IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

**In Re Application of:**

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**For: AN INDEPENDENT CENTRAL OFFICE CONNECTED TO CUSTOMERS VIA PACKET SWITCHED TRANSPORT SYSTEMS**

**Examiner:** Unknown

## DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name; and

I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a

☒ Utility Patent ☐ Design Patent

is sought on the invention, whose title appears above, the specification of which:

☐ is attached hereto.

☒ was filed on 10/12/00 as Serial No. 09/689,071 .

☐ said application having been amended on _____ .

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to be material to the patentability of this application in accordance with 37 CFR § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a-d) of any **foreign**

# AN INDEPENDENT CENTRAL OFFICE CONNECTED TO CUSTOMERS VIA PACKET SWITCHED TRANSPORT SYSTEMS

## CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is a continuation-in-part application of U.S. Patent Application Serial No. 09/390,730, filed September 7, 1999, which is, in turn, a continuation application of U.S. Patent Application Serial No. 08/933,545, filed September 19, 1997 (now U.S. Patent No. 5,790,130), which is, in turn, a continuation-in-part application of U.S. Patent Application Serial No. 08/890,589, filed July 9, 1997 (now U.S. Patent No. 5,991,310), which is, in turn, a continuation-in-part application of U.S. Patent Application Serial No. 08/806,471, filed February 26, 1997, the contents of all of these applications hereby being incorporated by reference. The present application also claims priority from U.S. Provisional Patent Application Nos. 60/159,061, 60/159,032, and 60/159,052 filed October 12, 1999, and U.S. Provisional Patent Application Nos. 60/160,593, 60/160,525, 60/160,539, and 60/160,591 filed October 20, 1999. The content of all of these provisional applications are also hereby incorporated by reference.

## BACKGROUND OF THE INVENTION

### Field of the Invention

The present invention relates generally to a telecommunications system that provides a central office that is independent of the local exchange carriers and, in particular, to a system that uses existing local area network (LAN) technologies to connect such an Independent Central Office (ICO) to customers in the vicinity of the ICO so as to provide central office functions to such customers, whether the customers are residents of residential housing developments (single detached, attached, and multi-family) or tenants of commercial developments.

### Description of the Prior Art

The divestiture of American Telephone & Telegraph (AT&T) in 1984 resulted in the creation of seven Regional Bell Operating Companies ("RBOCs"). Since AT&T remained as purely a long distance carrier, the business of providing local telephone services came under the control of these seven RBOCs. After divestiture, the seven RBOCs (the "Incumbent Local Exchange Carriers" or "LECS") owned all of the expensive "hardwire" infrastructure necessary to provide local telephone services and owned the local networks to which all of the long distance carriers ("IXCs") had to pay access fees in order to originate and terminate their customer's long

distance calls. Since the RBOCs had not been required to freely allow competition for local telephone service in the local markets, to date no company has been successful in entering the estimated $90 billion LEC market in the United States on a large scale, large scale being defined as including residential customers. Therefore, regarding the provision of local telephone services across the United States, the AT&T divestiture in 1984 basically replaced a national monopoly (AT&T) with seven geographic monopolies (RBOCs).

Despite the passage of the Telecommunications Act of 1996, the purpose of which was to effect significant competition in the LEC markets, the existing RBOCs, due to their overwhelming size and their ownership of the existing infrastructure, have to date been successful in inhibiting any significant competition in the LEC market since any new entrant into the market has only two options for the provisioning of local telephone services: (1) building new infrastructure which is prohibitively expensive, or (2) successfully negotiating contracts with the incumbent LECs which require the payment of excessive access fees to the incumbent LECs in order to utilize the LEC infrastructure to resell local telephone services. Neither of these options is particularly appealing since either option substantially favors the RBOCs in the following ways:

1. There is currently no viable, cost effective alternative to the conventional "hardwire" platform to allow large scale competition in the LEC market on a national basis or even on a regional basis.

2. The costs to build a new infrastructure today are prohibitive. In a Wall Street Journal article dated February 12, 1996, the costs of building such an infrastructure were projected at $5 billion to "get started" and $20 billion to "extensively penetrate the market." It has since become clear to the entire telecommunications industry that these projected costs were very low. In 1996, both AT&T and MCI announced strategic plans calling for large-scale (including residential customers) building of local networks to compete with the Incumbent LECs. However, neither AT&T nor MCI has pursued these plans and both have admitted that doing so, on a large scale, would not be economically feasible. On July 14, 1997, the Wall Street Journal reported MCI's projected loss of $800 million in its attempt to build local networks in a number of metropolitan markets to begin to compete for local commercial accounts. This news caused MCI to lose $5 billion of market value in one day! AT&T has also suffered significant losses in its attempt to enter the LEC market and has since opted to primarily use cable access to enter the home.

3. The RBOCs have enjoyed one of the highest operating cash flow margins of any U.S. industry, over double that of the IXCs. While

the LEC business has remained "proprietary," the long distance business, with its increased competition, has become much more of a "commodity" business with long distance rates pushed ever lower. AT&T has had its market share drop by over half since 1984 and has had its average revenue per minute cut almost in half. Hence, AT&T and MCI are not in a position to "outspend" the RBOCs in infrastructure development.

4. The RBOCs have all filed to become long distance service providers ("IXCs"). In contrast to the plight of AT&T and MCI in their attempts to enter the LEC market, there are no costly infrastructure obstacles blocking entry of the RBOCs into the IXC market: the RBOCs can buy ready made networks from IXC providers at wholesale rates for immediate deployment. The RBOCs initially announced that their initial strategies regarding the provision of long distance services would be to resell, where discounts usually run about 80%. However, in contrast, the resale discounts the RBOCs originally intended to offer the IXCs for resale of local services were closer to 10-15%.

To ensure their own competitive survival, the IXCs must make inroads into the profitable LEC market. However, to date no technology has been proposed which would enable a company independent of the RBOCs to provide local telephone services at a competitive cost. None of the previously available solutions is economically viable for the reasons noted above. There is thus a great need in the art for a system and method which would enable a company independent of the RBOCs to provide cost competitive local telephone services, and hence meaningful competition to the incumbent RBOCs in the LEC market, without requiring a cost prohibitive infrastructure investment.

Accordingly, a new telecommunications network platform is desired which permits cost effective competition with the Incumbent LECs in the local telephone market without requiring specialized customer premises equipment, without significant infrastructure investment, and without "deals" with the Incumbent LECs. Embodiments of the present invention have been designed to meet this great need in the art.

## SUMMARY OF THE INVENTION

The present inventors have met the above-mentioned needs in the art by creating a new telecommunications network platform for providing local and long distance telecommunications services independent of the existing infrastructure managed by the LECs. Those skilled in the art will appreciate that the techniques described herein permit the cost-effective creation of a hardwire platform of infrastructure and Central Offices (COs) in many areas throughout the United States.

In particular, the present invention relates to a telecommunications network platform that provides analog voice grade communications between a caller and an Independent Central Office (ICO) via one or more local area transport technologies so as to provide local and/or long distance as well as other media services to the caller. The switch of the independent central office is further connected to the incumbent local exchange carrier, long distance carrier, or other specialized carrier using any of a number of transport technologies, such as those described in related U.S. Patent Application Serial No. 09/552,055, filed April 19, 2000, as may be required to complete the customer connectivity. Through the bundling of communications services such as dial tone, long distance, Internet access, security system monitoring, and remote utility monitoring, a company independent of the incumbent LECs will be able, using the telecommunications network platform of the invention, to offer telecommunications services in a bundled platform offering a 20% to 30% savings to the consumer over existing services of these types. As will be explained below, this may be accomplished in accordance with the invention without requiring the subscriber to purchase any new costly hardware. Instead, existing technology is utilized is in a cost-effective manner so as to permit a plurality of subscribers to share an Independent Central Office for Central Office services, such as, but not limited to local calling, data transmission, and long distance calling. Several embodiments of the invention described herein provide analog voice grade communications from a caller to the public switched telephone network by utilizing alternative Metropolitan Area Network (MAN) mechanisms and then conventional connectivity or connectivity of the type described in the afore-mentioned related application from the Independent Central Office to the appropriate service carriers or services. In like manner, other services are provisioned for, including digital voice, data communications, messaging, Internet access, media reception, and related control, management, billing, and service functions. LEC bypass techniques of the type described in parent application serial number 08/806,471 may also be utilized to minimize LEC access fees; however, such LEC bypass techniques are not required for implementation of the present invention. Services may be implemented singly, or in combinations, such that the economic and technological characteristics of the embodiments are not dependent on the provisioning of multiple services (for example, high speed Internet access with analog-based voice calls).

In preferred embodiments, the Independent Central Office of the invention comprises telephone switching equipment such as a private branch exchange ("PBX") connected between the subscriber premises and LEC switch at the LEC Central Office. Such switching equipment located at the Independent Central Office may comprise a data service unit (DSU) and/or channel service unit (CSU) connected to the LEC switch

via one or more alternative MAN transport channels and a DS1 conversion card connected between the telephone switching equipment and the channel service unit. Alternatively, a D4 multiplexer may connect the channel service unit to at least one analog trunk within the telephone switching equipment, where the D4 multiplexer comprises a converter which converts analog voice signals from the analog trunk to digital signals for application to the channel service unit. This application discusses the details of the connectivity between the customer premises and the Independent Central Office that is thus, or in a related fashion, connected to the larger networks for voice, data, media, messaging, or other telecommunications services.

The telephone switching equipment of the ICO is preferably located in a residential housing development (single detached, attached, or multi-family) or a commercial development and used to provide local and long distance calling services, as well as Internet access and other telecommunications and data services, to the residents of the residential housing development or to the tenants of the commercial development. Services may be provisioned to surrounding extant potential residential and commercial customers without further refinement of the technology. Although the economic case for servicing the surrounding neighbors and businesses is distinct, the Independent Central Office servicing the residential, or mixed use, development substantially recoups the costs of the Independent Central Office that supports the economic implementation of services to surrounding neighbors. Particularly in applications of higher average revenue, such as high speed Internet access, specialized media connections, and other data services, there may be both an economic and a qualitative reason for customers outside the initial area of service provided by the Independent Central Office to be serviced. The long distance service and the local service within the development as well as local service via the public switched network are provided via interconnections outside the incumbent LEC infrastructure to interconnect to a CLEC, LEC, and/or IXC.

In accordance with the invention, the interconnections between the customer and the switch at the ICO are preferably packet based technologies such as Ethernet 802.3, Asynchronous Transfer Mode (ATM), Frame Relay, or fiber distributed data interface (FDDI). The customer premises would be adapted to include a gateway for converting analog POTs into packetized voice data and vice-versa, while the ICO would be adapted to include in IP gateway or a "software switch" for converting packet switched data to circuit switched data and vice-versa. In an alternate embodiment, the IP gateway may be located at the incumbent LEC premises so that MAN technologies may be used all the way out to the

incumbent LEC. The data packets may be sent over wire or fiber or using wireless LAN equipment.

As in the afore-mentioned related application, the ICO may be interconnected to the incumbent LEC using any of a number of data transport modalities including coaxial cable connections, T1/T3 wireline connections, ISDN/PRI wireline connections, SONET Ring fiber transports, optical fiber drops, IEEE 802.6 Dual Fiber Rings, cellular or PCS wireless connections, laser or infrared point to point connections, microwave transmissions, satellite point to point transmissions, power utility lines, DSL wireline connections, metropolitan area networking technologies, distance supported peripheral connection technologies, combinations of media, and the like.

Since the ICO platform of the invention is typically provided in new service areas not presently serviced by the Incumbent LECs, new infrastructure may be purchased which is not in direct competition with that provided by the incumbent LECs. Then, the MAN transport technology of the invention permits the new infrastructure to be connected into the existing public switched network at tariffs substantially below the tariffs of conventional residential voice lines, thus permitting the cost savings for the community's residents and making the technique of the invention economically viable. Also, the cost structure of the telecommunications network platform of the invention makes it possible to extend the platform of the invention to include pre-existing residential and commercial developments that need to have all or part of their communications infrastructure replaced. In areas where the placement of Incumbent LEC infrastructure has not kept pace with the growth in population, or rapid increases in teledensity, then the coincident location of the Independent Central Office can cover a high teledensity to compensate for the requirement of 'overbuilding' (inserting duplicative physical media infrastructure). The economic justification for service pricing from the Independent Central Office is then spread across an even larger number of customers resulting in a greater economic advantage for new development areas while supporting the provisioning of services for pre-existing residential and mixed potential customers. Economies of scale thus support the services of a premium nature (such as, but not limited to, high speed Internet, high speed data transmission, CLASS services, DSL-based services, ISDN-based services, and interactions with wireless formats) that can be profitably provided. In areas remote from an existing Incumbent LEC infrastructure central office, the advantages are more striking since many existing and emerging services are limited by physical distance from the Central Office Facilities (such as, but not limited to, wireline provisioned ISDN, wireline provisioned DSL, short-haul data transmission, high speed local area networking extensions, and related services and support).

Thus, the present invention provides the first platform for the provision of a complete package of local and long distance services without having to negotiate cohabitation or resale agreements with the LECs. Moreover, since the ICOs of the invention may independently gather billing data and perform other conventional Central Office functions, the system of the invention is not dependent on the LECs for customer support or for the gathering of billing data.

## BRIEF DESCRIPTION OF THE DRAWINGS

The objects and advantages of the invention will become more apparent and more readily appreciated from the following detailed description of the presently preferred exemplary embodiments of the invention taken in conjunction with the accompanying drawings of which:

FIGURE 1 illustrates the hardwire connection between an independent Central Office in a residential housing development, the subscriber premises, and the incumbent LEC Central Office.

FIGURE 2 illustrates the flow of an outbound call from a subscriber's premise in the residential housing development of the embodiment of FIGURE 1.

FIGURE 3 illustrates the flow of an incoming call to a subscriber's premise in the residential housing development of the embodiment of FIGURE 1.

FIGURE 4 illustrates a presently preferred embodiment of the invention whereby the hardwire connection between the customer premises and the independent Central Office (ICO) comprises a packet switched MAN transport system including an IP gateway at the switch of the ICO.

FIGURE 5 illustrates an alternative embodiment of the invention whereby the IP gateway is co-located at the premises of the incumbent LEC Central Office.

FIGURE 6 illustrates an alternative embodiment of the invention whereby an IP gateway is also co-located at the premises of the long distance carrier for direct connection from the ICO to the long distance carrier.

FIGURE 7 illustrates an alternative embodiment of the invention for providing data collection services via the ICO using the data transport techniques of the invention.

## DETAILED DESCRIPTION OF PRESENTLY PREFERRED EMBODIMENTS

A method and system for providing local and long distance calling services and for creating an Independent Central Office ("ICO") telecommunications platform in a residential housing development or commercial development in accordance with the presently preferred exemplary embodiments of the invention will be described below with reference to FIGURES 1-7. It will be appreciated by those of ordinary skill in the art that the description given herein with respect to those figures is for exemplary purposes only and is not intended in any way to limit the scope of the invention. All questions regarding the scope of the invention may be resolved by referring to the appended claims.

### INDEPENDENT CENTRAL OFFICE

An independent Central Office as described herein is set forth in detail U.S. Patent No. 5,790,130 and U.S. Patent No. 5,991,310, the contents of which are incorporated by reference above. As described therein, voice services, data, or Internet services are provided to a caller via an Independent Central Office (ICO) by utilizing existing tariffed network data services. LEC bypass techniques may or may not be used to interconnect the ICO to the Incumbent LEC Central Office; however, such techniques are generally preferred as they avoid payment of the LEC access fees for long distance services.

### TELEPHONE SERVICES PLATFORM FOR DEVELOPMENTS

In the embodiments described in the afore-mentioned parent applications, it was assumed that the D4 multiplexer was provided as part of the Central Office equipment owned and operated by the incumbent LEC. However, in the embodiment of the invention described herein, the D4 multiplexer need not be owned and operated by the incumbent LEC. Instead, as illustrated in FIGURE 1, the D4 multiplexers of the Central Office may be replaced by privately owned stand alone D4 multiplexers 58 not provided by the LEC 14 as part of the Central Office equipment. In FIGURE 1, the lines 60 connecting the customer premise 10 to the D4 multiplexer 58 are private copper wire cable (typically Category 3 wire connections for MAN transport) instead of the LEC provided analog data lines 18 described in the parent applications. In the embodiment of FIGURE 1, the privately owned D4 multiplexer 58 may be provided outside in a weatherproof housing 62 with an uninterruptible power source (UPS) so as to provide a simple independent Central Office capability in accordance with the invention which is free of most right of way concerns.

The privately owned D4 multiplexers 58 are placed in residential housing developments (single detached, attached, or multi-family) or mixed/commercial developments 64 as indicated by dotted line in FIGURE 1. In accordance with the invention, new copper

wire or twisted pair cable 60 is laid from the D4 multiplexers 58 to each new home during construction but control of these lines is not relinquished to the Incumbent LEC when construction is completed. Alternatively, the copper wire or twisted pair cable 60 may be laid in existing neighborhoods if cost-effective.

The D4 multiplexer 58 is preferably contained in an environmentally protected, climate controlled, vandal proof housing 62 suitable for outdoor use on the premises of the residential or commercial development 64. The housing 62 preferably contains two RJ-48S interfaces, two CSU cards, and up to forty-eight Nx56/64 voice/data card slots. The slot types are preferably universal in nature and adapted to accommodate FXS, E&M, Office Channel Unit Data Port (OCUDP), OPX, and NT1 interfaces. Housing 62 preferably mounts directly onto a concrete slab with two one inch conduit ducts (Network Interface and 120 VAC) and one four inch conduit duct (Customer Side Interface). The Customer Side Interface (CSI) preferably has an access panel allowing easy access to two 48 pin punchdown blocks. A fully redundant Uninterruptible Power Supply (UPS) system with at least a four hour backup is also provided.

The D4 multiplexer 58 may be independently controlled by an independent telecommunications service company to provide long distance services to development 64 via T1 line 22, DEXCS frame 24, and T1 line 27 using conventional techniques or the LEC bypass techniques described in the parent applications. Access to the public switched network for local service could continue to be provided by the Incumbent LEC Central Office 14 by connecting the DEXCS frame 24 directly to the Incumbent LECs switch 66, such as the 5ESS or DMS100 tariffed for voice services, via T1 line 68. However, in this case, the customer only receives cost savings for long distance services; LEC local service charges would continue to be charged for access to the customer premises.

On the other hand, savings for local as well as long distance services may be provided to the customers of the development 64 by further providing an Independent Central Office facility 70 of the type illustrated in FIGURE 1. As in the embodiments described in the afore-mentioned parent applications, Independent Central Office 70 is preferably, though not necessarily, accessed by the customer via the DEXCS frame 24 and T1 line 26 and contains a switch 42 such as a private branch exchange ("PBX") including Channel Service Unit cards 48 and DS1 cards 50. Access to the long distance network is preferably provided by the switch 42 by connecting an incoming call on incoming T1 line 26 to outgoing T1 line 46 for connection to the long distance network via DEXCS frame 24 and T1 line 27. However, access to local services may also be provided without payment of conventional LEC local service charges for residential voice service by providing Direct Inward Dialing (DID) across

digital high capacity trunk lines 72 and Direct Outbound Dialing (DOD) across digital high capacity trunk lines 44 purchased by the Independent Central Office 70 from the Incumbent LEC Central Office 14.

Those skilled in the art will appreciate that DID and DOD across digital high capacity lines provides an 8:1 ratio of subscribers to lines. DID numbers are assigned Automatic Number Identification (ANI) codes from the Incumbent LEC, which is currently a tariffed commercial service, substantially less per minute than tariffed residential customer voice service. When a DID number is dialed from within the public switched network, it is routed to an available channel on the PBX 42 via trunk lines 72, and PBX 42 picks up the ANI code and switches the call to the terminating station line (subscriber), who may be a subscriber in development 64 or a subscriber in development 73 (described in more detail below). On the other hand, calls originating within the subscriber houses 10 serviced by the Independent Central Office 70 are provided to the Customer premises via DOD trunk lines 44. Those skilled in the art will appreciate that this arrangement is similar to a corporate PBX environment where such a ratio of lines to subscribers is commonly used. However, those skilled in the art will further appreciate that such facilities have not previously been provided to residential customers in a residential neighborhood as proposed herein with the substantial cost savings to residential subscribers.

To put the cost savings in perspective, it is noted that 150 residential subscribers may be serviced by 150/8 = 19 inbound/outbound lines, whereby the Independent Central Office 70 need only purchase 19 inbound/outbound lines from the Incumbent LEC 14 but may sell 150. Moreover, the 19 inbound/outbound lines purchased from the Incumbent LEC 14 are tariffed at the lower commercial DID/DOD rate than the typical residential voice rate, resulting in significant additional cost savings.

Conventionally, DID/DOD digital trunk service purchased from the Incumbent LEC 14 allows a customer (in this case, the Independent Central Office 70) to use a T1/DS1 (1.544 Mbps) facility to transport PBX type services, including Direct Inward Dialing (DID), Direct Outward Dialing (DOD), Wide Area Telecommunications Service (WATS), or Custom 800 service from a wire center (Incumbent LEC 14) specified by the customer to their premises. The wire center must be within the same Local Access and Transport Area (LATA) as the customer location but does not have to be the normal serving wire center. As noted above, this service provides a cost effective method of delivering switched exchange access service via a DS1 facility. It also provides the subscriber with a digital handoff of the many PBX type services previously unavailable to residential subscribers, which services can terminate directly into the PBX 42 of the Independent Central Office 70. This direct interface provides the customer with

significant customer premise equipment cost savings while also providing the many PBX features at little or no additional cost.

Typically, a DID/DOD arrangement provides for the equivalent of 24 exchange access lines between a wire center and the PBX 42 of the Independent Central Office 70. These 24 channels may be used as trunk lines to PBX equipment 42 as proposed, and may provide DID, DOD, WATS, or Custom 800 service. Typically, the monthly charge for such Digital Trunk Service includes 24 services; however, the Independent Central Office 70 does not have to turn on all 24 services at the same time. In addition, all DID and DOD service may be provided directly from the trunk side of a digital Incumbent LEC Central Office switch 66. In an analog Incumbent LEC Central Office 14, on the other hand, a multiplexer must be used to convert the analog signals to digital signals. The use of the DS1 to transport the DID service to the customer end does not change the way DID works without the DS1, nor does it allow other features that would not be currently offered under the tariff.

Those skilled in the art will appreciate that DID service allows incoming calls to PBX 42 from the public switched network to go directly to a specific station line at a subscriber residence so that a PBX attendant is unnecessary. Such DID service, without outward dialing capability, uses one-way, incoming trunks. DID phone numbers must be ordered in multiples of 100, where each station is assigned an individual telephone number.

In the embodiment of FIGURE 1, the D4 Multiplexer 58 and the Independent Central Office 70 are preferably built in new residential developments and commercial developments while the developments are under construction so that it is not necessary to obtain additional telephone right-of-ways and the like for laying phone lines or cables. As shown in FIGURE 1, a small housing development in a particular LATA may simply use a D4 multiplexer 58, while a larger housing or commercial development 73 in that same LATA may instead include an Independent Central Office 70. Generally, at least one Independent Central Office is required per LATA. In this fashion, a particular developer who is active in a given LATA will not have to build more Independent Central Offices 70 than is necessary to service the housing units built by that developer in that LATA. Similar arrangements may be provided in existing neighborhoods except that the wiring into the homes 10 is maintained unless faulty.

The D4 Multiplexer 58 allows T1 lines purchased from the Incumbent LECs to be used to connect small developments 64 to the Independent Central Office 70 without having to run cable to, or buy a switch for, the small developments. In effect, the D4 Multiplexer 58 allows the switching services of the Independent Central Office 70 to be

extended using tariffed T1 service so that it remains cost effective to service small developments using the techniques of the invention. On the other hand, large housing development 73 may be served directly by on-site Independent Central Office 70, where local service is provided from the Incumbent LEC Central Office 14 via DID trunk 72 and DOD trunk 44 as in a conventional office environment. Long distance service, on the other hand, is provided via DEXCS frame 24 with or without the afore-mentioned LEC bypass techniques for avoiding the LEC origination fees.

The Independent Central Office 70 connects to the homes 10 within the residential housing (single detached, attached, or multi-family) development 73 via punch down blocks or wiring terminals 74, which function to separate out the respective twisted pairs of a 100 pair backbone cable 75 servicing the development 73 and to connect the respective twisted pairs to respective ports 76 of the PBX 42. 100 pair backbone cable 75 connects respective outdoor weatherproof wiring pedestals 78 within the housing development 73, which, in turn, terminate a plurality of twisted pairs 80 into respective subscriber homes 10. As noted above, backbone cable 75 and twisted pairs 80 are preferably, but not necessarily, laid in the virgin ground during the building of the housing development 73 so as to eliminate all right-of-way concerns and to minimize infrastructure costs.

The Independent Central Office 70 is preferably built during the building of the housing development 73 and subsequently used to manage, in addition to local and long distance calling services, cable television and other services provided to the housing development 73 via coaxial cable backbone or other media connection 82 and any other high capacity data line laid in the telephone lines right-of-way. For example, the coaxial cable backbone or other media connection 82 can be laid using the same right-of-ways as the telephone lines and similarly terminate at the Independent Central Office 70 for connection to a cable television network via a video bridge (amplified splitter) 84. In this fashion, the developer, via the Independent Central Office 70, may maintain control of all cable television and telephone services provided to housing development 73. Also, media connection 82 may include a high capacity data line laid in the same right-of-way and managed by the Independent Central Office 70 to provide a plurality of data services to the residential housing development 73. Of course, a commercial development would be wired in similar fashion.

Once the residential housing (or commercial) development 73 with Independent Central Office 70 is wired as shown in FIGURE 1, local telephone service is ordered from the Incumbent LEC Central Office 14 as follows.

Step 1: Identify the location of the Independent Central Office 70 and the location of the serving wire center (Incumbent LEC Central Office 14) for the DS1 facility.

Step 2: Identify the type of Central Office the DS1 will terminate in. An analog Central Office will require a multiplexer, while a digital Central Office requires a multiplexer except for DID.

Step 3: Identify the type and quantity of services to be ordered (DID/DOD).

Step 4: Determine the channel number assignments (blocks of 100).

Step 5: Identify the type of PBX used (*e.g.*, Lucent Definity G3 PBX) and the terminating equipment at the Independent Central Office (*e.g.*, CSU 48).

Step 6: Provide the information gathered in steps 1-5 to the Incumbent LEC to place the order for DID/DOD service.

Step 7: When the T1 line is installed by the Incumbent LEC, install the DS1 card into the PBX 42.

Step 8: Program the PBX's translation table to assign the telephone numbers to the subscriber lines (DID), including subscribers serviced via certain D4 multiplexers 58 in that LATA.

Step 9: Program all local outbound traffic to route through the T1 (DOD) line 44.

Outbound calls from and inbound calls to subscribers 10 in residential community 73 via Independent Central Office 70 will now be described with respect to FIGURES 2 and 3, respectively.

As shown in FIGURE 2, subscriber 10 in residential community 73 begins a call at step 86 by lifting a hand set and creating an off hook condition on a port 76 of PBX 42. The PBX 42 then sends an analog dial tone to the subscriber's hand set at step 88. Upon receipt of dial tone, the subscriber enters the desired phone number at step 90 as a series of DTMF tones to originate the telephone call. At step 92, the PBX 42 receives the DTMF tones and translates them to binary digits in a conventional manner. The binary digits are then compared to the pre-programmed route table in the PBX 42, and at step 94, the route table identifies the call as a local call within the development, as a local call outside the development, or as a long distance call. If the call is a local call within the development, the PBX

42 routes the call at step 96 to the analog port 76 assigned to the designated subscriber as in a conventional PBX office setup. On the other hand, if the call is a local call outside the development, at step 98 the PBX 42 routes the call to the DS1 card provided for DOD, where the DS1 digitizes and formats the call for common carrier service at step 100. The call is then forwarded at step 102 to the Incumbent Customer premises, such as a 5ESS, via T1 trunk line 44 for delivery to the Public Switched Network. However, if the route table identifies the call at step 94 to be a long distance call, at step 104 the PBX 42 routes the call to the DS1 card provided for long distance, where that DS1 digitizes and formats the call for common carrier service at step 106. The call is then forwarded at step 108 to the DEXCS frame 24 at the Incumbent LEC Central Office 14 via T1 line 46 for delivery to the Long Distance Network.

Incoming calls to a subscriber 10 in new housing development 73 are handled as illustrated in FIGURE 3. In particular, a call originated within the Public Switched Network designating the prefix for Incumbent Customer premises is delivered at step 110 to Incumbent Customer premises in a conventional manner. At step 112, the Incumbent Customer premises identifies the called number as a DID telephone number, adds station coding numbers, and sends the call to an available channel of the T1 trunk line 72 to the PBX 42. At step 114, PBX 42 receives the call, strips off the coding numbers, and compares them with the pre-programmed route table in the PBX 42. At step 116, the PBX 42 converts the call to analog carrier, switches the call to the corresponding subscriber station, and sends a ring down pulse. Then, at step 118, the ring down pulse continues until it either times out or an off-hook condition occurs.

In a preferred embodiment, calls to a subscriber 10 in new housing development 64 are routed using the bypass techniques described in the parent applications. Once the call is received via T1 line (DID) 72 by the PBX 42, the call is evaluated as described above with respect to steps 94-108 and routed to the subscriber 10 via outgoing T1 line 46, DEXCS frame 24, T1 line 22, D4 Multiplexer 58, and lines 60 to subscriber 10 in new development 64.

As so described, the hardwire telephone platform of the invention substantially differs from the prior art in that an Independent Central Office 70 is provided which can provide local and long distance services in competition with the Incumbent LECs while providing no infrastructure other than that for a new community, which would have to be added in any case. In particular, the wiring system of the invention uses twisted pair, coaxial cable, and/or another form of medium which is installed during an early phase of construction in a new residential housing (single detached, attached, or multi-family) or a new commercial

development. For large developments, the Independent Central Office is provided in a building or some other facility erected within the development to house the head end electronics and to provide an interface to the public switched network. For smaller developments, a private D4 multiplexer is provided which connects into an Independent Central Office within that LATA.

At present, it is contemplated that an IXC may utilize the Central Office platform of the invention to provide local services including originating access without payment of LEC access fees. The access fees would instead be under the control of a telecommunications service company for the developer who put the Central Office into the new residential or commercial development. Since the access fees would thereby be removed from LEC control, the IXC could negotiate a separate deal with the developer's telecommunications service company at rates which would, through natural competition, dramatically lower the per minute cost of long distance service, thereby yielding a tremendous competitive advantage over existing long distance competitors required to continue to pay the relatively high access fees to the Incumbent LECs. Alternatively, the local and long distance service could be provided solely by the telecommunications service company for the developer. Also, since local service would be provided via tariffed commercial DID/DOD services rather than tariffed residential voice services, local access to the public switched network could be provided by the telecommunications services company with increased functions and lower costs.

Utilizing a wire line or wireless tele-communications platform, a plurality of services including local, long distance, Internet access, and security monitoring can be provided. Additionally, those skilled in the art will appreciate that this ICO platform, in conjunction with a coaxial cable backbone or in conjunction with an additional high capacity data line laid in the same right-of-way, may provide these additional services: pay-per-view movies, interactive video games, interactive education, video telephony, video conferencing, electronic banking, environmental monitoring, utility monitoring, video surveillance, card access monitoring, bulletin board services, fax services, printing services, and customized electronic news. Further cost savings in implementing these features may be obtained by fully automating each Independent Central Office monitoring facility and remotely controlling the Independent Central Office facility from a regional monitoring facility. In addition, all data for billing and service charges may be captured by the on-site electronics in a conventional manner and forwarded to a central processing point for dissemination and bill generation.

The private PBX platform described with respect to FIGURES 1-3 permits a number of system enhancements. For example, the PBX 42 may incorporate an enterprise communications server application which will allow voice, data, video, wireless, and other types of communications between end-points such as voice terminals, data terminals, computers, transceivers, and the like. The PBX 42 may also support both analog and digital formats in both voice and data applications. Moreover, through the use of standard protocols, such as those commonly used on Local Area Networks (LANs) and Metropolitan Area Networks (MANs) (described in detail below) to connect nodes to an enterprise network, a wireless connection can be established such as described in U.S. Patent No. 5,446,736 to allow the extension of the communication platform of the invention beyond the range of the new developments as described herein. In addition to station connectivity, the PBX 42 may also support a wide number of interfaces including X.25, RS-232, Contact interfaces (analog line circuits for connecting the system to analog devices), and Network Interfaces (analog or digital interfaces, such as central office DID, DOD, common trunking, analog measured service, and ISDN basic and primary rate interfaces).

Similarly, the private D4 multiplexer platform 58 of the invention permits a number of system enhancements. For example, a D4 multiplexer may be used by Incumbent LECs to provide additional facilities. As an example, if an RBOC had a commercial development or industrial park in which it had a 100 pair cable running to the park, and it had already sold 100 trunk lines to the industrial park's customers, and one of those customers ordered 10 more new lines, today the RBOC would have to string a new 100 pair cable to the park to meet the 10 line demand. This process is very expensive and very labor intensive even though the RBOC owns the conduits and right-of-ways. The use of a D4 multiplexer would be much cheaper since the RBOC could install a D4 multiplexer on-site, take 2 pair from the existing 100 and convert those 2 pairs to a DS1 signal for termination on the D4 multiplexer. Since the T1 line can handle 24 DS0 lines, this creates a new net capacity of 22 pairs (24 new pairs minus 2 old pairs) at the industrial park. Moreover, Competitive LECs (CLECs) could use the D4 multiplexer to pick up small residential or commercial developments without running additional cabling.

**INDEPENDENT CENTRAL OFFICE USING PACKET SWITCHED INTERCONNECTIONS WITH CUSTOMERS**

The Metropolitan Area Network (MAN) transport of LEC telephony functions covers multiple levels of central office to peer (tandem) and carrier level interfacing. MAN transport also covers the transport of billing, call management, messaging, call status, directory, ANI,

and other voice and data traffic. The transport of all levels of telephony traffic can either be transparent (not perceptible) or visible (presented to a customer premise interface) as is required to meet customer demands. As customer demands for telephony functions in a residential/mixed setting increase both in volume and sophistication, the economic advantages of areas serviced by ICOs increases. Examples of applications enabled by single or multiple MAN transport capabilities include advanced telecommuting, remote data presence, remote residential monitoring, environmental monitoring, and very high reliability and availability. Just as past residential areas emphasized good road or water access, close proximity to work or education, the residential/mixed areas utilizing the ICO of the invention will emphasize good telephony infrastructures that connect residents to local area business, education, government, and service infrastructures.

As used herein, MAN transport specifically includes the connection of the Independent Central Office (ICO) 70 with a subscriber's premise for purposes of conveying data and telephony traffic between the two logical locations. The telephony traffic may include signaling data, call management, traffic management, rate information, billing information, ANI/CLID information, network management, addressing management, switch management, performance/capacity measurements, facilities information, provisioning information, directory information, quality management, service configuration, rule-bases/rule sets/updates, intelligent objects, parametrics, diagnostics, message traffic, and other traffic that manages, operates, or supports the MAN transport. An example of this traffic is the out-of-band data passed by ISDN or SS-7 transports.

**Preferred Packetized Data Transport Embodiments**

In FIGURE 4, where like numbers represent like elements from the above embodiments, the DID/DOD services of the embodiment of FIGURES 1-3 are replaced by one or more of any of a number of alternative Metropolitan Area Network (MAN) transport systems of the type described in copending U.S. Patent Application Serial No. 09/552,055, filed April 19, 2000, and hereby incorporated by reference. In particular, in FIGURE 4, the DID/DOD connections of FIGURE 1 are replaced by a media converter 120, a MAN transport system 122 interconnecting the ICO 70 to the public switched telephone network via links 124 and 126, and a MAN transport system 127 interconnecting the ICO 70 to the long distance network via links 128 and 129. Of course, as in the embodiment in FIGURE 5, only MAN transport system 122 needs to be used to connect the ICO 70 to the incumbent LEC and the long distance network where the IXC is accessible via the incumbent LEC via connection 27 as in FIGURE 1. Similarly, though not shown, those skilled in the art will appreciate that MAN transport system

127 may be used to connect the ICO 70 to the incumbent LEC and the long distance network where the public switched telephone network is accessible via the IXC. Accordingly, any of these embodiments of the interconnections among the ICO 70, the incumbent LEC, and the long distance network may be used as desired.

In accordance with the invention, it is preferred that MAN transport systems 122 and a127 support packet transfer technologies to interconnect the ICO 70 with the LEC and the IXC. In such embodiments, packetized voice and data are delivered across a T-carrier or other high speed transport system 123, 124 from the ICO 70 to the LEC/IXC via VoIP, VoFR, and/or VoATM technologies. The transport media may be any of a number of physical media including, but not limited to, twisted pair networks, coaxial networks, fiber optic networks, or wireless networks that interface either with and IP gateway or a packet gateway (not shown) which interconnects via high speed network connections 123, 124 with media converter 120 including a packet interface card. Alternatively, the packet transport may directly interface with the PBX 42 without the need for a T-carrier TDM link.

The CSU 48 preferably interfaces with the DS1/T1 line 27 and provides the line power and a place for the carrier to loop back the DS1/T1 line 27 for line inspection. CSU 48 also provides the correct physical network termination for the DS1/T1 line 27, as well as isolation and physical line protection. The CSU 48 further provides a combination of two functions defined by the public network carriers: (1) correct T1 framing and (2) synchronous protocol translation.

In the embodiment of FIGURE 4, it is recognized that the CSU 48 can be either a stand-alone unit or can be incorporated into other equipment (such as multiplexers, network interface cards, routers, and telephone switching equipment 42). Of course, other MAN transport technologies may be utilized, such as passive optical networks, voice over IP, SONET, etc. The DS1 card 50, on the other hand, functions in effectively the same manner as a D4 multiplexer described above by breaking down DS1 channels into DS0 channels and allowing the usable bandwidth to interact directly with the telephone switching equipment 42 at the Independent Central Office 70. In particular, DS1 card 50 functions as a line-side T1 interface which provides communications to remote locations by providing off-premise extensions to remote locations. Analog telephone functionality is extended over DS1 facilities and channel bank units to provide the telephone at the remote site with full access to 2500-type line functionality. In accordance with the invention, the software of the telephone switching equipment 42 is optioned to condition the DS1 channels of the DS1 card 50 as an FXO. Thus, the telephone switching equipment 42 could replace the

IXC as the terminating point of the local network.

The telephone switching equipment 42 also may be used to extend conventional LEC Central Office services, such as Public Dial Tone, Call Waiting, Call Forwarding, Three Way Calling, Caller ID, Internet access, security system monitoring, and the like to the customer premise 10. The telephone switching equipment 42 may be a Lucent Technologies Definity G3 PBX or 5ESS CDX system that further provides access to long distance service via CSUs 28 and media converter 120. Additionally, those skilled in the art will appreciate that all of the conventional land line transport systems described herein can be eliminated by utilizing wireless cable or microwave connections.

The interfacing of the long distance network to the ICO 70 may be performed in a manner similar to extant installations where the Point of Presence (POP) of the long distance carrier is channeled via Channel Service Units 48 that multiplex and demultiplex from traffic originating within the ICO service premises 70 and from the outside long distance network. However, the Independent Central Office 70 is not constrained when MAN transport technology is instead used to connect the CSUs 48 with the long distance carrier. For example, when the call originates within customer premises 10, it is processed through the ICO 70 and CSU 48 to provide outputs on T1 lines 27 to media converter 120.

In all embodiments of MAN transports 122 and 127 in accordance with the invention, the PBX 42, data network, and other ICO terminations of the LEC transport services are architected as a network interface at the ICO 70 and a network interface at the LEC premises connected via a known network media, where the details of the network interfaces and media vary in the respective MAN embodiments. Examples of such MAN transports include, inter alia, coaxial cable connections, T1/T3 wireline connections, ISDN/PRI wireline connections, SONET Ring fiber transports, optical fiber drops, IEEE 802.6 Dual Fiber Rings, cellular or PCS wireless connections, laser or infrared point to point connections, microwave transmissions, satellite point to point transmissions, power utility lines, DSL wireline connections, local area networking technologies, distance supported peripheral connection technologies, combinations of media, and the like.

In accordance with the invention, the ICO 70 is interconnected with the customer premises 10 via any of a number of known packet transfer technologies, such as voice over IP (Ethernet (LAN) 802.3), voice over Asynchronous Transfer Mode (VoATM), or voice over Frame Relay (VoFR). The physical connection may be any of a number of physical media including twisted pair networks, coaxial networks, fiber

optic networks, or wireless networks. A wired packet transfer facility 80 and/or a wireless packet transfer facility 81 is established between the residence 10 and the ICO 70. The packets are transmitted using, for example, a backbone cable 75 to the ICO 70. Alternatively, the packets may be transmitted via the coaxial cable 82 or via other physical transport media. As will be explained with respect to FIGURE 5, In addition to serving as transport for voice and data services to/from an ICO 70 to the customer premises, the packet transfer connection allows multiple-ICO facilities within a LATA to be connected without incurring toll charges for toll-intra-LATA calling. The use of a frame relay network also uses different media connections that may have desirable economic impacts depending on LEC connection costs. The advantages to customers served by one or more ICO's in a LATA are those both consistency of services (supported by the ICO) and the possible significant availability of multi-premise networking without involvement of the incumbent LEC is possible. Packet technology for voice service is also beneficial over POTS in that many services may be multiplexed onto a single pair of wires economically, multiple voice lines may be multiplexed together more efficiently for transport to the residence, and improved voice clarity may be obtained using digital technology.

Wireless delivery from the ICO 70 to the subscriber premise 10 can be accomplished in several ways. Options include short range or medium range analog technologies, short/medium range digital voice, and short/medium range packetized voice technologies. There are also many options for the frequency range that could accommodate these delivery methods. The present invention is not dependent on any single option or variant. For example, a wireless link 81 may be provided between the residence 10 and receiving/transmitting equipment located in close proximity to the residence (such as at hub 18), or a longer range wireless link may be used to transmit data wirelessly all the way to the ICO 70. The latter option is desirable in that wiring costs are reduced and in that the customer may receive phone service throughout the development using portable equipment. On the other hand, shorter range wireless equipment requires less spectrum since the frequencies may be reused throughout the development. Inexpensive equipment such as 900 MHz digital technologies are commercially available for such purposes. Other types of wireless equipment could support the 2.4 GHz ISM band, the 5.3 GHz NII band, the 47 MHz ISM band or frequencies assigned for fixed service wireless. For some of the higher frequencies, it may be necessary to use external antennas since these frequencies do not easily penetrate through buildings. Finally, wireless links require less standby power at the ICO 70 since the residential equipment need not be powered through the ICO 70.

When the fiber portion of this technology is further extended from the ICO 70 to the residence, the system might carry several hundred digital

channels which could be used to provide carrier services at very high bandwidth as well as video and packet data. The fiber carrying these signals would terminate on an optical interface connected to the switch 42 at the Independent Central Office 70.

In addition, Hybrid Fiber / Coax (HFC) access technologies may be used to transport broadband video and data services to and from residential and commercial customers. These new HFC systems can provide full duplex (i.e. bi-directional) digital communications services at high data rates which allow common carrier type services (digitized voice) or direct interconnect to be provided as a transport medium between the ICO 70 and the residence.

FIGURE 4 illustrates as system in accordance with the invention that uses packetized voice and data delivered via shared and dedicated links from the residence to the ICO 70 via VoIP, VoFR, VoATM, via local area network (LAN) technologies. These transport systems can be comprised of any number of physical media including, but not limited to, twisted pair networks, coaxial networks, fiber optic networks, or wireless networks. The interface to the public switched telephone network (PSTN) and the IXC may be through conventional T-carrier technology or any of a number of metropolitan area network (MAN) technologies described in the afore-mentioned related U.S. Patent Application Serial No. 09/552,055.

As illustrated in FIGURE 4, in a preferred embodiment of the invention, the subscriber premises 10 includes a packet converter device (gateway) 16 that converts the analog voice data to data packets. The packetized voice data is transported over physical media 80 (such as wireless links, optical fiber links, coaxial cable or twisted pair cable) to hubs 18 (e.g., Ethernet hubs) that are spaced throughout the development so as to connect every house as a node on the network. Alternatively, a digital packet converter device may be installed at a hub 18 and converted to an analog signal and interconnected to the residence 10 via conventional analog lines. Also, a VoIP device may be used in the residence 10 in place of gateway 16. The packetized data is transported to the ICO 70 via physical media 75 where it is converted to circuit switched data by an IP gateway 52. Also, as shown in phantom line, each hub 18 may have its own separate physical connection to the ICO 70, thereby facilitating the transmission of other data, such as utility monitoring data, as described below with respect to FIGURE 7. The circuit switched voice data is now applied to PBX 42 via link 76 in a conventional manner and connected to the public switched telephone network and long distance network as described above. The same operation occurs for incoming calls except that incoming voice data is converted by IP gateway 52 to packetized data with the correct address from a routing table, and the packet

converter device 16 at the subscriber premises 10 converts the packetized data back to analog voice data. Data other than voice would be passed straight through the system without conversion. The data and voice are distinguished from each other using addressing techniques well known to those skilled in the art.

FIGURE 5 illustrates an alternative embodiment of the invention where the IP gateway 52 is not located at the ICO 70 but is instead co-located at the premises of the incumbent LEC Central Office. Such an embodiment permits the ICO switching circuitry of FIGURE 4 to be replaced by a software switch 54 such as that maps the subscriber's telephone number to an IP address. The packetized voice data is then transmitted to the incumbent LEC preferably over an ATM transport media using conventional techniques. As shown in FIGURE 5, other MAN transport media 122 may also be used as desired. As shown, the IP gateway 52 is located at the incumbent LEC premises and converts the packetized data to circuit switched (analog or digital) data using a routing table in a conventional fashion for application to the public switched telephone network (PSTN) via, for example, a class 5 switch 66. The circuit switched data is also forwarded to the Point of Presence (POP) for the long distance network in the event of a long distance call. As illustrated in FIGURE 5, since the ICO 70 handles only packetized data, the ICO 70 may be readily connected to other software switches of other ICOs in a network configuration, thereby extending network connectivity to a destination not within the development. The data may be transported as VoATM, VoIP, or VoFR via any suitable physical media such as T1, T3, OC12, or OC48 lines, wireless connections, and the like. In this case, calls to other subscribers in the network may be treated as an internal WAN call that need not enter the PSTN. On the other hand, calls to nonsubscribers would be routed through switch 66 to the PSTN in a conventional manner. Inbound calls are received through other T-carrier links. The packet transfer system may also be extended to remote developments by utilizing high speed transport lines connected to a remote converter (not shown).

FIGURE 6 illustrates an alternative embodiment of the embodiment of FIGURE 5 whereby an IP gateway 52' is also co-located at the premises of the long distance carrier for direct connection from the ICO 70 to the long distance carrier. In this embodiment, the ICO 70 may connect directly to the POP of the long distance carrier without routing the data through the incumbent LEC, thereby saving the LEC access fee.

FIGURE 7 illustrates an alternative embodiment of the invention for providing data collection services via the ICO using the data transport techniques of the invention. In particular, the embodiment of FIGURE 7 allows the data outputs of monitoring devices 17 to be routed directly to

monitoring system may be provided independent of the packet voice data system described herein.

In a preferred embodiment, new utility/security/maintenance monitoring infrastructure is installed in new developments at the time the new houses are built. The developer provides a central monitoring facility and contracts the utility companies to provide the utility services to all customers serviced by the developer's infrastructure. Since the utility monitoring infrastructure is provided by the developer, the developer gets a recurring revenue stream. Also, since the utilities are monitored and administered by the developer or a partner company of the developer, the customer may receive the benefit of volume discounts for the utilities, thereby giving home owners an incentive to use the new infrastructure. The method of the invention may also be used when new infrastructure is installed in an old development. A legal entity such as a home owners association may enters into a contract to replace the old infrastructure due to age, reliability, feature, etc. This legal entity could then get a recurring revenue stream, as in the case of the developer of the new residential neighborhood. The same incentives to use the system would apply as well.

Those skilled in the art will appreciate that the application of framing-techniques (even to the extent of proprietary protocols used by many manufacturers and devices) can be used to encapsulate any number of communications protocols for transport. Thus, framing-techniques can be used to transport both extant communications and interfacing protocol types encoding information content and management data, and also to protocol types (versions or variants) that are still being defined. The extent of framing techniques includes that of encapsulated channelization, virtualization, abstractions, and embedding strategies such that the specific information/data content supported by the MAN transport may include abstractions and instantiations of interfaces, protocols, objects, and either concurrent or serial streams of ICO/LEC/Customer supported instances of any or all of these. Inherent in any deployment of MAN transport mechanisms (whether specifically frame or other as defined herein) is the capability to transport framing techniques traffic between the ICO/Customer using one or more methods concurrently or separately. Therefore, the bandwidth deployed in specific support of a MAN transport capable of support framing techniques is not necessarily bound to that of the underlying MAN transport mechanism, but can reflect either static (design) allocation or dynamic handling of the ICO/customer traffic.

Those skilled in the art will appreciate that the Independent Central Office (ICO) of the invention provides connectivity for customers (residential, mixed use, or businesses) for a full breadth of

telecommunications and media products and services. The ICO provides connectivity inclusive, but not limited to, services such as:

1) ICO (local) provided telephone exchange services (such as those provided by ESS and other advanced Private Branch Exchange installations, voice mail, messaging, facsimile, TDD, etc.);

2) Public Switched Telephone Network Local Exchange Carrier (local and non-interexchange calling) services;

3) Interexchange Carrier (IXC) Long Distance (voice and enhanced calling services such as messaging, third-party pay, etc.);

4) Data Transmission Services (including value added network access, Virtual Private Networks, frame relay, packet network, Private Virtual Circuit, multi-drop circuit, messaging, paging, Public Access Virtual Circuit, ISDN accessed data connections, fractional to multi-T carrier point to point data services, private SONET, private DQDB, SMDS, and others);

5) Internet Access (and other TCP/IP based services); and

6) Media Access Services (including services such as cable TV, interactive media, local media, media translations, pay-per-view, and others).

The transport mechanisms of the invention, with appropriate implementation, can provide services to end customers of the ICO with transparency for many services. For example, internal-ICO, local, and long distance voice services are available whether the transport is via wire/fiber media or wireless. As an additional example, remote telecommuting access to a corporate network could be provided to a residential customer using high bandwidth local ICO connection (to another customer of the ICO), Internet Access, ISDN, data transmission, dial-up analog modem, or two-way dedicated video. The flexibility of delivery media (i.e. Category 3 or 5 wiring, fiber drops, coaxial cable, fixed or cellular wireless, optical, or others) allows customers both access to services and to combinations of services that can be focused through the deployment under geographic services of an ICO.

Internal operations of the ICO to support monitoring, performance/capacity management, administrative, facilities management, billing, resource management, and other functions are also supported across the MAN transport to the ICO 70 for economies of scale for centralized business process functions. The connection processing for these capabilities may include in-band, out-of-band, separate network,

parallel network, and discrete media (such as tapes, compact disc, DVD, digital audio tape, etc.).

For example, the MAN transport mechanisms to the ICO permit integration of multiple modes of MAN transport into a single facility as a normal operating mode. Also, MAN transport mechanisms permit integration of multiple modes of wireless capability as a design characteristic of a central office facility. MAN transport mechanisms also permit integration of administration, operations, maintenance, technology migration, and security management as key components of central office construction and initial operations. Those skilled in the art will also appreciate that by providing for MAN transport transformations on both a dynamic and static basis that it is possible to deliver single or multi-modal services.

Voice telephony is still the compelling application of the ICO to the telephony, data services, and other communications needs of consumers and business. In a preferred embodiment the ICO provides for high quality voice telephony by providing packet transport to the subscriber premises using any one or more of the following:

1) Category – 3 dedicated wiring from the customer premise to the ICO and then supporting switch and service based products.

2) Category – 5 dedicated wiring from the customer premise to the ICO and then supporting switch, service, or data translation based products.

3) Coaxial Cable connecting the customer premise to the ICO and then supporting switch, service, data translation, or head-end based products.

4) Fiber (or fiber-over-copper) products

Extant implementations provide that the time domain sequence of events, message contents, finite state operations, and object interactions ('protocol') for each of these physical media connectivity can vary. The Category 3 telephony wiring falls into widespread telecommunications residential service delivery mechanisms. The Category 5 dedicated data products (such as Ethernet based network wiring) typically use TCP/IP protocols. The Coaxial Cable drops use varied proprietary protocols to handle CATV/PPV/Cable Management. Th present invention selects these based on current economics, and related factors such as:

1) Availability of contractors to rapidly deploy selected embodiments,
2) Availability of commodity parts to keep mass deployment costs down.
3) Availability of off-the-shelf management systems for the support of multiple layers of infrastructure.

Alternative embodiments also can have automated mechanisms to aggregate T1/T3 traffic via dynamic multiplexing. The present inventors foresee the incorporation of facilities such as Private Virtual Network (such as those for entertainment or game playing) into the ICO design. The availability of high-bandwidth on a less than 100% guaranteed basis (especially for packetized services using TCP/IP) using T1/T3 connections also provides for simplified and standardized deployments by companies of services to key employees or contributors using Private Virtual Network or Frame Relay provisioned services in a consistent fashion (whether ICO supported or by an ILEC).

Although exemplary embodiments of the invention have been described in detail above, those skilled in the art will readily appreciate that many additional modifications are possible in the exemplary embodiment without materially departing from the novel teachings and advantages of the invention. For example, those skilled in the art will appreciate that digital or analog cabling such as ThinNet, ThickNet, 10base-T, 10base-100, and the like may be used as the coaxial/wireline cable referenced herein. In addition, those skilled in the art will appreciate that other telephone equipment besides a PBX may be used to provide the switching and Central Office functions at the independent Central Office. The Independent Central Office may also house electronics in support of numerous other functions. Moreover, the switching equipment need not be analog but may be completely digital. Furthermore, the Independent Central Office need not be located within the residential housing development or commercial development but may be nearby or remote and connected to the wiring terminals or hubs using any of a number of wired or wireless protocols. Similarly, adjacent extant housing, industrial, or mixed use sites can be supported by either the service zone of the ICO (in the case of wireless or direct connect interfacing), extension of MAN transport (comparable to FX services), or comparable handling of desirable opportunities (such as secondary LEC/suppliers point of presence, or customer demarcations) that are within the MAN transport service reach of the ICO of the invention. Also, the system of the invention may be overlaid onto existing infrastructure where replacement/upgrading of that infrastructure is necessary and the overlay is cost-effective. Accordingly, these and all such modifications are intended to be included within the scope of this invention as defined in the following claims.

**We claim:**

1. A method of providing public switched telephone network access to residents/tenants of a residential housing/commercial development, comprising the steps of:

placing a telecommunications switch in or near the residential housing/commercial development in proximity to said residents/tenants, said telecommunications switch being maintained physically and financially independent of a central office switch at an incumbent local exchange carrier central office facility;

providing customers with a converter that converts a customer's analog voice data to packetized voice data for transmission and that converts received packetized voice data to analog voice data;

providing an IP gateway that receives circuit switched voice data from said telecommunications switch and said packetized voice data from customers, said IP gateway converting said circuit switched voice data to packetized voice data addressed to the appropriate customer and converting said packetized voice data to circuit switched voice data for routing by said telecommunications switch;

providing a communications medium for transmitting said packetized voice data between said IP gateway and each customer's converter; and

connecting said telecommunications switch and said central office switch so as to provide full duplex communication of at least said circuit switched voice data between said telecommunications switch and said central office switch.

2. A method as in claim 1, wherein said step of placing the telecommunications switch comprises the step of building a housing structure for said telecommunications switch and said IP gateway in a new residential housing/commercial development during construction of said new residential housing/commercial development and said step of providing a communications medium comprises the step of placing at least one of wires and optical fibers in telecommunications right-of-ways during construction of said new residential housing/commercial development.

3. A method as in claim 1, wherein said step of placing the telecommunications switch comprises the step of building a housing structure for said telecommunications switch and said IP gateway in a new residential housing/commercial development during construction of said new residential housing/commercial development and said step of providing a communications medium comprises the step of providing wireless communications equipment for transmission of said packetized voice data between said IP gateway and each customer's converter.

4. A method of providing long distance telephone network access to residents/tenants of a residential housing/commercial development, comprising the steps of:

placing a telecommunications switch in or near the residential housing/commercial development in proximity to said residents/tenants, said telecommunications switch being maintained physically and financially independent of a central office switch at an incumbent local exchange carrier central office facility;

providing customers with a converter that converts a customer's analog voice data to packetized voice data for transmission and that converts received packetized voice data to analog voice data;

providing an IP gateway that receives circuit switched voice data from said telecommunications switch and said packetized voice data from customers, said IP gateway converting said circuit switched voice data to packetized voice data addressed to the appropriate customer and converting said packetized voice data to circuit switched voice data for routing by said telecommunications switch;

providing a communications medium for transmitting said packetized voice data between said IP gateway and each customer's converter; and

connecting said telecommunications switch and a point of presence of a long distance telephone network so as to provide full duplex communication of at least said circuit switched voice data between said telecommunications switch and said point of presence.

5. A method as in claim 4, wherein said step of placing the telecommunications switch comprises the step of building a housing structure for said telecommunications switch and said IP gateway in a new residential housing/commercial development during construction of said new residential housing/commercial development and said step of providing a communications medium comprises the step of placing at least one of wires and optical fibers in telecommunications right-of-ways during construction of said new residential housing/commercial development.

6. A method as in claim 4, wherein said step of placing the telecommunications switch comprises the step of building a housing structure for said telecommunications switch and said IP gateway in a new residential housing/commercial development during construction of said new residential housing/commercial development and said step of providing a communications medium comprises the step of providing wireless communications equipment for transmission of said packetized voice data between said IP gateway and each customer's converter.

7. A method of providing voice data from a calling party to a called party via at least one of a public switched telephone network and a long distance network, comprising the steps of:

converting analog voice data from a calling party to packetized voice data;

transmitting said packetized voice data via a communications medium to a telecommunications switch in or near the residence/office of said calling party, said telecommunications switch being maintained physically and financially independent of a central office switch at an incumbent local exchange carrier central office facility;

converting packetized voice data received at said telecommunications switch to circuit switched voice data for routing by said telecommunications switch; and

transmitting said circuit switched voice data from said telecommunications switch to either said central office switch for routing to the called party via said public switched telephone network or to said long distance network for routing to the called party.

8. A method of providing voice data from a calling party to a called party via at least one of a public switched telephone network and a long distance network, comprising the steps of:

routing said voice data from the calling party via at least one of said public switched telephone network and said long distance network to a central office switch at an incumbent local exchange carrier central office facility and from said central office switch to a telecommunications switch in or near the residence/office of said called party, said telecommunications switch being maintained physically and financially independent of said central office switch at said incumbent local exchange carrier central office facility;

converting voice data received by said telecommunications switch to packetized voice data addressed to the called party;

transmitting said packetized voice data via a communications medium to the called party; and

converting packetized voice data received by said called party to analog voice data.

9. A method of providing public switched telephone network access to residents/tenants of a residential housing/commercial development, comprising the steps of:

placing a packet switch in or near the residential housing/commercial development in proximity to said residents/tenants;

providing residents/tenants with a converter that converts analog voice data to packetized voice data for transmission and that converts received packetized voice data to analog voice data;

providing a communications medium for transmitting said packetized voice data between said packet switch and each resident's/tenant's converter; and

providing an IP gateway in communication with a central office switch at an incumbent local exchange carrier central office facility, said IP gateway receiving circuit switched voice data from said central office switch and said packetized voice data from said packet switch, converting said circuit switched voice data to packetized voice data addressed to the appropriate resident/tenant, and converting said packetized voice data to circuit switched voice data for routing by said central office switch; and connecting said packet switch to said IP gateway.

10. A method as in claim 9, comprising the further step of connecting said IP gateway to a point of presence of a long distance telephone network.

11. A method as in claim 9, wherein said step of placing the packet switch comprises the step of building a housing structure for said packet switch in a new residential housing/commercial development during construction of said new residential housing/commercial development and said step of providing a communications medium comprises the step of placing at least one of wires and optical fibers in telecommunications right-of-ways during construction of said new residential housing/commercial development.

12. A method as in claim 9, wherein said step of placing the packet switch comprises the step of building a housing structure for said packet switch in a new residential housing/commercial development during construction of said new residential housing/commercial development and said step of providing a communications medium comprises the step of providing wireless communications equipment for transmission of said packetized voice data between said packet switch and each resident's/tenant's converter.

13. A method of providing long distance telephone network access to residents/tenants of a residential housing/commercial development, comprising the steps of:

placing a packet switch in or near the residential housing/commercial development in proximity to said residents/tenants;

providing residents/tenants with a converter that converts analog voice data to packetized voice data for transmission and that converts received packetized voice data to analog voice data;

providing a communications medium for transmitting said packetized voice data between said packet switch and each resident's/tenant's converter; and

providing an IP gateway in communication with a point of presence of said long distance telephone network, said IP gateway receiving circuit switched voice data from said long distance telephone network and said packetized voice data from said packet switch, converting said circuit switched voice data to packetized voice data addressed to the appropriate resident/tenant, and converting said packetized voice data to circuit switched voice data for routing by said long distance telephone network; and connecting said packet switch to said IP gateway.

14. A method as in claim 13, wherein said step of placing the packet switch comprises the step of building a housing structure for said packet switch in a new residential housing/commercial development during construction of said new residential housing/commercial development and said step of providing a communications medium comprises the step of placing at least one of wires and optical fibers in telecommunications right-of-ways during construction of said new residential housing/commercial development.

15. A method as in claim 13, wherein said step of placing the packet switch comprises the step of building a housing structure for said packet switch in a new residential housing/commercial development during construction of said new residential housing/commercial development and said step of providing a communications medium comprises the step of providing wireless communications equipment for transmission of said packetized voice data between said packet switch and each resident's/tenant's converter.

16. A method of providing voice data from a calling party to a called party via at least one of a public switched telephone network and a long distance network, comprising the steps of:

converting analog voice data from a calling party to packetized voice data;

transmitting said packetized voice data via a communications medium to a packet switch in or near the residence/office of said calling party;

said packet switch routing said packetized voice data to an IP gateway connected to at least one of a point of presence of a long distance network and a central office switch at an incumbent local exchange carrier central office facility connected to the public switched telephone network; and

said IP gateway converting said packetized voice data to circuit switched voice data for routing to the called party by at least one of said long distance telephone network and said central office switch.

equipment of residents/tenants of said residential housing/commercial development, said IP gateway converting received packetized data from said communications equipment to circuit switched data for application to said telecommunications switch and converting circuit switched data from said telecommunications switch to packetized data for transmission via said communications medium to said communications equipment of said residents/tenants.

20. An ICO facility as in claim 19, further comprising a data router that receives data from said residents/tenants via said communications medium and routes said data to a remote facility via at least one of a local data network and the Internet.

21. A method of providing utility usage monitoring information for a residence to the appropriate utility comprising the steps of:

placing electronic monitoring equipment for each utility in the residence;

the electronic monitoring equipment monitoring the utilities within the residence to determine utility usage information;

transporting the utility usage information over a communications infrastructure to a monitoring facility maintained in or near a development containing said residence;

collecting the utility usage information at the monitoring facility for a plurality of residences near or within the development; and

transmitting the utility usage information for each residence electronically to the appropriate utility.

22. A method as in claim 21, wherein said usage monitoring information comprises packetized monitoring data output by at least one of a gas usage monitoring device, an electricity usage monitoring device, a water usage monitoring device, a security monitoring device, and a maintenance condition monitoring device.

**ABSTRACT**

A system and method that provide analog voice grade communications from a caller to an independent Central Office (ICO) for local services and/or to a long distance inter-exchange carrier ("IXC") for long distance services by utilizing packet switched transport services between the ICO and the subscriber premises. The telephone switching equipment of the Independent Central Office is located in a residential housing development (single detached, attached, or multi-family) or a commercial development and used to provide local and long distance calling services, as well as Internet access and other telecommunications services, to the residents of the residential housing development or the tenants of the commercial development. The voice and/or data is packetized at the subscriber premises, transmitted via a voice over IP (Ethernet) connection, a Frame Relay (FR) connection, or an Asynchronous Transfer Mode (ATM) connection with the ICO. The ICO preferably includes an IP gateway that converts the packetized data into circuit switched data, and the circuit switched data is passed to a PBX or other conventional switch that is, in turn, connected to the incumbent LEC using any of a number of Metropolitan Area Network (MAN) transport technologies. Alternatively, the IP gateway may be co-located at the incumbent LEC premises and a soft switch used to route the packetized data to the incumbent LEC for conversion into circuit switched data and application to the public switched telephone network.

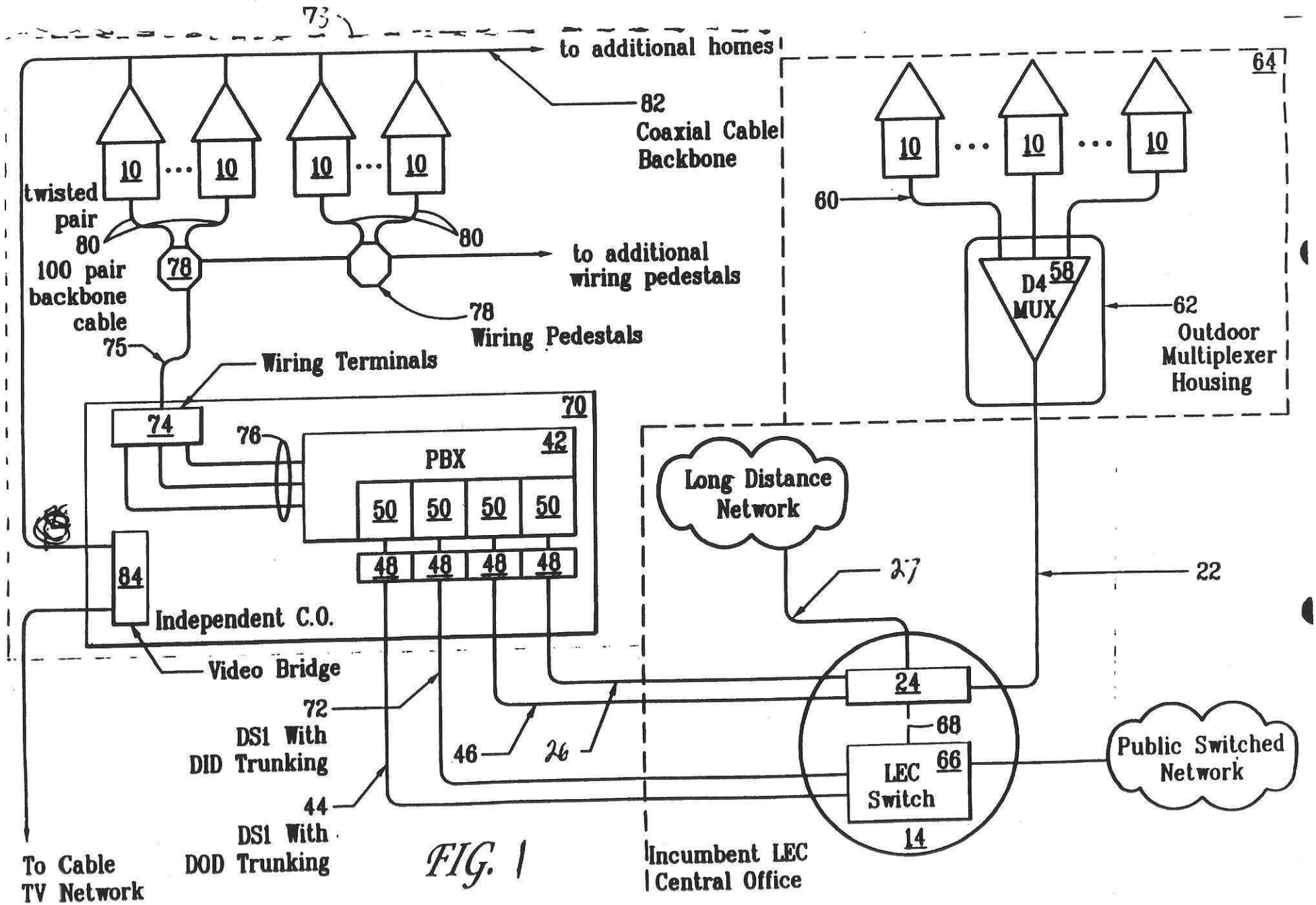

73
to additional homes
82
Coaxial Cable
Backbone
64
10
10
10
10
10
10
twisted
pair
80
100 pair
backbone
cable
75
78
80
to additional
wiring pedestals
78
Wiring Pedestals
60
D4
MUX
58
62
Outdoor
Multiplexer
Housing
Wiring Terminals
70
74
76
PBX
42
50
50
50
50
48
48
48
48
84
Independent C.O.
Video Bridge
Long Distance
Network
27
22
24
68
LEC
Switch
66
14
Public Switched
Network
72
DS1 With
DID Trunking
46
26
44
DS1 With
DOD Trunking
To Cable
TV Network
Incumbent LEC
Central Office

FIG. 1

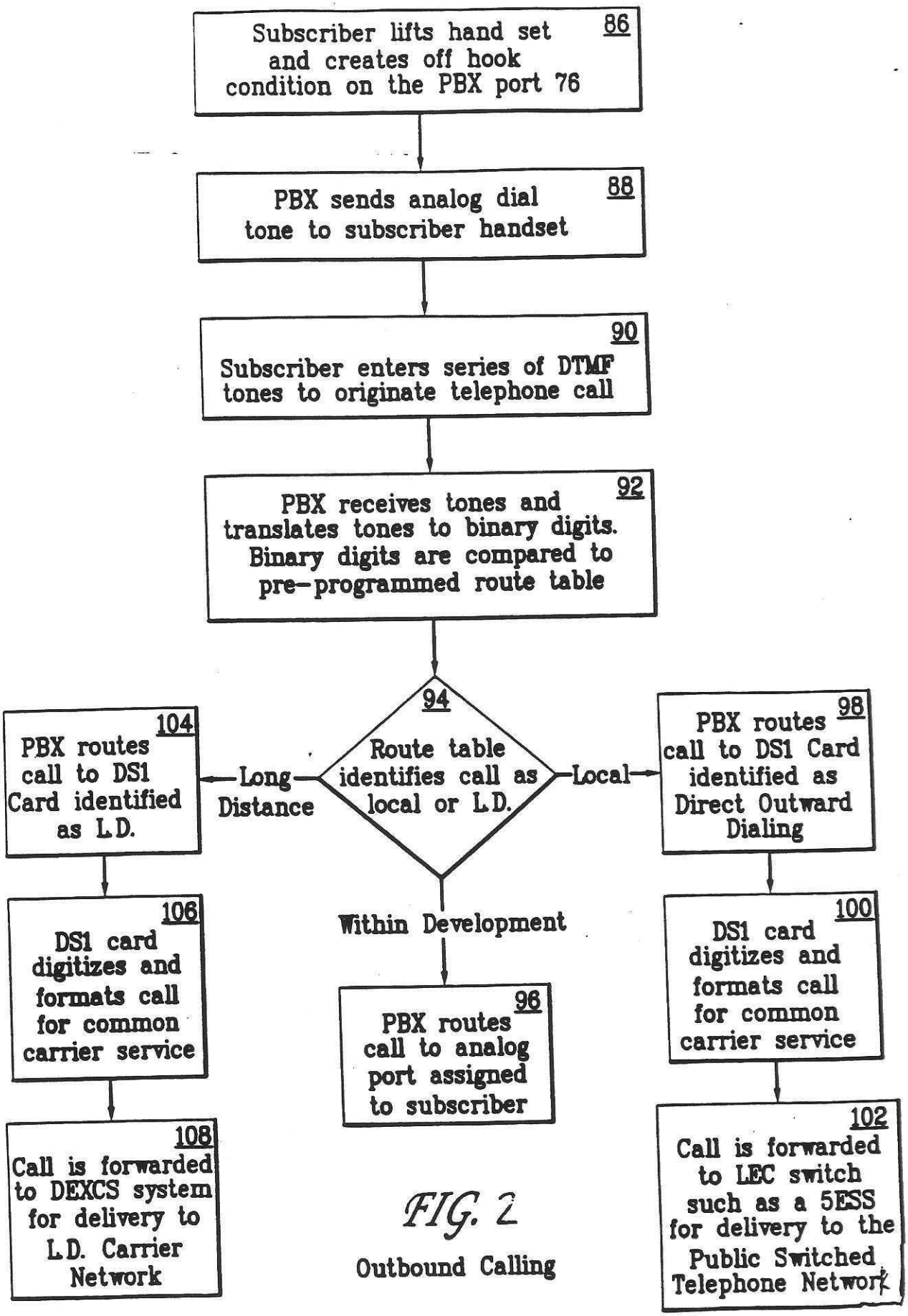
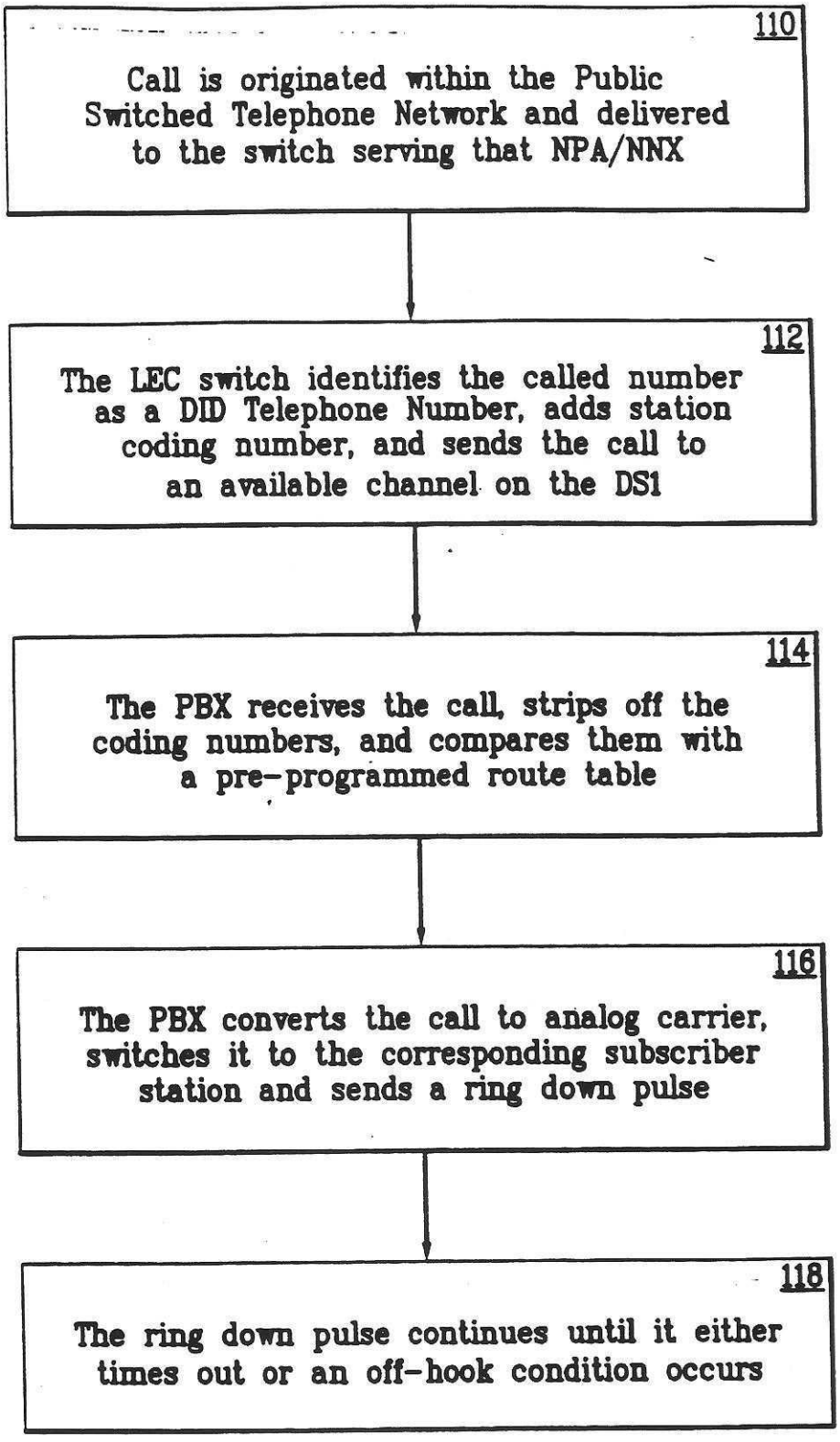



FIG. 2

Outbound Calling

FIG. 3

Incoming Calls



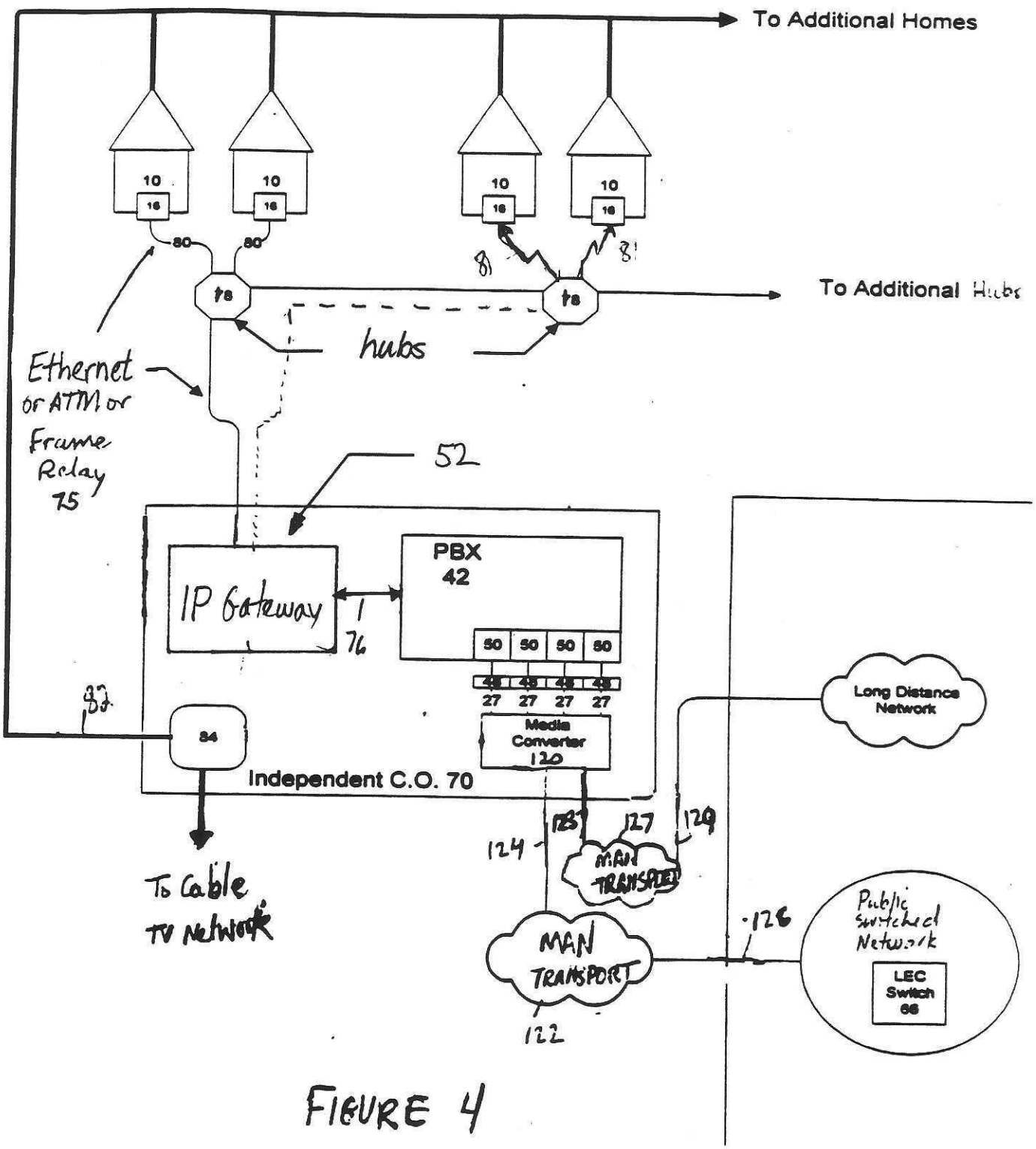

To Additional Homes
10
16
50
81
To Additional Hubs
hubs
Ethernet or ATM or Frame Relay 75
52
IP Gateway
76
PBX 42
50
48
27
Media Converter 120
84
Independent C.O. 70
To Cable TV Network
Long Distance Network
124
127
129
MAN TRANSPORT
126
Public switched Network
LEC Switch 66
122

FIGURE 4

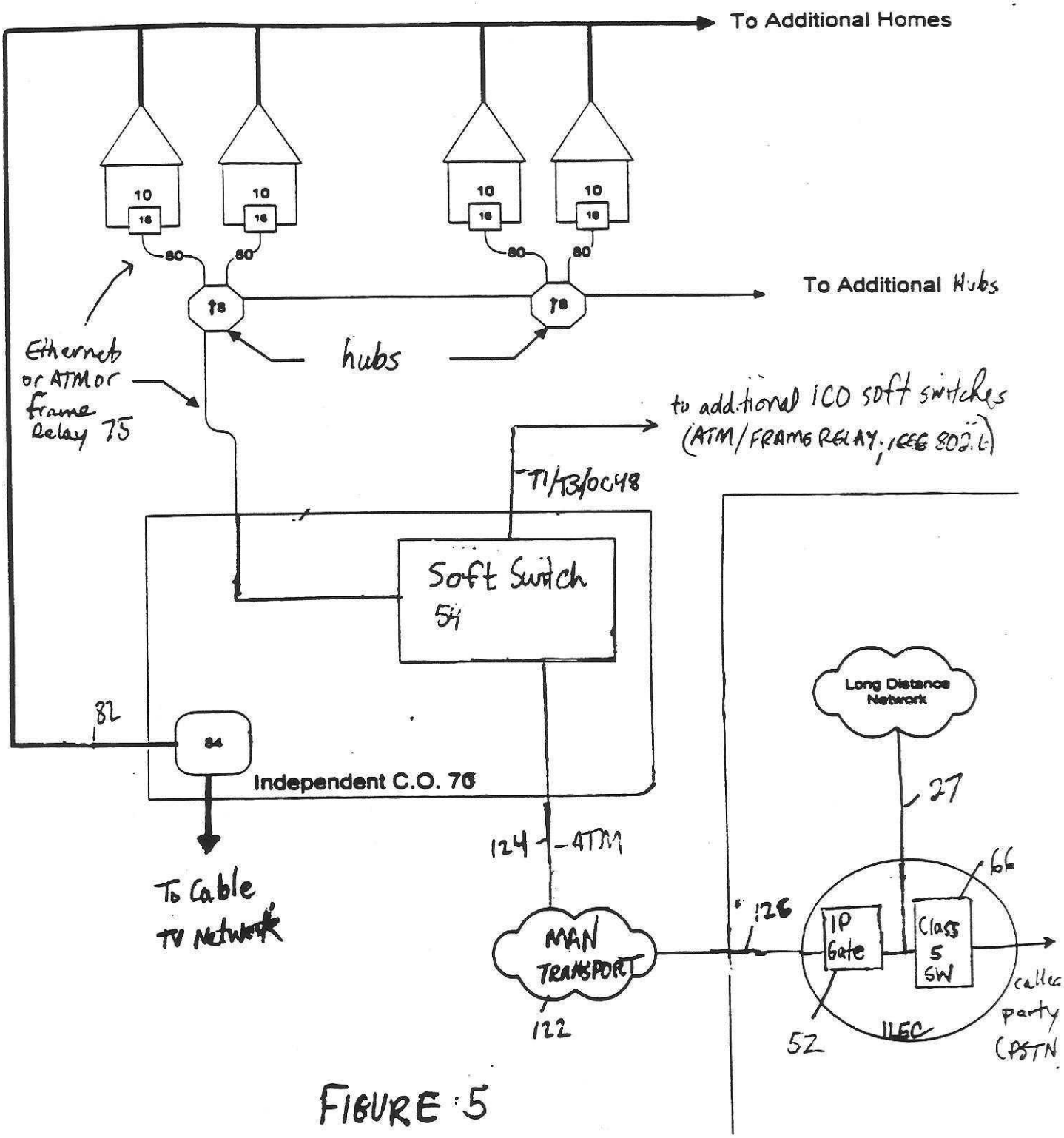

To Additional Homes
10
16
80
78
To Additional Hubs
hubs
Ethernet or ATM or Frame Relay 75
to additional ICO soft switches (ATM/FRAME RELAY, IEEE 802.L)
T1/T3/OC48
Soft Switch 54
82
84
Independent C.O. 76
To Cable TV Network
124
ATM
MAN TRANSPORT
122
126
Long Distance Network
27
66
IP Gate
Class 5 SW
52
ILEC
called party CPSTN

FIGURE 5

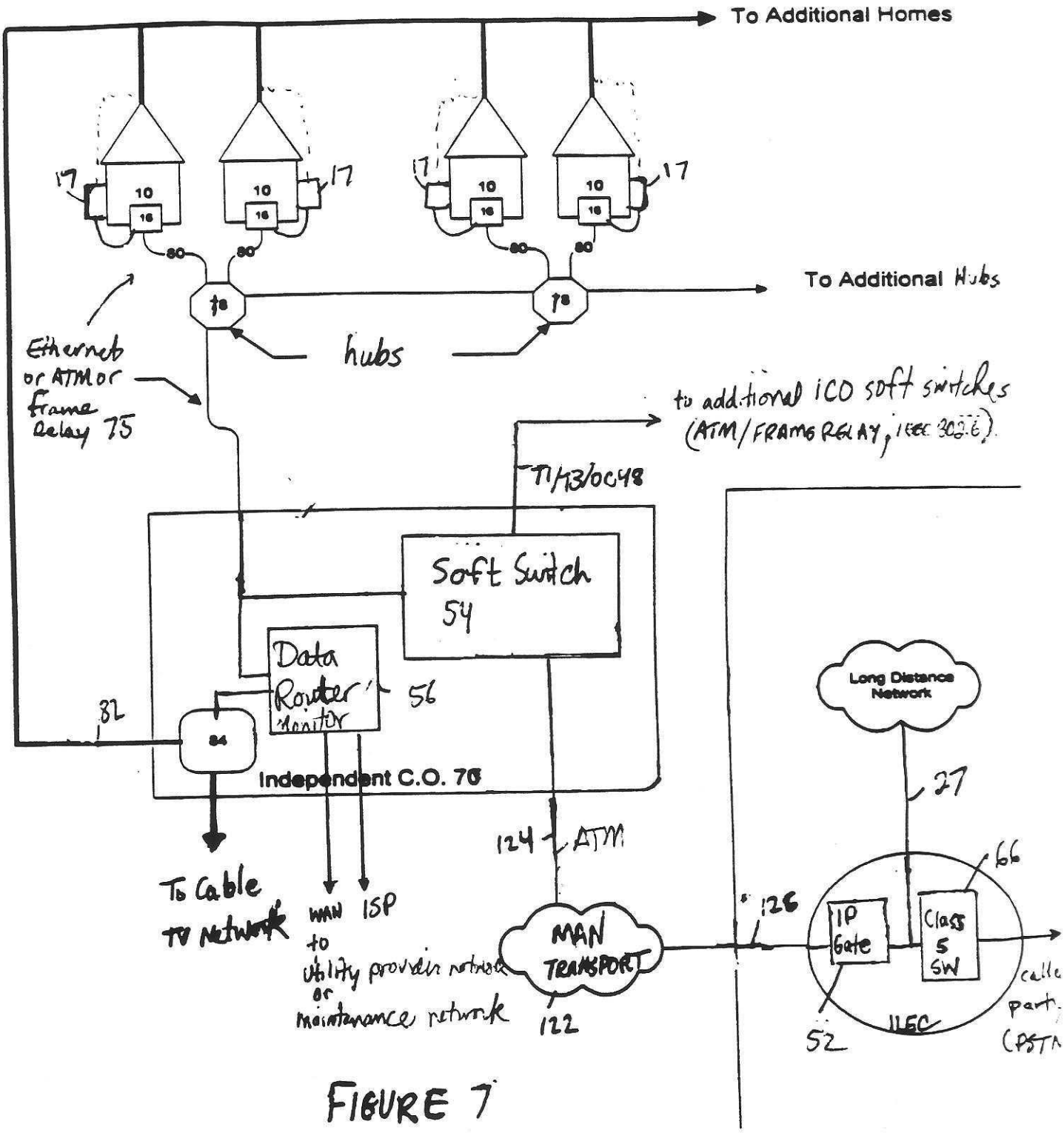

To Additional Homes
17
10
16
80
To Additional Hubs
hubs
Ethernet or ATM or Frame Relay 75
to additional ICO soft switches (ATM/FRAME RELAY, IEEE 802.6)
T1/T3/OC48
Soft Switch 54
Data Router/ Monitor
56
82
84
Independent C.O. 70
Long Distance Network
27
124
ATM
66
To Cable TV Network
WAN ISP to utility provider network or maintenance network
MAN TRANSPORT
122
126
IP Gate
Class 5 SW
52
ILEC
calle
part
CPSTN

FIGURE 7