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(56) Documents Cited:
WO 2007/011543 A2 **WO 2004/082255 A1**
US 20060222086 A1 **US 20060187022 A1**
US 20050083959 A1 **US 20040264680 A1**

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INT CL **H04B, H04L, H04M**
Other: **EPODOC, WPI, INSPEC, TXTE**

(54) Abstract Title: **Combining a Digital Data Signal (VoIP) with a mains power supply**

(57) Apparatus (10) for combining a digital data signal with a mains power supply, the apparatus comprising:

a) a network interface (11) for connection of a network-enabled data processing device (12) that communicates using digital internet protocol signals;

b) a modem (13) connected to the network interface, the modem configured to modulate a mains voltage supply on a mains power line (14) with said digital internet protocol signals and to demodulate digital internet protocol signals received from the mains power line (14);

c) a power output (15) configured to supply electrical power to the network-enabled data processing device (12) via the network interface (11); and

d) a power supply unit (16) configured to supply power from the mains power line (14) to each of the modem (13) and the network interface (11).

The network interface is a Voice over Internet Protocol (VoIP) module.

This invention allows a combination of VoIP with PLN (Power Line Networking), and simplifies deployment of such a system. Since a VoIP telephone requires electrical power and a network connection, integrating with PLN allows both to be obtained with a single mains cable. Embodiments of the invention include automatically switching operation directly to POTS (Post Office Telephone Service) connection in the event of power loss.

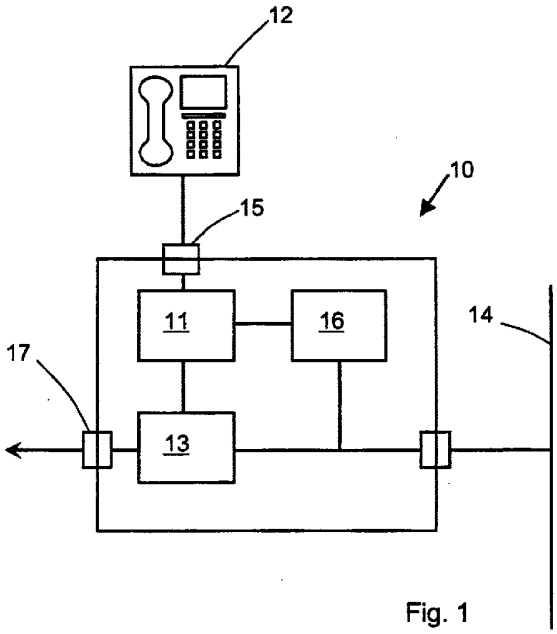

Fig. 1

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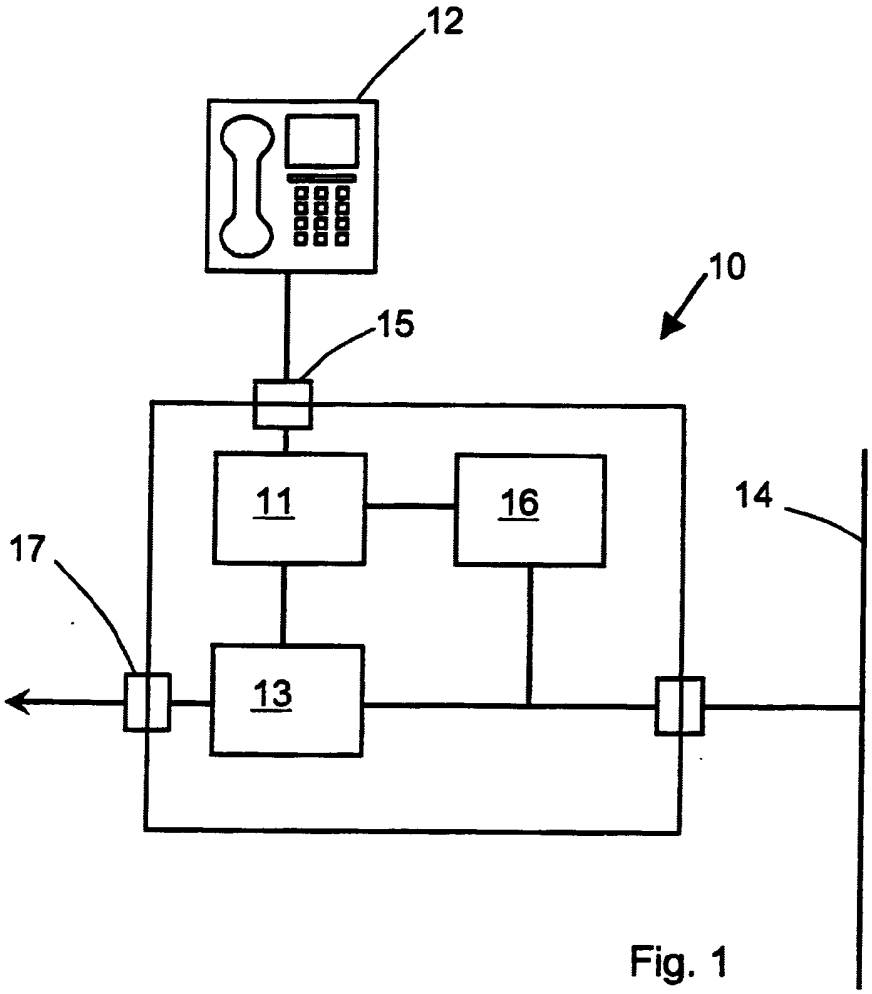

Fig. 1

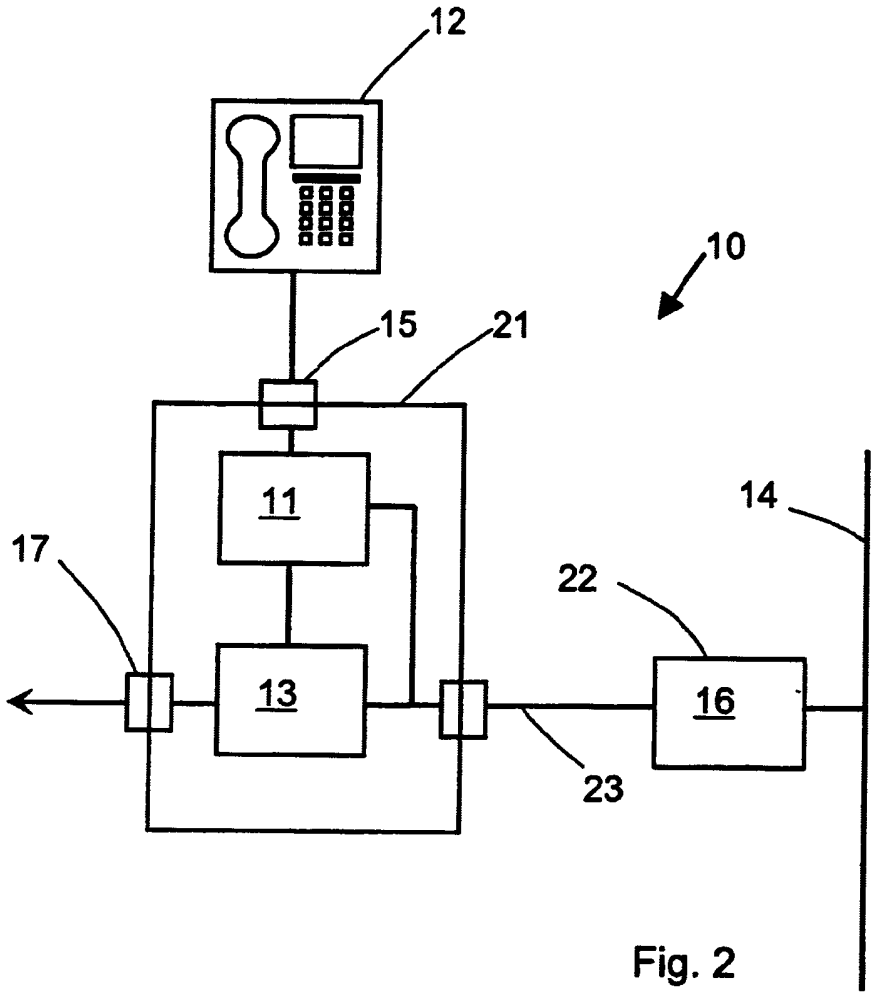

Fig. 2

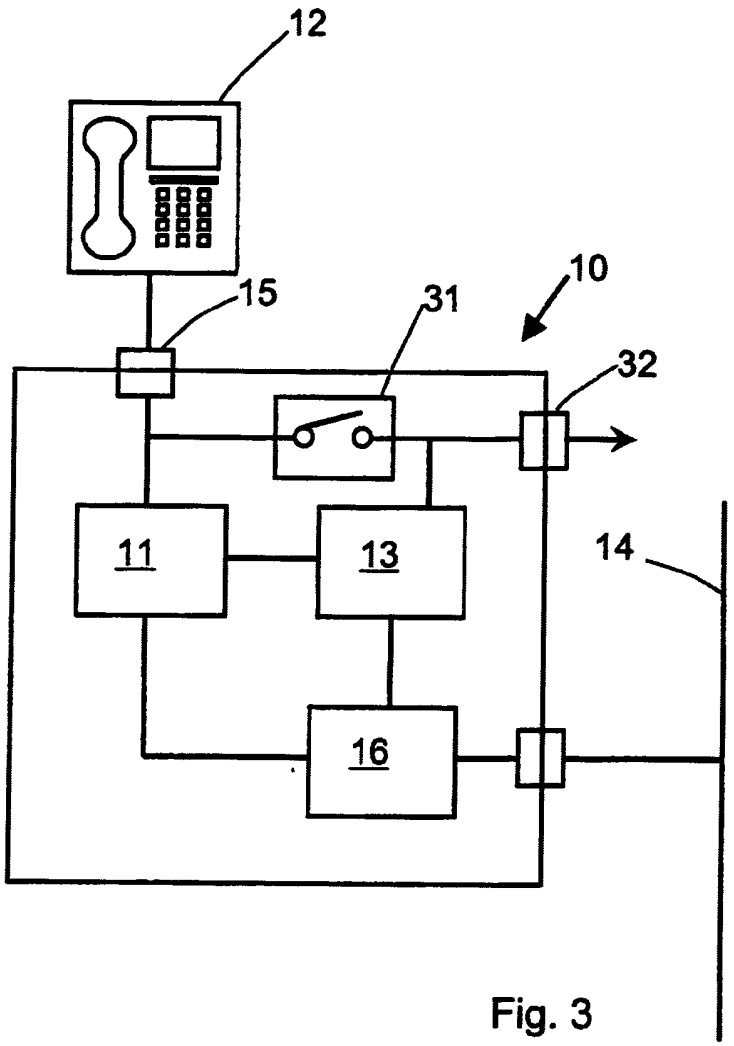

Fig. 3

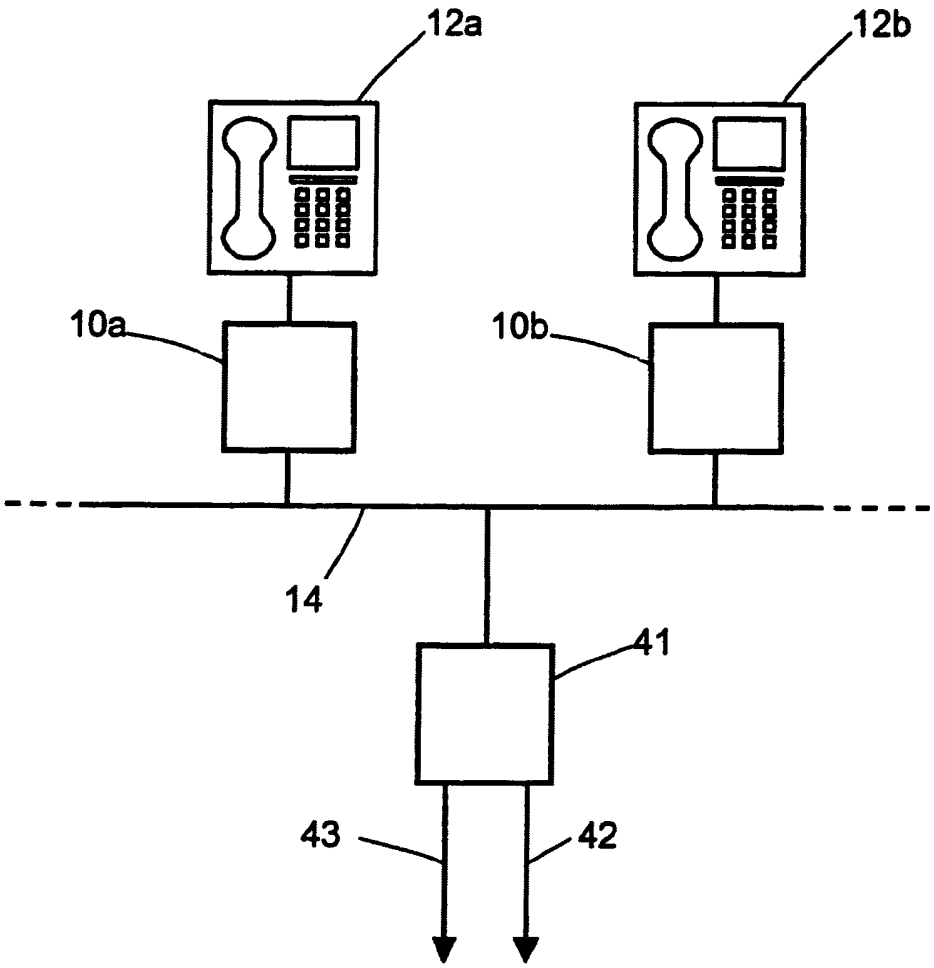

Fig. 4

NETWORK APPARATUS

Field of the Invention

The present invention relates to network apparatus for transmitting and receiving Voice over Internet Protocol (VoIP) signals over mains power lines.

Background

Voice-over-IP (VoIP) is a technology that may be used to replace traditional public exchanges (PBXs) with IP-enabled exchanges known generally as soft PBXs or IPBXs configurable via software. VoIP uses either network-enabled telephones or 'smart' sockets, known as Analogue Telephony Adaptors (ATAs), which convert analogue phone signals into digital signals suitable for transmission over networks such as Ethernet networks. Wired or wireless telephones can be used.

A traditional VoIP telephone may have separate network and power cables, which requires having a power socket nearby, as well as having to run suitable cabling (such as twisted pair wiring, for example category 5 wiring) to the phone location.

Power Line Networking (PLN), also known as Power Line Communications (PLC), Power Line Telecoms (PLT) or Broadband over Power Lines (BPL), allows digital data to be transmitted over mains wiring by modulation of the mains voltage signal. Ethernet frames are modulated onto a high frequency carrier signal which is carried over existing mains wiring within a building. Ethernet-type networks can thereby be set up without the need for extensive wiring.

A typical PLN bridge connects, via a standard Ethernet connection, a network enabled device to a mains supply line. The PLN bridge modulates and demodulates signals sent to and from the mains line.

Typical PLN implementations do not, however, integrate VoIP. Several separate units are therefore typically needed for connection of a telephone to a PLN setup.

Summary of the Invention

According to a first aspect, the invention provides an apparatus for combining a digital data signal with a mains power supply, the apparatus comprising:

a) a network interface for connection of a network-enabled data processing device that communicates using digital internet protocol signals;

b) a modem connected to the network interface, the modem configured to modulate a mains voltage supply on a mains power line with said digital internet protocol signals and to demodulate digital internet protocol signals received from the mains power line;

c) a power output configured to supply electrical power to the network-enabled data processing device via the network interface; and

d) a power supply unit configured to supply power from the mains power line to each of the modem and the network interface.

According to a second aspect, the invention provides an apparatus for combining a VoIP telephone signal with a mains power supply, the apparatus comprising:

a) a VoIP module configured to convert analogue audio signals from an analogue telephone handset into digital internet protocol signals and vice versa;

b) a modem connected to the VoIP module, the modem configured to modulate a mains voltage supply on a mains power line with said digital internet protocol signals and to demodulate digital internet protocol signals received from the mains power line;

c) a power output configured to supply electrical power to the analogue telephone handset; and

d) a power supply unit configured to generate one or more power supplies from the mains power line for each of the VoIP module, the modem and the power output.

According to a third aspect, the invention provides a network for the transmission of VoIP signals, the network comprising:

an apparatus according to the invention of the first or second aspect, the apparatus connected to a power supply line for the transmission of VoIP signals to and from the apparatus;

a network gateway having a PSTN connection and an external network connection for the transmission of VoIP signals, the network gateway connected to the power supply line for the transmission of VoIP signals between the apparatus and the network gateway,

wherein the network gateway is configured to pass VoIP signals to and from the external network connection and, in the event of failure of the external network connection, to pass analogue signals corresponding to the VoIP signals to and from the PSTN connection.

The invention allows a combination of VoIP with PLN, and simplifies deployment of such a system. Since a VoIP telephone requires electrical power and a network connection, integrating with PLN allows both to be obtained with a single mains cable.

Alternatively, the VoIP telephone may be powered by Power Over Ethernet (PoE, according for example to IEEE standard 802.3af), so that the cabling to the telephone carries both data and power.

Brief Description of the Drawings

The invention will now be described by way of example with reference to the appended drawings in which:

figure 1 illustrates schematically an example of a network apparatus;

figure 2 illustrates schematically an alternative example of a network apparatus;

figure 3 illustrates schematically an alternative example of a network apparatus; and

figure 4 illustrates schematically an exemplary network arrangement.

Specific Description

In figure 1, a VoIP PLN device 10 is shown connected to a mains supply line 14 and a telephone handset 12. A modem 13 (modulator/demodulator) is connected to the mains supply 14, the modem 13 being configured to modulate IP-encoded

signals on to the mains supply and to demodulate IP signals from the mains supply. A network interface module 11 is connected to the modem 13, the module connected via a telephone connection 15 to the telephone handset 12. The telephone connection 15 may be configured to carry analogue signals if the telephone is a standard analogue handset. Alternatively, the telephone handset may be network enabled, and the network interface 11 configured to received and transmit IP signals to the telephone. The connection 15 may also be configured to carry power to the telephone, through either a single wired connection or via a separate wire. A single wire connection may comply with Power over Ethernet (PoE) standards such as IEEE 802.3nn (where nn indicates a particular subset of standards).

A power supply unit 16 generates the required low voltage power supply for the network interface 11 (and optionally the PoE connection 15) and the modem 13.

One or more further connectors 17 may be provided for the attachment of other network-enabled devices such as a further network enabled telephone, a computer, printer or other type of network enabled device.

The connectors 15, 17 are preferably of the form known as modular connectors, which are typically registered jacks (e.g. of RJ45 form)

The device 10 may be plugged into any mains socket in a building and be configured to work immediately, by the network in the building being configured according to Zero Configuration Networking standards such as mDNS (multicast Domain Name System) or UPnP (Universal Plug and Play), or being configured to allow IP addressing via a unique MAC (Media Access Control) address allocated to the device 10. Elsewhere in the building a standard PLN device may be configured to bridge the mains-carried data frames from the device 10 on to a conventional IP network, from where the data can be carried to a soft PBX.

With one or more additional connections 17, all of the communications requirements for a typical office workspace can be provided by the device 10.

The device 10 may operate as a PLN bridge combined with a PoE midspan, i.e. allowing connection of any suitable network-enabled device, e.g. a IEEE 802.3af compatible device, via the connection 15. This would allow any PoE-powered device to be networked onto the PLN with a single cable. Such devices may, for example, be PoE VoIP telephones, networked printers or PoE wireless access points.

To avoid the safety issue of having mains voltages inside the device itself, and the inconvenience of a necessarily thick mains cable, the device can be reconfigured according to the example shown in figure 2. In this configuration, the device 10 comprises a first housing 21 having the modem 13 and network interface 11, and a second housing 22 having the power supply 16. Modulated signals are transmitted over a low voltage connection 23, e.g. a dc power connection or an ac power connection, connecting the power supply 16 to the modem 13 and network interface 11. The device 10 could be provided with multiple connections 15 for modular connectors such as RJ45 connectors as required.

The device 10 of either example may plug into a standard mains socket. The device may comprise one or more POTS (Post Office Telephone Service) sockets configured to receive a standard analogue telephone connector. A single mains connection thereby combines the power needed by the device 10 with the data networking needed for the VoIP traffic.

With the additional connector 17 adapted to provide power over Ethernet, other devices may be connected and powered via the device 10 of the examples illustrated.

The device 10 may be configured to operate according to Home Phoneline Networking Alliance (HomePNA) standards (www.homepna.org). A possible configuration is shown in figure 3.

HomePNA standards allow Ethernet signals to be carried over existing CAT3 telephone extension wiring. Such extension wiring is designed only to allow a "party line" where only one telephone can be active at a time, and all telephones

share the same number. The same wiring can, however, be used to connect more than one VoIP telephone to a soft PBX when using HomePNA networking. Each networked VoIP phone can then effectively be an independent extension. In the event of power loss, or the telephone being otherwise unable to contact to a suitable PBX, the device may be configured, as shown in figure 3, to automatically switch operation directly to a POTS (Post Office Telephone Service) connection 32. A normally-open relay switch 31 allows the telephone 12 to be directly connected to the POTS connection 32 when power is removed, or when a VoIP service is otherwise unavailable. In this way, the telephone can continue to make and receive calls, albeit in the old "party line" way. This allows for a backup service, enabling emergency calls to be made in the event of failure of the VoIP service.

The device 10 of figure 3 may also be configured to operate similarly to the devices of figures 1 or 2, i.e. using the mains supply line 14 to transmit and receive VoIP signals. The modem 13 may be configured to operate in one of two modes, the first being operable to modulate and demodulate signals over the mains supply line 14, the second being operable to modulate and demodulate signals over the CAT3 wiring connected to the POTS connection 32.

The device 10 of figure 3 may also be configured to receive standard analogue telephones via one or more connectors 15. In the event of loss of VoIP functionality, the telephones may be connected via the relay 31 to the POTS connection 32.

One or more local media gateways 41 may be provided on the local network, each connected to one or more Public Switched Telephone Network (PSTN) lines 42, as shown in figure 4. The media gateway 41 is also connected to an external network via a network connection 43 for the transmission of VoIP signals. The system can therefore be made tolerant of individual device faults, such as failure of the PBX. Each VoIP telephone 12a, 12b or VoIP PLN device 10a, 10b may be statically configured with the address of one or more suitable media gateway to use. Additionally, the VoIP PLN devices 10a, 10b may be configured in one or more of the following ways:

(1) Using Zero Configuration Networking, for example by mDNS (multicast DNS) or uPNP (universal plug-and-play), allowing the device to automatically discover any media gateways on the network.

(2) Placing outgoing calls to one of the media gateways if a soft PBX is unavailable, trying other gateways (if available) if a first PSTN line is in use.

(3) Failure of external communications may be due to the failure of the router, which often also acts as Dynamic Host Configuration Protocol (DHCP) server for the LAN. The system can be made resilient against this if all devices also support Link Local Addressing (according to RFC 3927) to allocate their own IP addresses in the absence of a DHCP server.

The media gateway 41 could also be configured to handle inbound PSTN calls, in which case each gateway will be configured to locate one or more VoIP phones 12a, 12b to ring. To achieve this, the VoIP PLN devices 10a, 10b are configured to announce their presence using Zero Configuration Networking. These announcements can include configured preference information to influence the decision as to which telephone(s) should ring for incoming calls. The ability to receive PSTN calls and route them automatically to available phones may be desirable not just in failure scenarios.

If an external network connection is provided using an Asynchronous Digital Subscriber Line (ADSL), a PSTN line 42 is typically the conduit for the ADSL service, and may be available regardless of the ADSL facility. The connections 42, 43 shown in figure 4 may therefore be effected through a single connection. The media gateway may therefore be connected to this PSTN line as a backup for VoIP telephones within the local network.

An advantage of certain aspects of the invention is that a 'plug and play' network can be constructed around VoIP PLN devices 10a, 10b. Provided one or more media gateways 41 are connected to the network and to an available PSTN line 42 and external network connection 43, each VoIP PLN device 10a, 10b can immediately obtain access to the available PSTN port 42 as well as VoIP services. No upstream soft PBX is necessarily required.

To allow internal calls, each VoIP telephone 12a, 12b or VoIP PLN device 10a, 10b may be configured with a chosen extension number, which could also be announced over the local network via Zero Configuration Networking.

A particular implementation of aspects of the invention as illustrated above is in the creation of a "Pub Hub". A large public house, bar or restaurant may have several PSTN lines for various functions (e.g. payphone, remote sensing, credit card clearance, ATM, landlord phone, fax machine). These could be replaced with a single ADSL line, and the PSTN services may be emulated using voice-over-IP, fax-over-IP (e.g. via the T.38 protocol) or modem-over-IP (e.g. V.150). Existing PSTN lines may terminate at different points in the building. Replacing these lines with VoIP PLN devices can be done without the need for additional cable, since the devices may use either the existing CAT3 cabling (via HomePNA) or the power supply line.

Other embodiments are within the scope of the invention, as defined by the appended claims.

CLAIMS

1. Apparatus for combining a digital data signal with a mains power supply, the apparatus comprising:

a) a network interface for connection of a network-enabled data processing device that communicates using digital internet protocol signals;

b) a modem connected to the network interface, the modem configured to modulate a mains voltage supply on a mains power line with said digital internet protocol signals and to demodulate digital internet protocol signals received from the mains power line;

c) a power output configured to supply electrical power to the network-enabled data processing device via the network interface; and

d) a power supply unit configured to supply power from the mains power line to each of the modem and the network interface.

2. The apparatus of claim 1 wherein the network interface is a VoIP module and the network enabled data processing device is a VoIP telephone handset, the VoIP module being configured to receive and transmit VoIP signals from and to the handset.

3. Apparatus for combining a VoIP telephone signal with a mains power supply, the apparatus comprising:

a) a VoIP module configured to convert analogue audio signals from an analogue telephone handset into digital internet protocol signals and vice versa;

b) a modem connected to the VoIP module, the modem configured to modulate a mains voltage supply on a mains power line with said digital internet protocol signals and to demodulate digital internet protocol signals received from the mains power line;

c) a power output configured to supply electrical power to the analogue telephone handset;

d) a power supply unit configured to generate one or more power supplies from the mains power line for each of the VoIP module, the modem and the power output.

4. A telephone handset comprising the apparatus of claim 1 or claim 2

5. A mains supply plug housing comprising the apparatus of any of claims 1 to 3.

6. A mains socket housing comprising:
the apparatus of any of claims 1 to 3;
a mains socket; and
an analogue or digital telephone handset connector.

7. The apparatus of any preceding claim further comprising a POTS connection, wherein the apparatus is configured to automatically switch operation to the POTS connection in response to loss of VoIP service.

8. The apparatus of claim 7 wherein the modem is configured to modulate and demodulate IP signals via the POTS connection.

9. The apparatus of claim 2 or claim 3 in which the VoIP module, the modem and the power output are integrated into a first housing and the power supply unit is provided in a second housing, the first and second housings being connected by a low voltage cable.

10. The apparatus of claim 3 in which the power output is connected via a modular connector.

11. The apparatus of claim 10 in which the modular connector is a registered jack connector.

12. The apparatus of claim 2 or claim 3 further including one or more digital network sockets connected to the modem.

13. A network for the transmission of VoIP signals, the network comprising:

an apparatus according to any preceding claim, the apparatus connected to a power supply line for the transmission of VoIP signals to and from the apparatus;

a network gateway having a PSTN connection and an external network connection for the transmission of VoIP signals, the network gateway connected to the power supply line for the transmission of VoIP signals between the apparatus and the network gateway,

wherein the network gateway is configured to pass VoIP signals to and from the external network connection and, in the event of failure of the external network connection, to pass analogue signals corresponding to the VoIP signals to and from the PSTN connection.

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12

Application No:	GB0703092.7	**Examiner:**	Mr Euros Morris
Claims searched:	All	**Date of search:**	31 May 2007

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X,Y	X 1-6, 9-13. Y: 7-8	WO2007/011543 A2 (INTERNATIONAL BROADBAND ELECTRIC COMMUNICATIONS): Whole document relevant, esp page 4 line 27 - page 5 line 7, page 7 lines 3-14.
X,Y	X 1-6, 9-13. Y: 7-8	US2006/0222086 A1 (FRYE JR): Whole document relevant, esp paragraphs 0003-0004, 0005.
X,Y	X 1-6, 9-13. Y: 7-8	US2006/0187022 A1 (DAWSON ET AL): Whole document relevant, esp paragraph 0022.
X,Y	X 1-6, 9-13. Y: 7-8	WO2004/082255 A1 (SERCONET LTD): Whole document relevant, esp page 6 line 30 - page 7 line 11, page 9 line 17 - page 10 line 24.
X	1-13	US2005/0083959 A1 (BINDER): Whole document relevant, esp paragraphs 0030-0033, 0060, 0063.
Y	Y: 7-8	US2004/0264680 A1 (WU ET AL): Whole document relevant.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X}:

H4K; H4R

Worldwide search of patent documents classified in the following areas of the IPC

H04B; H04L; H04M

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI, INSPEC, TXTE

International Classification:

Subclass	Subgroup	Valid From
H04M	0007/00	01/01/2006
H04B	0003/54	01/01/2006
H04M	0001/253	01/01/2006