(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
7 December 2000 (07.12.2000)

PCT

(10) International Publication Number
WO 00/74360 A1

(51) International Patent Classification[7]: H04M 7/00, H04L 12/64

(21) International Application Number: PCT/EP99/03754

(22) International Filing Date: 31 May 1999 (31.05.1999)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicant *(for all designated States except US)*: **NORTEL NETWORKS LIMITED** [CA/CA]; World Trade Center of Montreal, 8th floor, 380 St. Antoine Street West, Montreal, Quebec H2Y 3Y4 (CA).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **RADEMACHER, Uwe** [DE/DE]; Auguststrasse 23, D-12621 Berlin (DE).

(74) Agent: **WIEBUSCH, Manfred**; Artur-Ladebeck-Strasse 51, D-33617 Bielefeld (DE).

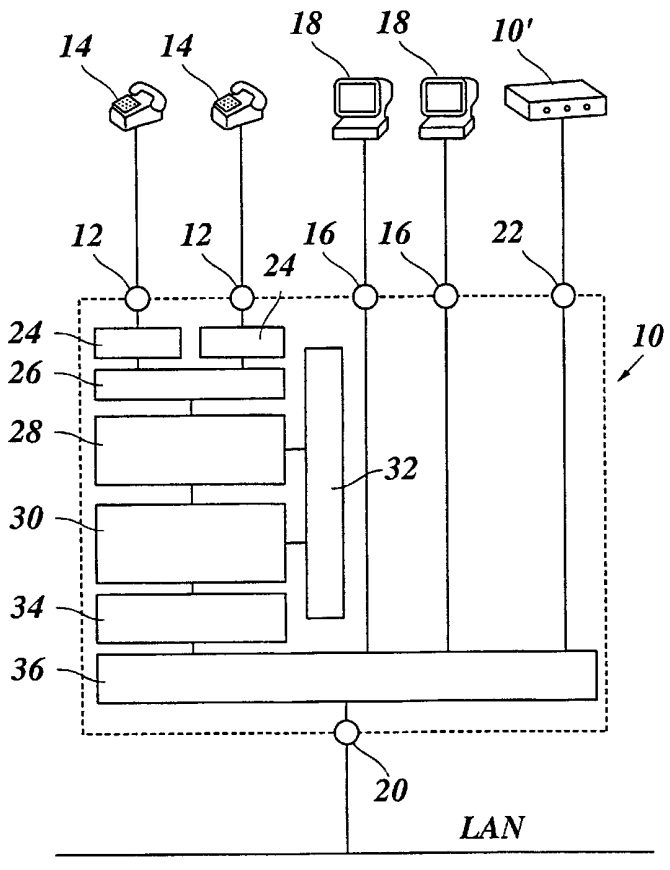
(81) Designated States *(national)*: CA, US.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: CONNECTION DEVICE WITH REAL TIME AND NON-REAL TIME DATA PORTS



(57) Abstract: Connection device for a telecommunication system, comprising: at least one real time port (12) connectable to a real time terminal (14) which is specifically adapted for handling real time data, at least one network port (20, 22) connectable to a data network for transmitting and receiving data packets which each include control information specifying at least the destination of the packet; and relay means (36) for feeding data from the real time port to the network port and vice versa, characterized in that it further comprises at least one data port (16) connectable to a data processing unit (18) capable of processing non-real time data, said relay means (36) is further adapted to feed data from the data port (16) to the network port (20, 22) and to direct data from the network port either to the real time port (14) or to the data port (16), depending on the specified destination, and control means (30, 34) are provided for handling the real time data with a higher priority than non-real time data.

WO 00/74360 A1

CONNECTION DEVICE WITH REAL TIME AND NON-REAL TIME DATA PORTS

DESCRIPTION

The invention relates to a connection device for a telecommunication system, comprising at least one real time port connectable to a real time terminal which is specifically adapted for handling real time data, at least one network port connectable to a data network for transmitting and receiving data packets which each include control information specifying at least the destination of the packet, and relay means for feeding data from the real time port to the network port and vice versa.

More specifically, the invention relates to a connection device which offers the possibility to use a data network such as the Internet or a local area network (LAN) for making a telephone call. Since, in case of a telephone call, the voice of the speaker should be made audible on the side of the listener without any noticeable delay, it is essential that the voice data are transmitted and processed in real time. Data of this type, i.e. data which need to be transmitted and processed without any substantial delay, will be termed "real time data" herein. Although voice data are the most prominent example for such real time data, it will be understood, that real time data occur also in other applications, e.g. in video, multimedia or remote control applications.

In contrast to this, the data that are normally transmitted through a data network, for example, text data sent as an e-mail, are normally buffered on the side of the receiver, so that real time processing is not essential. Data of this kind will be termed "non-real time data" herein.

In general, the standards or transmission protocols used for data transmission through a network, such as the Internet protocol (IP), are optimised for non-real time data. The continuous stream of digital data of a file to be transmitted through the network is subdivided into a plurality of packets, and a header is added to each packet. This header includes information on the destination to which the packet is to be sent and may also include additional information on the type of the data, depending on the transmission standard that is being used. Thanks to the information provided in the header, each packet can individually be routed through the network from the sender to the receiver. Thus, the time required for transmitting a packet from the sender to the receiver may vary from packet to packet, depending on the load on the network. In addition, each

packet first needs to be compiled on the side of the sender, before it can be sent through the network. As a result, it is only with a certain delay that the original file can be re-assembled on the side of the receiver.

Nevertheless, several standards have been developed which permit the transmission of voice data through a network of this type practically in real time. On the side of the sender, the analogue voice data are at first converted into digital data and are sampled over a certain period of time which will determine the length of the data packet. Preferably, data compression is applied in order to reduce the number of bits that need to be transmitted. Then, the header is added to each packet and the packet is sent through the network. On the side of the receiver, the voice data included in the packets are decompressed and re-assembled to form a continuous data stream which is then reconverted into analogue data. It will be understood that the time delay between the recording of the voice data on the side of the sender and the reproduction of these data on the side of the receiver cannot be smaller than the sample time for an individual packet. Thus, in order to keep the delay as small as possible and to provide a good quality of the telephone connection, the packets should be made as small as possible. However, small packets are inefficient in terms of bandwidth, because a header has to be transmitted with each packet and, as a result, the ratio between useable voice data and the overhead of control data becomes worse when the number of packets increases. Thus, a suitable compromise has to be made for the time intervals in which the packets are sent. In case of non-real time data, the optimal packet length is considerably larger.

In many known standards for the transmission of voice data, additional processing routines are applied to the digital data. In particular, it is advantageous to provide a routine for echo cancellation. A certain amount of echo is inevitably produced in an any telephone connection. However, in a normal telephone call, this echo is not noticeable because the time delay between the echo and the original signal is too small to be resolved by the human ear. When the delay between the original signal and the echo becomes larger due to the packet-wise transmission, echo cancellation becomes important.

A connection device of the type indicated above serves as an adapter between the telephone set and the data network may not only be used for making telephone calls through a wide area network (WAN), but also offers the possibility to

integrate a telephone system with one or more telephone sets into an existing local area network. Since computer networks such as Ethernet or the like are available in many offices or companies, this removes the necessity to install a separate wiring for the telephone system. Instead, the telephone sets are simply plugged to the computer network just like personal computers, printers or other equipment. Then, the telephone sets are connected among each other only through the cables of the computer network. If the computer network itself is connected to a public telephone network through an ISDN switch or the like, then it is possible to make not only internal calls but also external calls. In addition to a reduction installations costs, the integration of the telephone system into the computer network has the advantage that all the functionality of the computer network becomes available for administrating the telephone system. Thus, all the service functions of an advanced telephone system such as a data base for telephone numbers, voice mail, automatic telephone responder and the like, can easily be implemented as software in one or more of the computers of the network.

Examples of known telecommunication systems of this type are disclosed in DE 94 18 959 U and in the publication "NetServe VoiceServer Telefonanlage der II. Generation", published by Netserve Systementwicklung und Projektierung GmbH, Berlin, Germany. In these systems, a device that is marketed under the trade name "voice hub" serves as a connection device for connecting one or more telephone sets to a LAN (e.g. Ethernet) and a so-called voice server provides the administration and service software for the telephone system and can be connected to a public telephone network by means of, for example, an ISDN board, so that the telephone sets are connected to each other and to the public telephone network through the LAN.

Most commonly used LANs, such as, for example, coax Ethernet, have a bus architecture, which means that all network components, e.g. a server, a number of client computers and also the above-mentioned "voice hubs" are directly connected to a LAN bus, and the data transmitted through the bus are, in principle, available for each component. This architecture has the advantage that the wiring scheme is comparatively simple and, accordingly, the costs for installing a network of this type within a building, a factory or the like are relatively small. However, the bus architecture imposes certain requirements on the hardware

configuration of the cable connections.

In this respect, it may therefore be preferable to use a network that is based on end-to-end connections, such as twisted-pair Ethernet. In this case, a specific connection device, e.g. a so-called Ethernet hub, is connected to all the components of the network through end-to-end cable connections and serves as a relay for the data traffic among the various components. Of course, the above mentioned "voice hub" can also be connected to such an Ethernet hub, but then the wiring scheme becomes relatively complex and no substantial savings are achieved in comparison to a conventional installation in which separate wirings are provided for the LAN and the telephone system.

It is accordingly an object of the invention to provide a connection device of the type specified in the preamble of claim 1 which is more efficient when the real time terminal is to be integrated in a data network based on end-to-end connections.

In order to achieve this object, the connection device according to the invention is characterized in that it further comprises at least one data port connectable to a data processing unit capable of processing non-real time data, said relay means is further adapted to feed data from the data port to the network port and to direct data from the network port either to the real time port or to the data port, depending on the specified destination, and control means are provided for handling the real time data with a higher priority than non-real time data.

With the connection device according to the invention, at least one real time terminal, e.g. an analogue or digital telephone set, and at least one processing unit, e.g. a personal computer for processing non-real time data can be connected to the data network through one and the same port. As a result, one or more telephone sets and one or more computers can easily be connected to the data network, no matter whether the data network has a bus architecture or an end-to-end architecture.

The device according to the invention is particularly useful for a typical desk top environment in which one or two computers and one or two telephone sets are installed on the desk top within a limited area, e.g. within the same office room. Then, only one cable needs to be installed and to be connected to the network

port of the connection device installed in this room, and the connection device has intelligence for routing both the voice data and the computer data to their respective destinations. Since the connection device is also capable of handling the voice data and the computer data with different priorities, it is possible to suspend the transmission of computer data when voice data are received or are to be sent, so that the transmission time intervals between the voice packets will not become unacceptably long and a telephone connection with high quality is achieved even though the voice data and the computer data share the same transmission line.

Useful details of the invention are specified in the dependent claims.

Preferably, the connection device has at least two network ports. The second network port can then be used for connecting another connection device of the same type, so that the data network can be established or extended by forming a cascade of connection devices interconnected only through end-to-end connections.

If the data network is a LAN, any known standard such as the ITU standard H.323 may be used for managing internal telephone calls, i.e. telephone calls among the various telephone sets connected to the LAN. In addition, the LAN may of course have a gateway or interface to a wide area network (WAN) or a public telephone network, so that external telephone calls are also possible.

On the other hand, the connection device according to the invention is not limited to use within a LAN, but it can also be connected directly to a WAN. Likewise, the data network may be a hybrid fiber cable network (HFC network). In this case, the network port of the connection device includes or is connected to a cable modem suitable for data transmission over a broadband cable (CATV).

The connection device according to the invention may be configured as a stand-alone component, but it may also be physically integrated into the telephone set or into the computer to which it is connected. In the latter case, it is preferable however that the connection device is operable independently of the computer, so that telephone calls can be made and received even when the computer is not operating.

Preferred embodiments of the invention will now be described in conjunction with the accompanying drawings, in which:

Fig. 1 is a block diagram of a connection device according to a first embodiment of the invention;

Fig. 2 is a block diagram of a telecommunication system employing connection devices according to the invention; and

Fig. 3 is a block diagram of a connection device according to a modified embodiment of the invention.

In the example shown in figure 1, the connection device 10 comprises two real time ports 12 each of which is connected to a real time terminal which in this case is formed by an analogue telephone 14, two data ports 16 each of which is connected to a data processing unit represented here by a desk top computer 18, and a first network port 20 connected to a local area network LAN. A second network port 22 is connected to the first network port of another connection device 10' which may have the same construction as the connection device 10.

In case of an Ethernet LAN, the network ports 20, 22 and as well the data ports 16 may conform the standard Ethernet 10/100 twisted pair/RJ45 suitable for connection to a 100 Mbit/s data network or a 10 Mbit/s cable modem. Thus, the connection device may be used either in the 10 or the 100 M/bit modus. The real time ports 12 may be analogous RJ11 ports.

Internally, the connection device 10 comprises a telephone adapter 24 for each of the ports 12, a coding/decoding unit (codec) 26 connected to the two adapters 24, a digital signal processing unit (DSP) 28 connected to the codec 26, a host processor 30 controlling the operation of the connection device, a memory 32 connected to the DSP 28 and the host processor 30 and including preferably a non-volatile memory part (flash), a network controller 34 and relay means 36 interconnecting the network controller 34 and the ports 16, 20 and 22.

When a telephone call is made from one of the telephones 14, the call signalling data needed for establishing the connection and the voice data are coded in the codec 26 and are then processed in the DSP 28 under the control of the host

processor. The digital signal processing for the voice data may for example include data compression, echo cancellation and the like. The processed voice data are buffered in the memory 32 and are compiled to form data packets that have a size in the order of 80 bytes and are to be sent through the LAN in intervals of, for example, 30 ms. In a typical example, each packet comprises 24 byte of voice data and a 54 byte of header in accordance with the pertinent transmission protocols (e.g. MAC, IP/UDP, RTP). Thus, a bandwidth of about 20 Kbit/s is required for transmitting the voice data in one direction through the LAN.

The network controller 34 controls the transmission of data through the relay means 36. Once a telephone connection has been established, there is a risk of conflict between the voice data which are to be transmitted through the network port 20 every 30 ms and data packets from one of the computers 18 which are to be transmitted through the same port 20 but may be of a size that is considerably larger than that of the voice packets. In order to assure a high quality of the telephone connection, it is therefore an important feature of the connection device 10 that the voice packets are handled with priority. Thus, for example, when a voice packet is being compiled, the network controller 34 will reserve the port 20 for the transmission of this voice packet and will instruct the relay means 36 and/or the computers 18 to suspend the transmission of data packets.

It would also be possible that data packets sent from one of the computers 18 are temporarily buffered within the connection device.

When all components of the network are connected to the LAN through connection devices such as the connection device 10, it would also be possible to grant priority to the voice packets by reserving appropriate time slots in advance in the entire LAN, as long as a telephone connection exists.

When data packets are received through the network port 20 or 22, the headers of these packets are inspected, and if the packet is identified as a voice packet to be sent to one of the telephones 14, this packet is decompressed and decoded and forwarded to the pertinent port 12, and this handling of the packet is again performed with priority, if necessary.

Figure 2 shows an example of a LAN (Ethernet) with end-to-end architecture.

The network comprises a server 38 and a number of direct clients (four in this case) that are all connected to an Ethernet hub 40 through end-to-end connections. One of the direct clients is the connection device 10 that has been shown in figure 1 and to which the two telephones 14 and the two desk top computers 18 have been connected. The connection device 10' is again connected to the second network port of the device 10 and is thus indirectly connected to the Ethernet hub 40. Another connection device (not shown) may be connected to the device 10' in a similar manner, so that a cascade of connection devices is formed. Each of these connection devices may again connect up to two telephones and two computers.

Figure 2 further shows another connection device 10'' which has the same construction as the device 10 but which is used here only for connecting one telephone 14.

The other two clients connected to the Ethernet hub 40 are a so-called gateway 42 serving as an interface to a public telephone network (e.g. ISDN) and a so-called gatekeeper 44 which administers all user IDs and internal and external addresses (including Internet addresses and telephone numbers).

Thus, the LAN shown in figure 2 can be used not only for telephone calls between one of the telephones 14 and the telephone 14' but also for telephone calls from any of the telephones 14, 14' to the outside.

Every user of the LAN signs-on at the gatekeeper 44 where his address and/or telephone number is stored in a table. When a telephone call is made from any of the telephones 14, 14', a request is sent to the gatekeeper 44 which looks up the telephone number or address of the receiving side and routes the call either to the pertinent connection device 10 or the gateway 42. Likewise, when a call for one of the users is received from outside, the gateway 42 will cause the gatekeeper 44 to look up the pertinent address, and the call will be routed to the user. It will be understood that this system offers a high flexibility when a user moves within the LAN area from one location to another.

The system may also be configured to allow telephone calls among the two telephones 14 connected to the same connection device 10, but this will not be ne-

cessary in most practical cases.

Figure 3 shows a modified example of a connection device 10a which is adapted to be connected to a broad band cable network and/or a hybrid fiber cable network (HFC). In this case, a built-in cable modem 46 is intervening between the relay means 36 and the network port 20. Optionally, a third network port 48 may be provided which is configured as a LAN port just as the port 22, so that a LAN can be established by cascading a plurality of connection devices.

CLAIMS

1. Connection device for a telecommunication system, comprising:

at least one real time port (12) connectable to a real time terminal (14) which is specifically adapted for handling real time data,

at least one network port (20, 22, 48) connectable to a data network for transmitting and receiving data packets which each include control information specifying at least the destination of the packet; and

relay means (36) for feeding data from the real time port to the network port and vice versa,

characterized in that

it further comprises at least one data port (16) connectable to a data processing unit (18) capable of processing non-real time data,

said relay means (36) is further adapted to feed data from the data port (16) to the network port (20, 22, 48) and to direct data from the network port either to the real time port (12) or to the data port (16), depending on the specified destination, and

control means (30, 34) are provided for handling the real time data with a higher priority than non-real time data.

2. Connection device according to claim 1, comprising digital processing means (26) adapted for real time processing of voice data that are transmitted between the real time port (12) and the network port (20, 22, 48).

3. Connection device according to claim 1 or 2, comprising at least two network ports (20, 22, 48), one of which is arranged for connecting another connection device (10').

4. Connection device according to any of the claims 1 to 3, wherein a cable modem (46) is connected to one of the network ports (20).

5. Method for transmitting, through a data network, both real time data and non-real time data in the form of data packets which each include control information specifying at least the destination of the packet, comprising the steps of:

connecting at least one real time terminal (14) which is specifically adapted for handling real time data and at least one a data processing unit (18) capable of processing non-real time data to common relay means (36) and

operating said relay means (36) to feed data from the real time terminal (14) and the data processing unit (18) to the network and to direct data from the network either to the real time terminal (14) or to the data processing unit (18), depending on the specified destination, with the real time data being handled with a higher priority than non-real time data.

6. Method according to claim 5, wherein the real time data are voice data.

Fig. 1

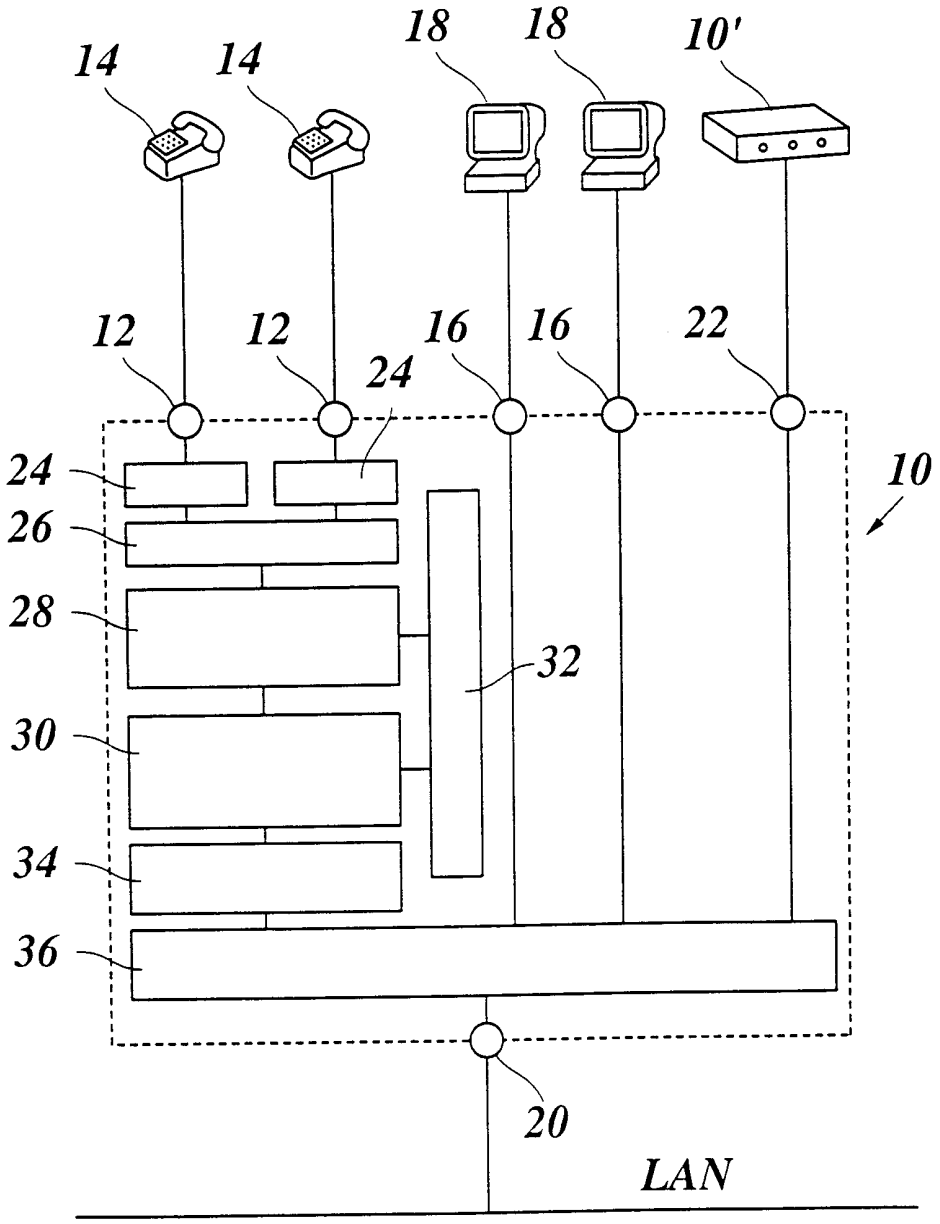


Fig. 2

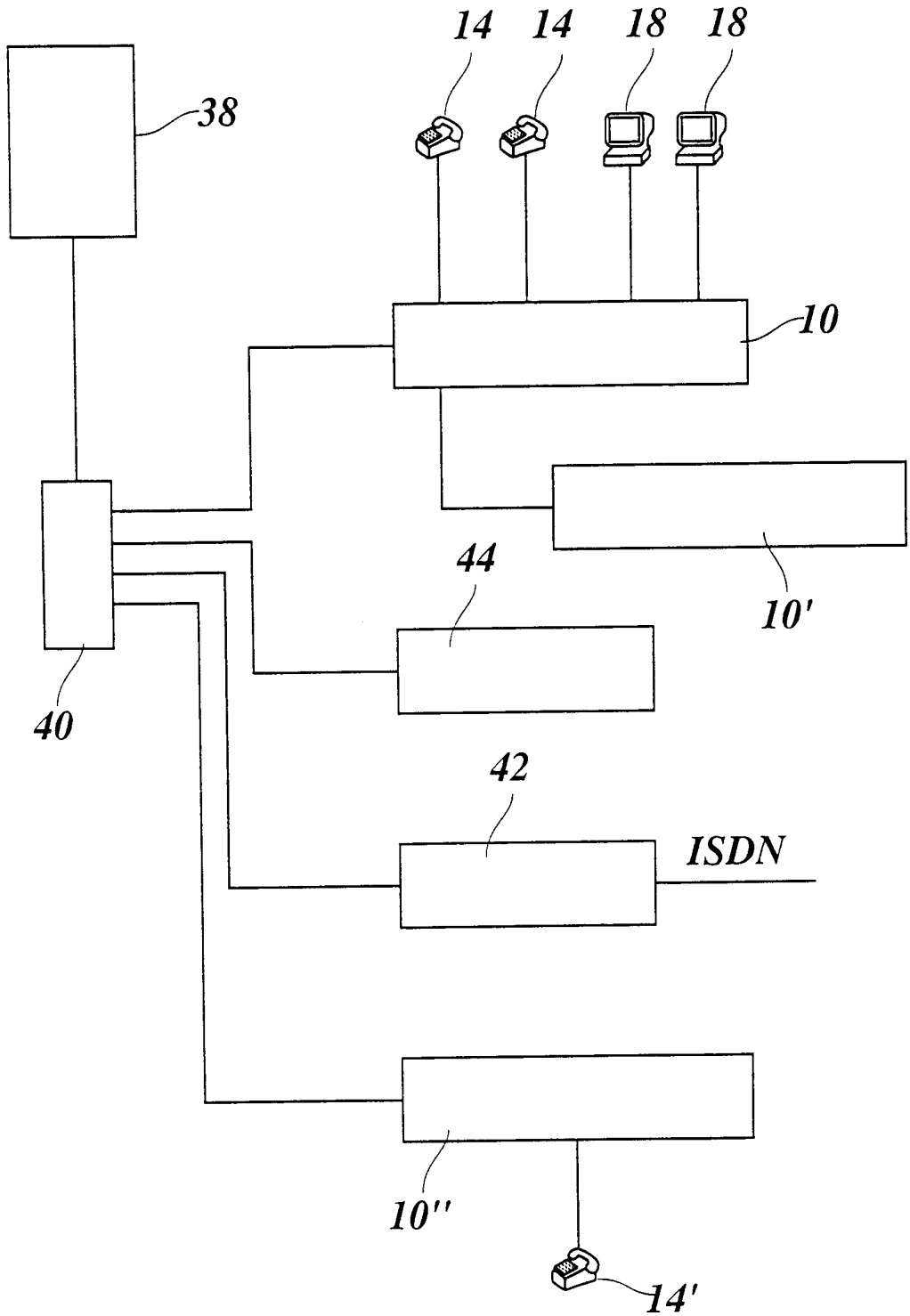
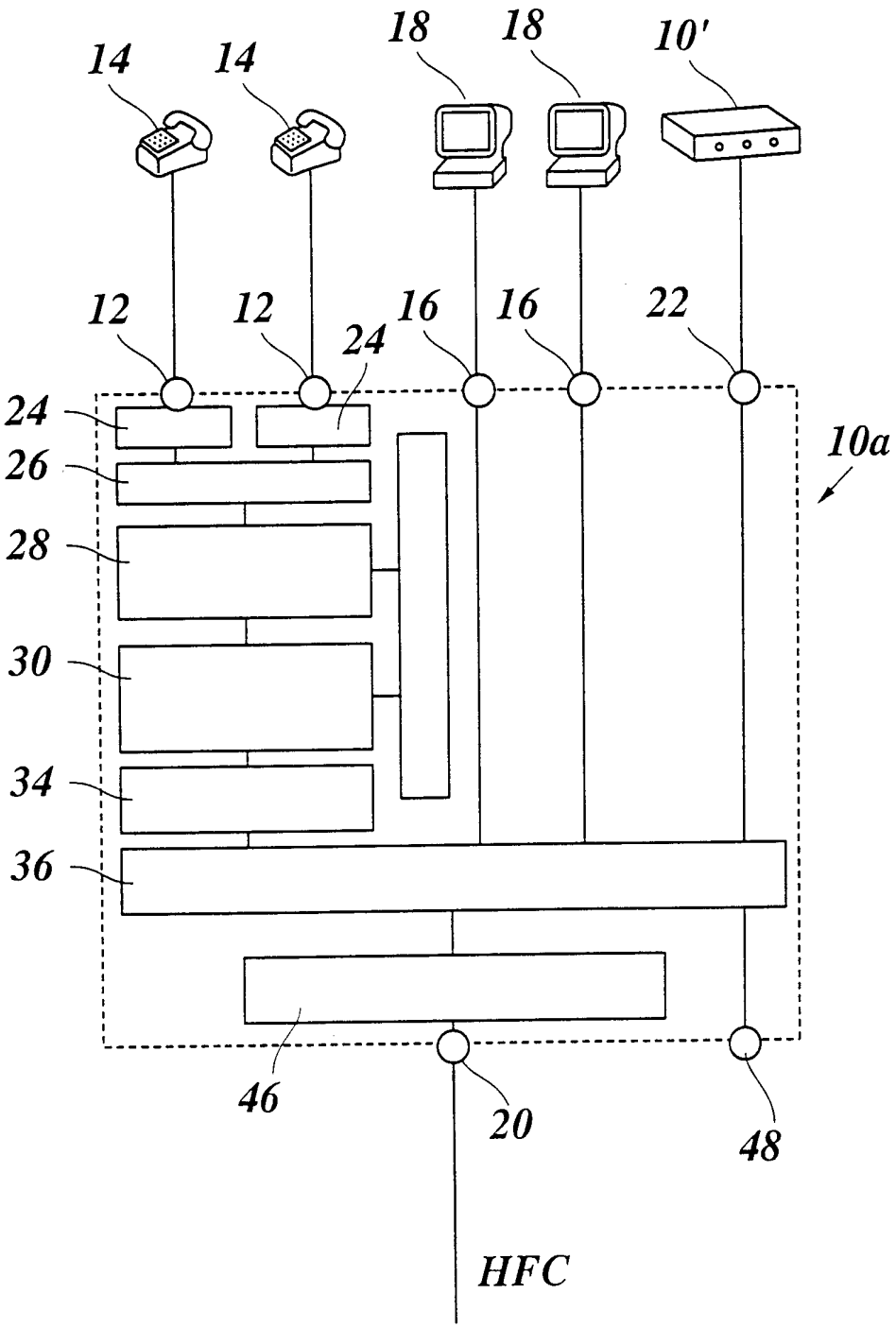


Fig. 3



INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/EP 99/03754

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04M7/00 H04L12/64

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)
IPC 7 H04M 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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 425 027 A (BARAN PAUL) 13 June 1995 (1995-06-13) figures 3,4 column 2, line 30 -column 3, line 10 column 4, line 19 - line 34 column 5, line 58 -column 8, line 30	1,2,5,6
Y	---	3,4
Y	US 5 550 820 A (BARAN PAUL) 27 August 1996 (1996-08-27) figures 1,3 column 4, line 56 -column 5, line 20 column 7, line 13 -column 8, line 43	3,4

A	EP 0 851 653 A (LUCENT TECHNOLOGIES INC) 1 July 1998 (1998-07-01) figures 8-10 column 7, line 39 -column 10, line 47	1-6

	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 February 2000	03/03/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Eraso Helguera, J

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/EP 99/03754

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 46073 A (ERICSSON TELEFON AB L M ;HANSSON ALLAN (SE); TOENNBY INGMAR (SE)) 11 December 1997 (1997-12-11) page 8, line 31 -page 9, line 25 page 13, line 15 -page 16, line 4 page 21, line 24 -page 22, line 20 figures 4,7,9,10 ---	1-6
A	KONISHI T ET AL: "VOICE AND DATA INTEGRATED COMMUNICATION ON LAN (VOICEHUB)" OKI TECHNICAL REVIEW,JP,OKI ELECTRIC INDUSTRY, TOKYO, vol. 63, no. 159, 1 July 1997 (1997-07-01), pages 5-10, XP000699911 ISSN: 0912-5566 the whole document ---	1-6
A	US 4 707 826 A (FROGGATT DENNIS G) 17 November 1987 (1987-11-17) abstract; figure 1 -----	1,5

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte onal Application No
PCT/EP 99/03754

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5425027 A	13-06-1995	AU 673415 B	07-11-1996
		AU 5958994 A	15-08-1994
		CA 2153174 A	21-07-1994
		EP 0677233 A	18-10-1995
		JP 8508855 T	17-09-1996
		WO 9416534 A	21-07-1994
		US 5642351 A	24-06-1997
		US 5870395 A	09-02-1999
US 5550820 A	27-08-1996	AU 7173094 A	03-01-1995
		CA 2165424 A	17-12-1994
		DE 704142 T	10-10-1996
		EP 0704142 A	03-04-1996
		JP 9504659 T	06-05-1997
		WO 9430028 A	22-12-1994
		US 5926479 A	20-07-1999
		CA 2144953 A	14-04-1994
		EP 0686332 A	13-12-1995
		WO 9408414 A	14-04-1994
		US 5544164 A	06-08-1996
EP 0851653 A	01-07-1998	CA 2221218 A	23-06-1998
		JP 10210182 A	07-08-1998
WO 9746073 A	11-12-1997	SE 506775 C	09-02-1998
		SE 511236 C	30-08-1999
		AU 3113697 A	05-01-1998
		AU 3113797 A	05-01-1998
		AU 3198597 A	05-01-1998
		AU 3198697 A	05-01-1998
		CN 1221530 A	30-06-1999
		CN 1221533 A	30-06-1999
		CN 1221531 A	30-06-1999
		CN 1221534 A	30-06-1999
		EP 0898837 A	03-03-1999
		EP 0898833 A	03-03-1999
		EP 0903031 A	24-03-1999
		EP 0898838 A	03-03-1999
		SE 9602212 A	05-12-1997
		SE 9603932 A	29-04-1998
		WO 9747118 A	11-12-1997
		WO 9747127 A	11-12-1997
		WO 9747119 A	11-12-1997
		AU 5236698 A	22-06-1998
		EP 0948860 A	13-10-1999
		SE 9604409 A	30-05-1998
		WO 9824224 A	04-06-1998
US 4707826 A	17-11-1987	GB 2162022 A	22-01-1986
		EP 0168927 A	22-01-1986
		JP 61035648 A	20-02-1986