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PROVISIONAL APPLICATION COVER SHEET

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This is a request for filing a PROVISIONAL APPLICATION under 37 CFR 1.53(b)(2).

Assistant Commissioner for Patents Washington, D.C. 20231	Docket Number 12727		Type a plus sign (+) inside this box →	+

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TITLE OF THE INVENTION (280 characters max)

DELIVERY AND DISTRIBUTION OF POWER IN ADDITION TO THE DATA COMMUNICATION OVER THE LOCAL/WIDE AREA NETWORK INFRASTRUCTURE

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ENCLOSED APPLICATION PARTS (check all that apply)

☒ Specification (Including Drawings) Number of Pages 15 ☐ Small Entity Statement

☐ Drawing(s) Number of Pages _____ ☐ Other (specify) _____

METHOD OF PAYMENT (check one)

☒ A check or money order is enclosed to cover the Provisional filing fees ☒ The Commissioner is hereby authorized to charge filing fees and credit Deposit Account No. **19-2090**	PROVISIONAL FILING FEE AMOUNT(S) $150.00	

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No

☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____

Respectfully submitted,

SIGNATURE: David Farah Date January 12, 1999

TYPED or PRINTED NAME DAVID A. FARAH, M.D. REGISTRATION NO. 38,134 (if appropriate)

☐ Additional inventors are being named on separately numbered sheets attached hereto

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Jc525 U.S. PTO 01/12/99

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Delivery and distribution of Power in addition to the data communication over the Local/Wide Area Network infrastructure

1. Concept Description

Today's Ethernet Local and Wide Area Network (LAN/WAN) infrastructure use to carry and distribute high bitrate data communication signals between devices. Network elements, including hubs, switches, bridges, routers, interconnections, a variety of devices equipped with network interface cards (NIC), data servers, desktop PCs, portable PCs and other network terminals consume power in order to operate. The power these devices may be supplied by either an internal or external batteries or by AC power network outlets.

The innovative idea of the PowerDsine™ Power over LAN solution, which is described in this document, is to deliver and distribute power in addition to data communication to the network elements over the LAN data communication network within a business building or a campus.

The motivating factors for consolidating power and data communication over a single network are to a) simplify and reduce the cost of installations and b) to provide uninterrupted power to critical devices in the event of main building power failure.

Network installations may be simplified and less costly by reducing the number of required power cables, power outlets and AC power supplies and by the ability to position network devices in places where AC main power is unavailable.
The cost of providing power back up to all critical network devices and terminals may be significantly reduced by distributing uninterrupted power from a few points via the LAN versus connecting each one of those critical devices to a dedicated UPS. The assumption is that only a few network switches, routers and hubs will be connected to uninterrupted power sources and the rest of the network critical devices will be receiving their operating power via the LAN.

Other benefits of Power over LAN includes reducing the safety requirements and cost of terminal equipment which may be fed from low safe voltage, now available on the LAN rather than including an internal 110/220VAC power supply. In the case of IP Telephony, Power over LAN allows providing uninterrupted power to IP telephones in a similar fashion to the ordinary analog telephony network (PSTN) which are in use today.

This article describes methods for delivering and managing power over LAN networks, which were primarily designed for digital communication. Attention is given to reduce any possible disturbances to the data communication and to maintain compatibility with the IEEE Std 802.3 and other relevant standards.

There are in use today other systems that use a single cable connection to deliver both communication and energy. The Public Service Telephone Network (PSTN), ISDN and HDSL communication devices and devices that transmit data over the public or private power networks are a few examples. The differences between these systems and applications the one that will be described in this document, is as follows:

- Power over LAN deals with high bandwidth data communication networks (10Mb/s, 100Mb/s and 1000Mb/s) which are neutrally more susceptible to noise, network bandwidth and channels crosstalk.
- The LAN medium was designed and built to carry data communication signals. Practically, this means that unlike superimposing low energy level data communication signals over networks for power, the cables, connections, line interface circuitry and terminal devices were not designed to handle high power. Hence, the power, which will be delivered on the LAN, must be used efficiently and be directed to critical network elements.

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- Mixed point-to-point and Point-to-multi point (star) network architecture (vs. just point-to-point). This network architecture requires addressing subjects such as fault protection and management in order to prevent scenarios where a single faulty point might effect the whole network area.
- The network in this case should comply with the IEEE Std 802.3x standards.
- Power over LAN deals with distributed power over a variety of network hierarchy levels. Including optional network nodes bypassing and a power networking management mechanism.
- The LAN IEEE Std 802.3 line interface circuitry is unique compared to the types which are used in other combined power and communication applications (such as PSTN and HDSL).
- LAN infrastructure limits the cable lengths to only a few hundred meters in comparison to a few kilometers in PSTN and HDSL communication. Therefore different remote power feeding methods which are more cost-effective for shorter reach may be employed.
- A Power over LAN network must support and not harm also devices that were not designed to accept power from the data network.

The Power over the LAN may be delivered as DC or low frequency AC voltages that will not interfere with the data communication signals. The power voltages over the LAN cables must be kept below 120Vpeak and the current must be limited in order to maintain compatibility with the UL60950 and the EN60950 safety standards.

The power over the data cable may be transferred by the spare Category 5 wire pairs (one or two pairs) or by the receive and transmit wire pairs (either one or both pairs) by using different connection methods (see Figures 3-7).

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2. The Need

Today, each data network device which is not self energized (includes a battery, for example) requires a power connection in addition to the network connection. This fact complicates and increases the cost of installation and limits the positioning of network devices to where power and data network connections are available. In fact, it requires building and maintaining two separate networks that are connected to each such device, one for data communication and the other for power distribution. In addition, for the network devices to be able to work during building main power failures, each network device must either include an internal battery or must be connected to a dedicated uninterrupted power source (UPS). In some applications, such as in IP (or LAN) telephones the number of network devices, which should operate during building power outage, may be very high.

The PowerDsine™ Power over LAN eliminates the need of each network device, which do not operates of a battery, to be connected to a power outlet in addition to it's network connection. This significantly reduces the number of cables, outlets and connections and thereby simplifies the installation and provides a cost-effective means for providing an uninterrupted power to multiple network devices.

Keeping in mind the fact that the network infrastructure was primarily designed and optimized to carry high bandwidth, low power data communication signals. The IEEE Std 802.3 standard requires that the electrical charges over the transmitting cable will be isolated and balanced in reference to the earth ground at both ends. Category 3 to 5 LAN cables, RJ45 connectors, the line interface of network consuming devises and all IEEE Std 802.3 compatible devices along the network were not designed to carry power which is sufficient to operate most network devices. Therefore, using the LAN infrastructure to simultaneously distribute data communication and power is not obvious and requires a solution which addresses the following challenges:

- Power distribution should not increase the network bit error rate (BER) or disturb the data communication in any way.
- Power on the network should not introduce risk users and network maintenance personnel.
- Power over the LAN should not harm standard LAN equipment, which does not receive its power from the data network.
- The addition of power over the data network should not degrade the network's reliability.

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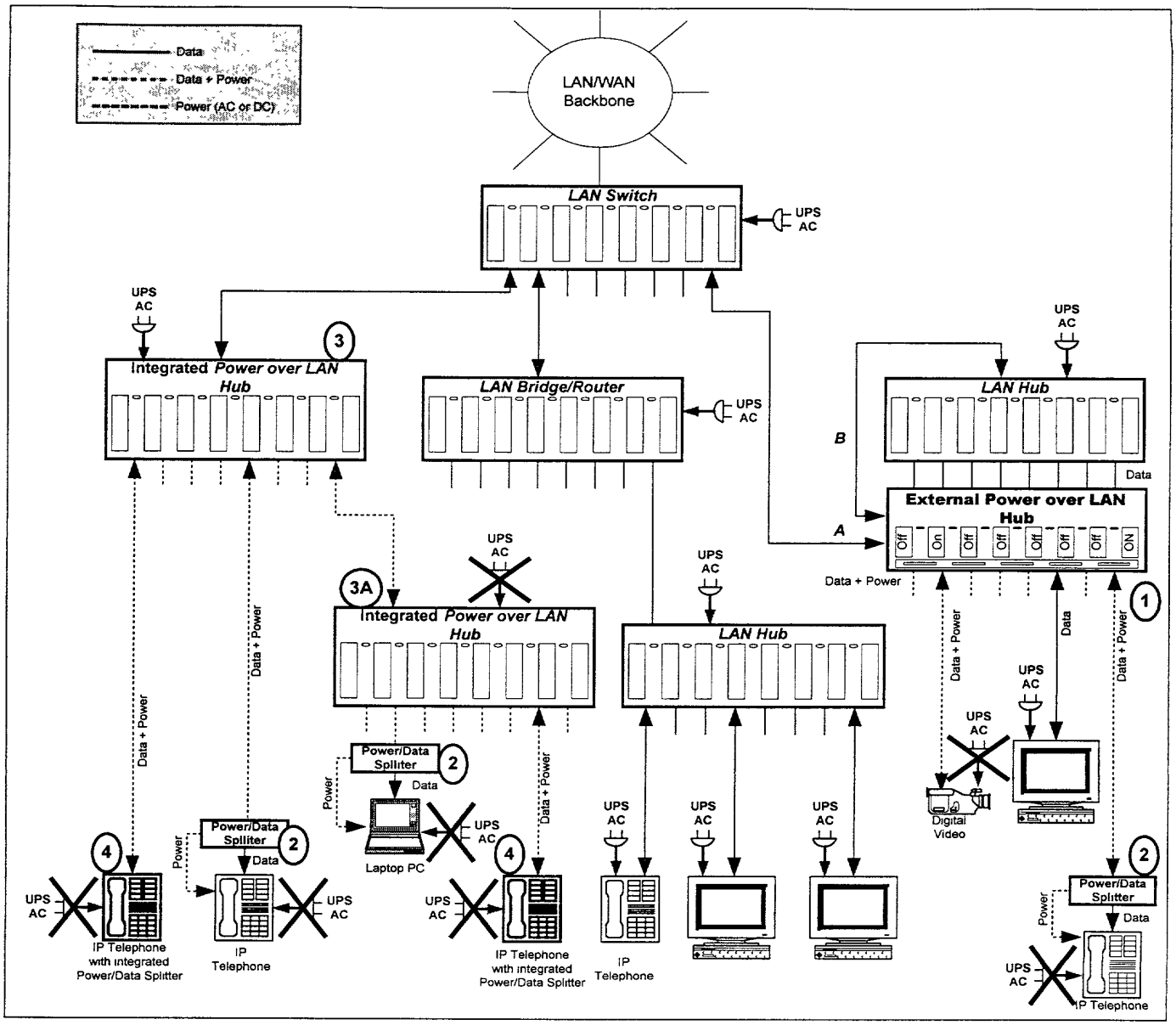

Figure 1 – Power over LAN Typical network installation

3. Application

Typical applications of network systems which utilize Power over LAN may include IP or LAN Telephony, digital video conferencing equipment, portable computers and network printers. Security alarm devices connected to the network, remotely controlled Smart Home devices and other similar applications. All network managing devices including hubs, routers, bridges, switches may receive their operating power from the data communication network.

The possible applications of Power over LAN are only limited by the amount of power that may be delivered through the LAN network without making it dangerous to use or not cost attractive.

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