU) for the formation of logic nodes for potential connections.

11. An internet node according to Claim 10, characterised
5 in that

- it comprises a resource management device,
- the resource management device monitors connections
10 for time-critical traffic and prevents overloading,
- the resource management device allocates or releases resources as required.

15 12. An internet node according to Claim 10 or 11, characterised in that it is set up in a user device.

13. An internet node according to Claim 10 or 11, characterised in that it is set up in an ISP.

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14. A network, characterised by a method according to one of Claims 1 to 9 and/or characterised in that it comprises at least one node according to one of Claims 10 to 13.

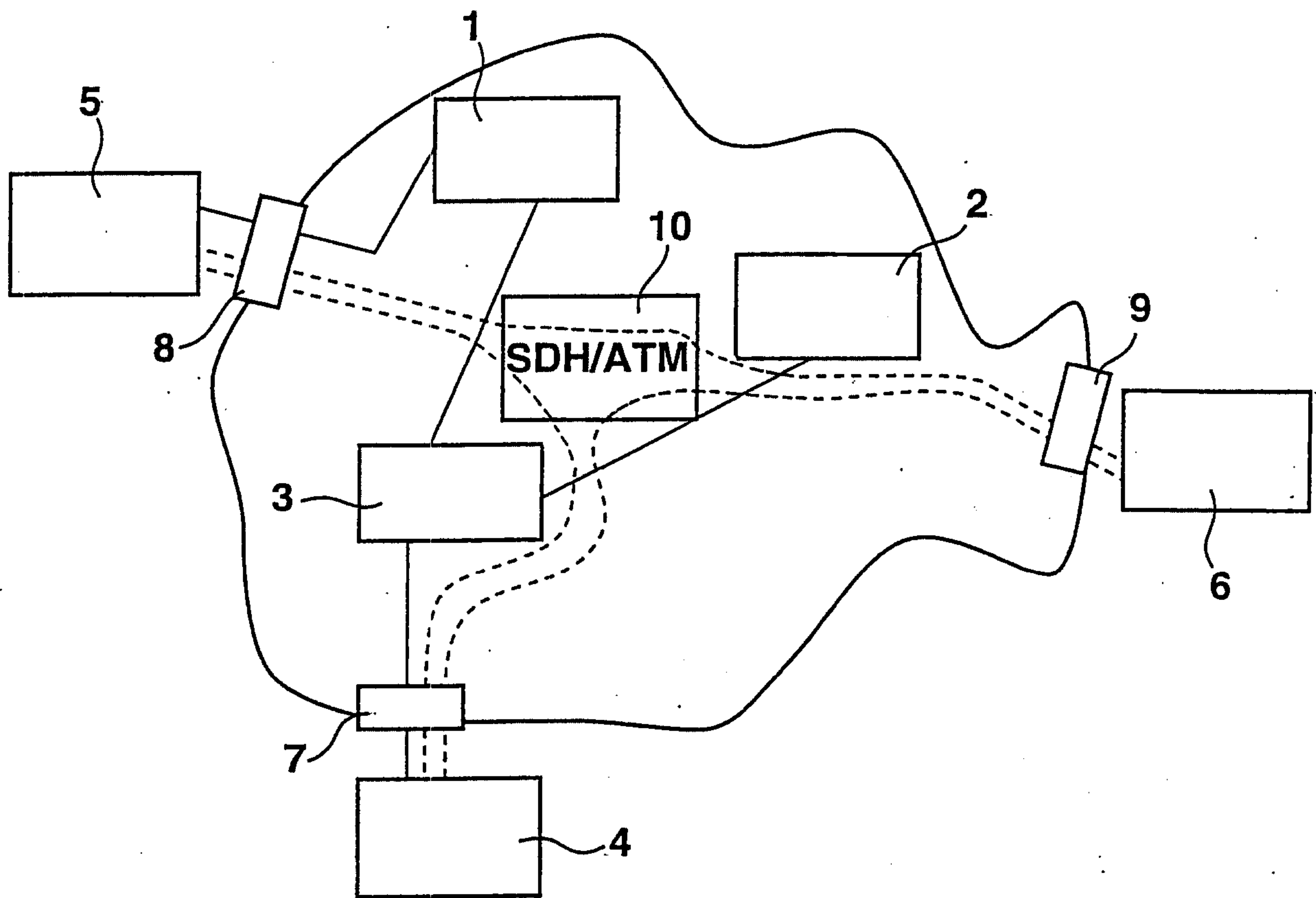
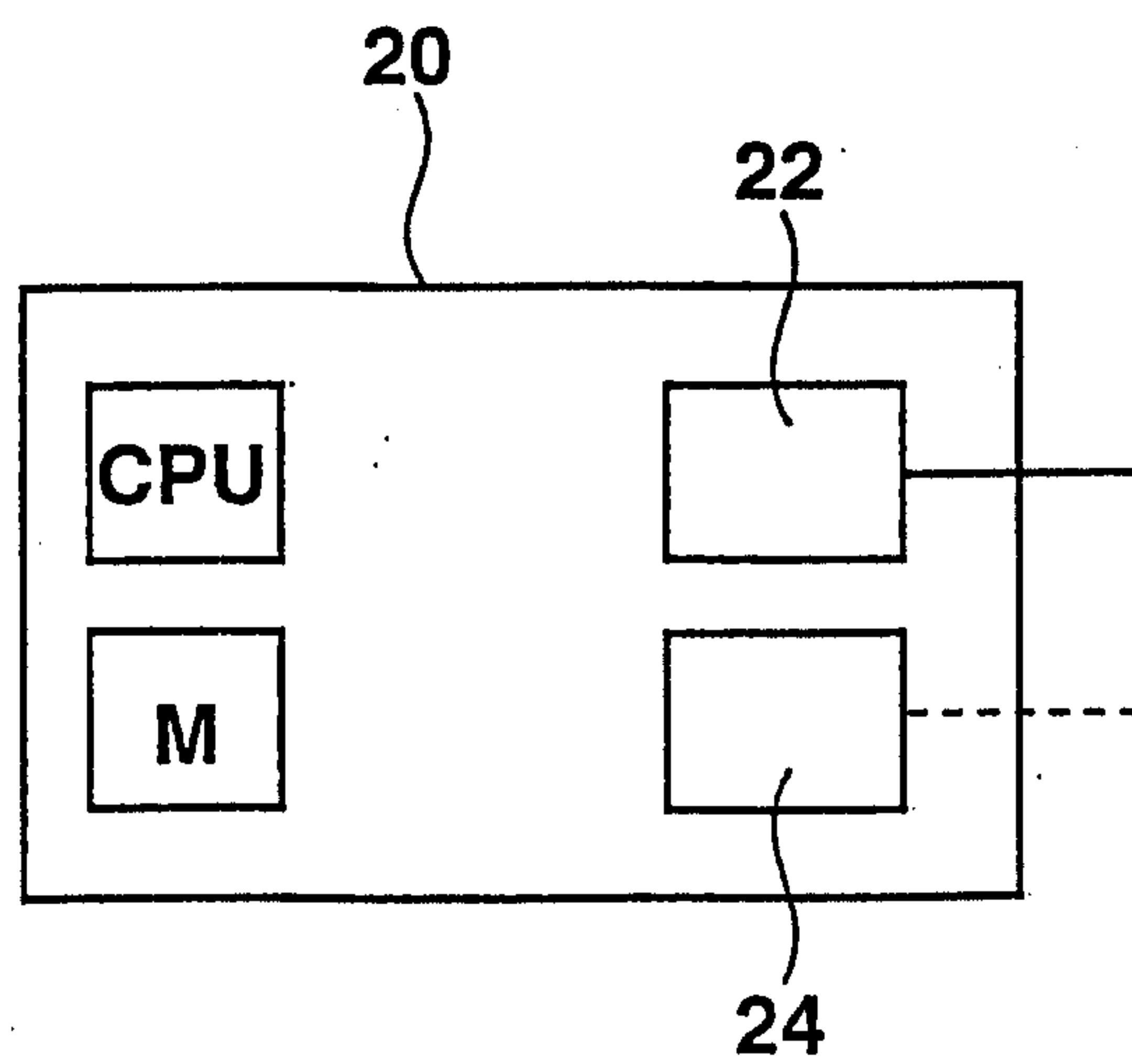
Fig. 1**Fig. 2**

Fig. 3