IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

U.S. PATENT NO:	6,243,373
ISSUE DATE:	June 5, 2001
FILING DATE:	November 1, 1995
TITLE:	Method and apparatus for implementing a computer network / internet telephone system
DOCKET NO.	B9281-13487
INVENTOR:	David L. Turock

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REQUEST FOR EX PARTE REEXAMINATION OF U.S. PATENT NO. 6,243,373

Third-party requester, Electronic Frontier Foundation ("Requester"), respectfully requests reexamination under 37 CFR § 1.510 for *Ex Parte* Reexamination of claims 1-6 and 13-18 of United States Patent No. 6,243,373 ("the '373 patent").

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I. Introduction

This is a Request under 37 CFR § 1.510 for *Ex Parte* Reexamination of claims 1-6 and 13-18 of United States Patent No. 6,243,373 ("the '373 patent"). The '373 patent remains in force according to the maintenance fee records available from the Office.

II. Request Requirements Under 37 CFR §1.510

A. Substantial New Question of Patentability

This request presents two substantial new questions of patentability (SNQ) based on printed publications. Section III details the SNQs presented.

B. Identification of Claims for Which Reexamination is Requested

Reexamination is requested for the following claims based on the references cited. A detailed explanation of the pertinence and manner of applying the cited prior art to every claim for which reexamination is requested is included in section IV.

1. Claims 1-6 and 13-18

Reexamination of **claims 1-6 and 13-18** is requested in view of the following reference:

- U.S. Patent No. 5,568,475 to Doshi et al, entitled "ATM Network Architecture Employing an Out-of-Band Signaling Network". A copy of the reference is attached as Appendix 2.

2. Claims 1-6 and 13-18

Reexamination of **claims 1-6 and 13-18** is requested in view of the following references:

- U.S. Patent No. 5,568,475 to Doshi et al, entitled "ATM Network Architecture Employing an Out-of-Band Signaling Network". A copy of the reference is attached as Appendix 2.

- Request for Comments (RFC) 1577: Classical IP and ARP over ATM. A copy of the reference is attached as Appendix 3.

A detailed explanation of the pertinence and manner of applying the cited prior art to every claim for which reexamination is requested is included in section IV.

C. Copies of Printed Publications Relied Upon

Included with this Request is a copy of each printed publication identified in section II.B above.

D. Copy of the Patent

A copy of the entire '373 patent including the front face, drawings, and specification/claims (in double column format) is included with this Request as Appendix 1. No disclaimer, certificate of correction or reexamination certificate is included in the USPTO records for the '373 patent.

E. Certification

A copy of this Request is being served as of this date on the patent owner at the address provided for in 37 CFR § 1.33(c), as certified below. The address of record is:

Darby & Darby
805 Third Avenue
New York, NY 10022

F. Fee

The fee specified in 37 CFR § 1.20(c)(1) is included.

III. Statement Pointing Out Substantial New Questions of Patentability

A. Because Doshi *Anticipates Claims 1-6 and 13-18 of the '373 Patent, it Raises a Substantial New Question of Patentability*

U.S. Patent No. 5,568,475 to Doshi et al, entitled "ATM Network Architecture Employing an Out-of-Band Signaling Network" (hereinafter "*Doshi*") was filed on December 21, 1994 and is prior art to the '373 patent under at least 35 U.S.C. § 102(e). *Doshi* describes an architecture for receiving telephone calls from a central office, converting data received from the central office to an Asynchronous Transfer Mode ("ATM") protocol for transport through a public ATM network, and converting the data back from the ATM protocol to a PSTN protocol to reach the called party. *Doshi* was not cited or considered by the Examiner or the applicant during prosecution of the '373 patent, and is thus available to establish a substantial new question of patentability.

Doshi discloses all of the elements of claims 1-6 and 13-18 of the '373 patent. In *Doshi*, the received telephone call specifies only the telephone number of the second telephone set (i.e., the caller is not required to dial two or more phone numbers) as recited in claim 1 of the '373 patent. Also, the ATM protocol of *Doshi* is a type of "Internet protocol" and the ATM network of *Doshi* is a type of "public computer network" as recited in claim 1. As is known to one of ordinary skill in the art, ATM is commonly used to transport data packets on the Internet. Additionally, the ATM network of *Doshi* contains computers (e.g., ATM switches), and is accessed by central offices of local exchange carriers (LECs) in a public switched telephone network (PSTN), making it a public computer network.

Teachings of *Doshi* therefore provide subject matter not previously considered during prosecution and raise a substantial new question of patentability with respect to claims 1-6 and

13-18 of the '373 patent, as further detailed in section IV.

B. Because **Doshi** *Combined with RFC 1577 Render Obvious Claims 1-6 and 13-18 of the '373 Patent, they Raise a Substantial New Question of Patentability*

The RFC 1577 reference entitled "Classical IP and ARP over ATM" (hereinafter "*RFC 1577*") was published in January 1994 and is prior art to the '373 patent under at least 35 U.S.C. § 102(b). *RFC 1577* is part of a series of Request For Comments (RFCs) that are used as standard references by those in the field of computer networking. Though one of ordinary skill in the art would know that ATM is an Internet protocol, *RFC 1577* explicitly discloses the use ATM to transport Internet data (e.g., IP packets) over the Internet. The first page of *RFC 1577* states "this document specifies an Internet standards track protocol for the Internet community…" and "this memo considers only the application of ATM as a direct replacement for the 'wires' and local LAN segments connecting IP end-stations ('members') and routers operating in the 'classical' LAN-based paradigm." *RFC 1577* was not cited or considered by the Examiner or the applicant during prosecution of the '373 patent, and is thus also available, like *Doshi*, to establish a substantial new question of patentability.

It would have been obvious to one of ordinary skill in the art at the time of the claimed invention to combine the teachings of *Doshi* with the disclosure of *RFC 1577* that ATM is an Internet protocol for transporting packets over the Internet. One of ordinary skill in the art would have consulted *RFC 1577* as a standard reference in the art for providing further information regarding the use of ATM in *Doshi*. Therefore, *RFC 1577*, in combination with *Doshi*, raises a substantial new question of patentability with respect to claims 1-6 and 13-18 of the '373 patent.

IV. Detailed Explanation

A. Overview of the '373 Patent

The '373 patent was filed on November 1, 1995 and issued on June 5, 2001. The patent includes two independent claims (claims 1 and 13) and 22 dependent claims (claims 2-12 and 14-24). Claims 1-12 recite methods for routing a telephone call between two telephone sets using a public computer network. Claims 13-24 recite systems corresponding to the methods of claims 1-12.

B. *Claims 1-6 and 13-18 are unpatentable under 35 U.S.C. § 102(e) as anticipated by* Doshi*.*

1. Claim Construction

Claims 1 and 13 of the '373 patent use the term "public computer network." For example, claim 1 recites: "... establishing a communication link over said public computer network ..." Claims 1 and 13 of the '373 patent also use the term "Internet protocol." For example, claim 1 recites "... converting data received from the central office to an Internet protocol ..."

In determining the broadest reasonable construction, the USPTO should note that a litigation involving the '373 patent occurred in the United States District Court for the Eastern District of Texas, Marshall Division: *C2 Communications v. AT&T, Inc., et al.*, No. 2:06-cv-00241-TJW-CE. Prior to settlement of the litigation, the court issued two claim construction orders. A claim construction order dated June 13, 2008 is attached as Appendix 4. A clarification dated September 9, 2008 of this claim construction order is attached as Appendix 5.

The order dated June 13, 2008 construes a "public computer network" in the claims of the '373 patent to be "a computer network available for use by the general public" (page 13). The order also construes an "Internet protocol" in the claims of the '373 patent to be "a communications format capable of transmitting data over the Internet" (page 13). The clarification dated September 9, 2008 construes an "Internet protocol" to be "a communications format capable of transmitting data over, on, or across the Internet" (page 1).

2. Background

Doshi discloses a "public computer network" as claimed in the '373 patent and as construed to mean "a computer network available for use by the general public." A Motion for Summary Judgment that the claims of the '373 patent are invalid in view of *Doshi* was filed by the defendant on July 3, 2008 in the above mentioned litigation. For reference, this Motion is attached as Appendix 6. As discussed on page 15 of the Motion, the ATM network described in *Doshi* (see, e.g., *Doshi*, Abstract) is a network that consists of computers used by the public. Dr. Bharat T. Doshi, an inventor of *Doshi*, further confirmed this by stating during a deposition that the ATM network of *Doshi* is "a public data network and can be used by public computers." (Motion of July 3, 2008, p. 15). The ATM network of *Doshi* is also referred to as the IXC network, or intercarrier exchange network (*Doshi*, Fig. 1, item 200). The deposition transcript of Dr. Doshi is attached as Appendix 7 for reference.

A Response to the Motion was filed by the plaintiff on July 29, 2008, and is attached as Appendix 8. On pages 15-17 of the Response, the plaintiff responded to the arguments above. In the Response, plaintiff admits that "...*Doshi*'s ATM network ... is clearly made available to the public under the Court's construction of "public computer network." (Response, pages 15, last paragraph). Defendant's Reply filed on August 11, 2008 to the Response is attached as Appendix 9. The first full paragraph of page 7 of the Reply further addresses the disclosure of a "public computer network" by *Doshi*.

Doshi also discloses an "Internet protocol" as claimed in the '373 patent and as construed to mean "a communications format capable of transmitting data over, on, or across the Internet." The ATM protocol disclosed in *Doshi* is a type of "Internet protocol." As discussed in the Motion of July 3, 2008 attached as Appendix 6, Dr. Doshi stated during his deposition that ATM networks have been used as part of the Internet, and that Internet Protocol Version 4 was being carried over ATM at the time of the filing of the '373 patent (Motion of July 3, 2008, p. 9-10). Also, see the deposition transcript of Dr. Doshi attached as Appendix 7. As a result, the ATM protocol of *Doshi* is a "communications format capable of transmitting data over, on, or across the Internet" and is an "Internet protocol".

In the Response to the Motion (attached as Appendix 8), the plaintiff argues that *Doshi* does not disclose converting data to "Internet Protocol Versions 1 through 9" (Response, p. 9). However, this is irrelevant, because the term "Internet protocol" includes any communications format capable of transmitting data over, on or across the Internet. It is not limited to Internet Protocol Versions 1-9. The plaintiff further argues that the ATM protocol lies beneath the "Internet Protocols" in the OSI protocol Stack (Response, p.10). Even assuming it is correct that ATM is beneath Internet Protocol version 4 (IPv4), it is also irrelevant. Though it may be at a different OSI layer than IPv4, ATM is capable of transmitting data across the Internet and is an "Internet protocol". The plaintiff's arguments are further addressed in the Defendant's Reply filed attached as Appendix 9 (see Reply, pages 3-5).

3. Claims 1-6 and 13-18 are anticipated by *Doshi*

Claims 1-6 and 13-18 are unpatentable under 35 U.S.C. § 102(e) as anticipated by *Doshi*. The following chart illustrates how each limitation in those claims is taught by the references:

CLAIM ELEMENT	***Doshi***
Claim 1	
1. A method of routing a full duplex telephone call between a first telephone set and a second telephone set using a public computer network as at least part of a communication link connecting said first and second telephone sets, comprising the steps of:	*Doshi* discloses an architecture for receiving telephone calls from a PSTN, converting the voice data from a PSTN protocol to an Asynchronous Transfer Mode ("ATM") protocol for transport through a public ATM network, and conversion of the voice data from the ATM protocol to the PSTN protocol to reach the called party. The public ATM network is a computer network containing ATM switches, which are types of computers. See, e.g., *Doshi*, col. 2, line 61 – col. 3, line 19. "Controller 215-5 activates the virtual circuit connection from input port 1 to output port 213-1 so that speech signals originating at station set S1 and destined for station S2 may be transported over 45 switch fabric 215-4 during the associated virtual connection." *Doshi*, col. 6, lines 43-47.
receiving at a first computer network access port a first telephone call from a central office placed from said fist [*sic*] telephone set initiating said full duplex telephone call, said first telephone call specifying a telephone number of said second telephone set, without specifying additional telephone destinations;	*Doshi* discloses receiving a call placed from a first telephone set S3 from central office 175 at network access port 241. See *Doshi*, FIG. 6. In *Doshi*, the telephone number of the second telephone set is specified without specifying additional destinations. "More particularly, a CO, e.g., CO 25, responsive to receipt of a telephone call originated by an associated telephone station set, e.g., station set S1, and responsive to a user thereat dialing a telephone number identifying a called telephone station set, e.g., station set S2, collects the digits as they are dialed by user. When CO 25 receives the last of the dialed digits, it then routes the call towards its destination via a trunk selected as a function of the dialed telephone number." *Doshi*, col. 4, lines 31-39. "Referring then to FIG. 6, assume that the user at station set S3 places a call to station set S4 by going off-hook and dialing the telephone number associated with the latter station set." *Doshi*, col. 8, lines 41-44. "Echo Canceler 205 receives the digital sample and, in a conventional manner, cancels the sample if it represents an echo of a digital speech sample originating at station S2." *Doshi*, col. 7, lines 24-27. The Echo canceler 205 enables full duplex communication (e.g., from S1 to S2 and from S2 to S1), as known to one of ordinary skill in the art.
converting data received from the central office to an Intenet [*sic*] protocol;	*Doshi* discloses converting the data received from the central office for transport using ATM. ATM is an Internet protocol capable of transmitting data over, on, or across the Internet. See ATM Switches 215 and 220 in *Doshi*, FIG. 6. "If not, then the sample is presented to STM/ATM Terminal

CLAIM ELEMENT	*Doshi*
	Adapter 210. TA 210, more particularly, is arranged to pack samples of voice signals as they are received from STM switch 25 via trunk (channel) 1 of trunk group 27 into an ATM cell." *Doshi*, col. 7, lines 27-31. "Assuming that TA 255 accepts the call, then CO 175 begins to transmit the dialed telephone number and caller's ANI via the selected trunk (digital channel of path 176)." *Doshi*, col. 8, lines 52-54.
establishing a communication link over said public computer network between said first computer network access port and a remote second computer network access port;	*Doshi* discloses establishing a communication link between module 235 (containing a first computer network access port) and module 245 (containing a remote second computer network access port) as illustrated in FIG. 6. The communication link is established through ATM network 200. ATM network 200 contains ATM switches, which are types of computers. ATM network 200 is accessed by Local Exchange Carriers (LECs) 325 and 300, which are components of a Public Switched Telephone Network. As a result, ATM network 200 is both a computer network and a public network. See also the description of FIG. 6 at *Doshi*, col. 8, line 41 – col. 9, line 48.
placing a second telephone call from said second computer network access port to said second telephone set using a PSTN;	*Doshi* discloses placing a second telephone call from the port of module 235 to set S4 through LEC 300 and CO 180 (i.e., through a PSTN). See *Doshi*, FIG. 6. "Responsive to receipt of the IAM message via link 156, signal processor 240 of module 235 selects the idle trunk to CO 180 (associated with the trunk from switch 250 to TA 225) and sends an off-hook signal thereto via port 241 of module 235 and the selected trunk. If CO 180 can accept the call, then it returns an off-hook signal via the latter trunk." *Doshi*, col. 9, lines 20-25.
converting data received from the public computer network from Intenet [*sic*] protocol to a PSTN protocol; and	*Doshi* discloses converting data received from the public computer network 200 from an Internet protocol (e.g., ATM) to a PSTN protocol for transmission to the CO 180. See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "TA 225 then unpacks the payload of 48 octets of the received cell and supplies them to the so-called ATM Adaptation Layer (AAL) implemented in TA 225. The AAL (a) buffers the received octets, (b) removes the AAL header, if any, (c) performs AAL functions with respect to the received octets, and (d) then sends each octet in sequence to CO 50 via EC 230 and translated trunk and subgroup of path 52." *Doshi*, col. 8, lines 14-22.
connecting said first telephone call, said communication link and	*Doshi* discloses communication between telephone set S3 and telephone set S4. See *Doshi*, FIG. 6. "When the station S4 user answers the call, then the station S3

CLAIM ELEMENT	***Doshi***
said second telephone call to thereby establish a telephone call between said first telephone set and said second telephone set.	user may begin to communicate with the station S4 user via the virtual connections that are respectively established by switches 215 and 220 as they are needed." *Doshi*, col. 9, lines 44-48.
Claim 2	
2. The method of claim 1 further comprising the step of: receiving said first telephone call from a public switched telephone network.	*Doshi* discloses receiving a telephone call from set S3 through Local Exchange Carrier (LEC) 325 containing Central Office (CO) 175. LECs and COs are components of a public switched telephone network (PSTN), as known to one of ordinary skill in the art. See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "More particularly, a CO, e.g., CO 25, responsive to receipt of a telephone call originated by an associated telephone station set, e.g., station set S1, and responsive to a user thereat dialing a telephone number identifying a called telephone station set, e.g., station set S2, collects the digits as they are dialed by user. When CO 25 receives the last of the dialed digits, it then routes the call towards its destination via a trunk selected as a function of the dialed telephone number." *Doshi*, col. 4, lines 31-39.
Claim 3	
3. The method of claim 2 further comprising the step of: placing said second telephone call using said public switched telephone network.	*Doshi* discloses placing a second telephone call from the port of module 235 to set S4 through CO 180 (i.e., through a PSTN). See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "Responsive to receipt of the IAM message via link 156, signal processor 240 of module 235 selects the idle trunk to CO 180 (associated with the trunk from switch 250 to TA 225) and sends an off-hook signal thereto via port 241 of module 235 and the selected trunk. If CO 180 can accept the call, then it returns an off-hook signal via the latter trunk." *Doshi*, col. 9, lines 20-25.
Claim 4	
4. The method of claim 1 further comprising the step of: placing said second telephone call using a public switched telephone network.	*Doshi* discloses placing a second telephone call from the port of module 235 to set S4 through CO 180 (i.e., through a PSTN). See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "Responsive to receipt of the IAM message via link 156, signal processor 240 of module 235 selects the idle trunk to CO 180 (associated with the trunk from switch 250 to TA 225) and sends an off-hook signal thereto via port 241 of module 235 and the selected trunk. If CO 180 can accept the call, then it returns an off-hook signal via the latter trunk." *Doshi*, col. 9, lines 20-25.
Claim 5	

CLAIM ELEMENT	*Doshi*
5. The method of claim 1, wherein said first telephone call is the only call which is required to be placed by said first telephone set to effect communication with said second telephone set.	*Doshi* discloses a single call being the only call placed from the first telephone set S3. See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "More particularly, a CO, e.g., CO 25, responsive to receipt of a telephone call originated by an associated telephone station set, e.g., station set S1, and responsive to a user thereat dialing a telephone number identifying a called telephone station set, e.g., station set S2, collects the digits as they are dialed by user. When CO 25 receives the last of the dialed digits, it then routes the call towards its destination via a trunk selected as a function of the dialed telephone number." *Doshi*, col. 4, lines 31-39. "Referring then to FIG. 6, assume that the user at station set S3 places a call to station set S4 by going off-hook and dialing the telephone number associated with the latter station set." *Doshi*, col. 8, lines 41-44.
Claim 6	
6. The method of claim 2 wherein said computer network is at least a portion of an Internet computer network.	*Doshi* discloses an ATM-based network. ATM is an Internet protocol used to transport packets over the Internet, and the Internet is comprised of ATM-based networks. See ATM Switches 215 and 220 in *Doshi*, FIG. 6. "If not, then the sample is presented to STM/ATM Terminal Adapter 210. TA 210, more particularly, is arranged to pack samples of voice signals as they are received from STM switch 25 via trunk (channel) 1 of trunk group 27 into an ATM cell." *Doshi*, col. 7, lines 27-31.
Claim 13	
13. A system for routing a full duplex telephone call between a first telephone set and a second telephone set using a public computer network as at least part of a communication link connecting said first and second telephone sets, comprising:	*Doshi* discloses an architecture for receiving telephone calls from a PSTN, converting the voice data from a PSTN protocol to an Asynchronous Transfer Mode ("ATM") protocol for transport through a public ATM network, and conversion of the voice data from the ATM protocol to the PSTN protocol to reach the called party. The public ATM network is a computer network containing ATM switches, which are types of computers. See, e.g., *Doshi*, col. 2, line 61 – col. 3, line 19. "Controller 215-5 activates the virtual circuit connection from input port 1 to output port 213-1 so that speech signals originating at station set S1 and destined for station S2 may be transported over 45 switch fabric 215-4 during the associated virtual connection." *Doshi*, col. 6, lines 43-47.
a first computer network access port which receives a	*Doshi* discloses a network access port 241 that receives a call placed from a first telephone set S3 through central office 175.

CLAIM ELEMENT	***Doshi***
first telephone call from a central office placed from said first telephone set initiating said full duplex telephone call, said first telephone call specifying a telephone number of said second telephone set, without specifying additional telephone destinations;	See *Doshi*, FIG. 6. In *Doshi*, the telephone number of the second telephone set is specified without specifying additional destinations. "More particularly, a CO, e.g., CO 25, responsive to receipt of a telephone call originated by an associated telephone station set, e.g., station set S1, and responsive to a user thereat dialing a telephone number identifying a called telephone station set, e.g., station set S2, collects the digits as they are dialed by user. When CO 25 receives the last of the dialed digits, it then routes the call towards its destination via a trunk selected as a function of the dialed telephone number." *Doshi*, col. 4, lines 31-39. "Referring then to FIG. 6, assume that the user at station set S3 places a call to station set S4 by going off-hook and dialing the telephone number associated with the latter station set." *Doshi*, col. 8, lines 41-44. "Echo Canceler 205 receives the digital sample and, in a conventional manner, cancels the sample if it represents an echo of a digital speech sample originating at station S2." *Doshi*, col. 7, lines 24-27. The Echo canceler 205 enables full duplex communication (e.g., from S1 to S2 and from S2 to S1), as known to one of ordinary skill in the art.
a first protocol conversion module converting data received from the central office to an Intenet [*sic*] protocol;	*Doshi* discloses a Terminal Adapter 210 for converting the data received from the central office for transport using ATM. ATM is an Internet protocol capable of transmitting data over, on, or across the Internet. See ATM Switches 215 and 220 in *Doshi*, FIG. 6. "If not, then the sample is presented to STM/ATM Terminal Adapter 210. TA 210, more particularly, is arranged to pack samples of voice signals as they are received from STM switch 25 via trunk (channel) 1 of trunk group 27 into an ATM cell." *Doshi*, col. 7, lines 27-31. "Assuming that TA 255 accepts the call, then CO 175 begins to transmit the dialed telephone number and caller's ANI via the selected trunk (digital channel of path 176)." *Doshi*, col. 8, lines 52-54.
a communication link over a public computer network between said first computer network access port and a second computer network access port;	*Doshi* discloses a communication link between module 235 (containing a first computer network access port) and module 245 (containing a remote second computer network access port) as illustrated in FIG. 6. The communication link is established through ATM network 200. ATM network 200 contains ATM switches, which are types of computers. ATM network 200 is accessed by Local Exchange Carriers (LECs) 325 and 300, which are components of a Public Switched Telephone Network. As a

CLAIM ELEMENT	***Doshi***
	result, ATM network 200 is both a computer network and a public network. See also the description of FIG. 6 at *Doshi*, col. 8, line 41 – col. 9, line 48.
a calling circuit which places a second telephone call from said second computer network access port to said second telephone set using a PSTN;	*Doshi* discloses a calling circuit which places a second telephone call from the port of module 235 to set S4 through CO 180 (i.e., through a PSTN). See *Doshi*, FIG. 6. "Responsive to receipt of the IAM message via link 156, signal processor 240 of module 235 selects the idle trunk to CO 180 (associated with the trunk from switch 250 to TA 225) and sends an off-hook signal thereto via port 241 of module 235 and the selected trunk. If CO 180 can accept the call, then it returns an off-hook signal via the latter trunk." *Doshi*, col. 9, lines 20-25.
a second protocol conversion module converting data received from the public computer network from Internet protocol to a PSTN protocol; and	*Doshi* discloses conversion module TA 225 for converting data received from the public computer network 200 from an Internet protocol (e.g., ATM) to a PSTN protocol for transmission to the CO 180. See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "TA 225 then unpacks the payload of 48 octets of the received cell and supplies them to the so-called ATM Adaptation Layer (AAL) implemented in TA 225. The AAL (a) buffers the received octets, (b) removes the AAL header, if any, (c) performs AAL functions with respect to the received octets, and (d) then sends each octet in sequence to CO 50 via EC 230 and translated trunk and subgroup of path 52." *Doshi*, col. 8, lines 14-22.
a call management circuit which connects said first telephone call, said communication link and said second telephone call to thereby establish a telephone call between said fist [*sic*] telephone set and said second telephone set.	*Doshi* discloses communication between telephone set S3 and telephone set S4. See *Doshi*, FIG. 6. "When the station S4 user answers the call, then the station S3 user may begin to communicate with the station S4 user via the virtual connections that are respectively established by switches 215 and 220 as they are needed." *Doshi*, col. 9, lines 44-48.
Claim 14	
14. The system of claim 13 further comprising: a public switched telephone network interface circuit which receives said first telephone call through said public switched telephone network.	*Doshi* discloses receiving a telephone call from set S3 through Local Exchange Carrier (LEC) 325 containing Central Office (CO) 175. LECs and COs are components of a public switched telephone network (PSTN), as known to one of ordinary skill in the art. The call is received at the interface connecting LEC 325 and module 245. See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "More particularly, a CO, e.g., CO 25, responsive to receipt of a telephone call originated by an associated telephone station set, e.g., station set S1, and responsive to a user thereat dialing a

CLAIM ELEMENT	***Doshi***
	telephone number identifying a called telephone station set, e.g., station set S2, collects the digits as they are dialed by user. When CO 25 receives the last of the dialed digits, it then routes the call towards its destination via a trunk selected as a function of the dialed telephone number." *Doshi*, col. 4, lines 31-39.
Claim 15	
15. The system of claim 14 further comprising: a second public switched telephone network interface circuit which places said second telephone call through said public switched telephone network.	*Doshi* discloses placing a second telephone call from the port of module 235 to set S4 through CO 180 (i.e., through a PSTN). The call is placed at the interface connecting LEC 300 and module 235. See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "Responsive to receipt of the IAM message via link 156, signal processor 240 of module 235 selects the idle trunk to CO 180 (associated with the trunk from switch 250 to TA 225) and sends an off-hook signal thereto via port 241 of module 235 and the selected trunk. If CO 180 can accept the call, then it returns an off-hook signal via the latter trunk." *Doshi*, col. 9, lines 20-25.
Claim 16	
16. The system of claim 13 wherein said public switched telephone network interface circuit places said second telephone call through said public switched telephone network.	*Doshi* discloses placing a second telephone call from the port of module 235 to set S4 through CO 180 (i.e., through a PSTN). See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "Responsive to receipt of the IAM message via link 156, signal processor 240 of module 235 selects the idle trunk to CO 180 (associated with the trunk from switch 250 to TA 225) and sends an off-hook signal thereto via port 241 of module 235 and the selected trunk. If CO 180 can accept the call, then it returns an off-hook signal via the latter trunk." *Doshi*, col. 9, lines 20-25.
Claim 17	
17. The system of claim 13, wherein said first telephone call is the only call which is required to be placed by said first telephone set to effect communication with said second telephone set.	*Doshi* discloses a single call being the only call placed from the first telephone set S3. See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "More particularly, a CO, e.g., CO 25, responsive to receipt of a telephone call originated by an associated telephone station set, e.g., station set S1, and responsive to a user thereat dialing a telephone number identifying a called telephone station set, e.g., station set S2, collects the digits as they are dialed by user. When CO 25 receives the last of the dialed digits, it then routes the call towards its destination via a trunk selected as a function of the dialed telephone number." *Doshi*, col. 4, lines 31-39. "Referring then to FIG. 6, assume that the user at station set S3 places a call to station set S4 by going off-hook and dialing the telephone number associated with the latter station set." *Doshi*,

<u>CLAIM ELEMENT</u>	***<u>Doshi</u>***
	col. 8, lines 41-44.
<u>Claim 18</u>	
18. The system of claim 14 wherein said computer network comprises an Internet computer network connection.	*Doshi* discloses an ATM-based network. ATM is an Internet protocol used to transport packets over the Internet, and the Internet is comprised of ATM-based networks. See ATM Switches 215 and 220 in *Doshi*, FIG. 6. "If not, then the sample is presented to STM/ATM Terminal Adapter 210. TA 210, more particularly, is arranged to pack samples of voice signals as they are received from STM switch 25 via trunk (channel) 1 of trunk group 27 into an ATM cell." *Doshi*, col. 7, lines 27-31.

The detailed explanation in the above claim chart describes how *Doshi* discloses each and every element of claims 1-6 and 13-18 of the '373 patent as well as posing a substantial new question of patentability. Therefore, reexamination of these claims is warranted.

C. *Claims 1-6 and 13-18 are unpatentable under 35 U.S.C. § 103 as obvious in view of the combination of* Doshi *and* RFC 1577.

The claim construction and background material discussed in sections IV.B.1. and IV.B.2. above equally apply to this section. Specifically, the ATM protocol in *Doshi* is an "Internet protocol" and the ATM network in *Doshi* is a "public computer network." *RFC 1577* is part of a series of Request For Comments (RFCs) that are used as standard references by those in the field of computer networking. Though one of ordinary skill in the art would know that ATM is an Internet protocol (as discussed in Section IV.B. above), *RFC 1577* explicitly discloses the use ATM to transport Internet data (e.g., IP packets) over the Internet.

Claims 1-6 and 13-18 are unpatentable under 35 U.S.C. § 103 as obvious in view of the combination of *Doshi* and *RFC 1577*. The following chart illustrates how each limitation in those claims is taught by the references:

<u>CLAIM ELEMENT</u>	**<u>*Doshi* and *RFC 1577*</u>**
<u>Claim 1</u>	
1. A method of routing a full duplex telephone call between a first telephone set and a second telephone set using a public computer network as at least part of a communication link connecting said first and second telephone sets, comprising the steps of:	*Doshi* discloses an architecture for receiving telephone calls from a PSTN, converting the voice data from a PSTN protocol to an Asynchronous Transfer Mode ("ATM") protocol for transport through a public ATM network, and conversion of the voice data from the ATM protocol to the PSTN protocol to reach the called party. The public ATM network is a computer network containing ATM switches, which are types of computers. See, e.g., *Doshi*, col. 2, line 61 – col. 3, line 19. "Controller 215-5 activates the virtual circuit connection from input port 1 to output port 213-1 so that speech signals originating at station set S1 and destined for station S2 may be transported over 45 switch fabric 215-4 during the associated virtual connection." *Doshi*, col. 6, lines 43-47.
receiving at a first computer network access port a first telephone call from a central office placed from said fist [*sic*] telephone set initiating said full duplex telephone call, said first telephone call specifying a telephone number of said second telephone set, without specifying additional telephone destinations;	*Doshi* discloses receiving a call placed from a first telephone set S3 from central office 175 at network access port 241. See *Doshi*, FIG. 6. In *Doshi*, the telephone number of the second telephone set is specified without specifying additional destinations. "More particularly, a CO, e.g., CO 25, responsive to receipt of a telephone call originated by an associated telephone station set, e.g., station set S1, and responsive to a user thereat dialing a telephone number identifying a called telephone station set, e.g., station set S2, collects the digits as they are dialed by user. When CO 25 receives the last of the dialed digits, it then routes the call towards its destination via a trunk selected as a function of the dialed telephone number." *Doshi*, col. 4, lines 31-39. "Referring then to FIG. 6, assume that the user at station set S3 places a call to station set S4 by going off-hook and dialing the telephone number associated with the latter station set." *Doshi*, col. 8, lines 41-44. "Echo Canceler 205 receives the digital sample and, in a conventional manner, cancels the sample if it represents an echo of a digital speech sample originating at station S2." *Doshi*, col. 7, lines 24-27. The Echo canceler 205 enables full duplex communication (e.g., from S1 to S2 and from S2 to S1), as known to one of ordinary skill in the art.
converting data received from the central office to an Intenet [*sic*] protocol;	*Doshi* discloses converting the data received from the central office for transport using ATM. ATM is an Internet protocol capable of transmitting data over, on, or across the Internet. See ATM Switches 215 and 220 in *Doshi*, FIG. 6. "If not, then the sample is presented to STM/ATM Terminal

CLAIM ELEMENT	***Doshi* and *RFC 1577***
	Adapter 210. TA 210, more particularly, is arranged to pack samples of voice signals as they are received from STM switch 25 via trunk (channel) 1 of trunk group 27 into an ATM cell." *Doshi*, col. 7, lines 27-31. "Assuming that TA 255 accepts the call, then CO 175 begins to transmit the dialed telephone number and caller's ANI via the selected trunk (digital channel of path 176)." *Doshi*, col. 8, lines 52-54. Further, *RFC 1577* explicitly states that ATM is an Internet protocol capable of transmitting data over, on, or across the Internet. "The goal of this specification is to allow compatible and interoperable implementations for transmitting IP datagrams and ATM Address Resolution Protocol (ATMARP) requests and replies over ATM Adaptation Layer 5." *RFC 1577*, page 2. "This memo considers only the application of ATM as a direct replacement for the 'wires' and local LAN segments connecting IP end-stations ('members') and routers operating in the 'classical' LAN-based paradigm." *RFC 1577*, page 1. Also, see *RFC 1577*, Abstract, page 1.
establishing a communication link over said public computer network between said first computer network access port and a remote second computer network access port;	*Doshi* discloses establishing a communication link between module 235 (containing a first computer network access port) and module 245 (containing a remote second computer network access port) as illustrated in FIG. 6. The communication link is established through ATM network 200. ATM network 200 contains ATM switches, which are types of computers. ATM network 200 is accessed by Local Exchange Carriers (LECs) 325 and 300, which are components of a Public Switched Telephone Network. As a result, ATM network 200 is both a computer network and a public network. See also the description of FIG. 6 at *Doshi*, col. 8, line 41 – col. 9, line 48.
placing a second telephone call from said second computer network access port to said second telephone set using a PSTN;	*Doshi* discloses placing a second telephone call from the port of module 235 to set S4 through LEC 300 and CO 180 (i.e., through a PSTN). See *Doshi*, FIG. 6. "Responsive to receipt of the IAM message via link 156, signal processor 240 of module 235 selects the idle trunk to CO 180 (associated with the trunk from switch 250 to TA 225) and sends an off-hook signal thereto via port 241 of module 235 and the selected trunk. If CO 180 can accept the call, then it returns an off-hook signal via the latter trunk." *Doshi*, col. 9, lines 20-25.
converting data received from the public computer	*Doshi* discloses converting data received from the public computer network 200 from an Internet protocol (e.g., ATM) to a

CLAIM ELEMENT	***Doshi* and *RFC 1577***
network from Intenet [*sic*] protocol to a PSTN protocol; and	PSTN protocol for transmission to the CO 180. See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "TA 225 then unpacks the payload of 48 octets of the received cell and supplies them to the so-called ATM Adaptation Layer (AAL) implemented in TA 225. The AAL (a) buffers the received octets, (b) removes the AAL header, if any, (c) performs AAL functions with respect to the received octets, and (d) then sends each octet in sequence to CO 50 via EC 230 and translated trunk and subgroup of path 52." *Doshi*, col. 8, lines 14-22.
connecting said first telephone call, said communication link and said second telephone call to thereby establish a telephone call between said first telephone set and said second telephone set.	*Doshi* discloses communication between telephone set S3 and telephone set S4. See *Doshi*, FIG. 6. "When the station S4 user answers the call, then the station S3 user may begin to communicate with the station S4 user via the virtual connections that are respectively established by switches 215 and 220 as they are needed." *Doshi*, col. 9, lines 44-48.
Claim 2	
2. The method of claim 1 further comprising the step of: receiving said first telephone call from a public switched telephone network.	*Doshi* discloses receiving a telephone call from set S3 through Local Exchange Carrier (LEC) 325 containing Central Office (CO) 175. LECs and COs are components of a public switched telephone network (PSTN), as known to one of ordinary skill in the art. See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "More particularly, a CO, e.g., CO 25, responsive to receipt of a telephone call originated by an associated telephone station set, e.g., station set S1, and responsive to a user thereat dialing a telephone number identifying a called telephone station set, e.g., station set S2, collects the digits as they are dialed by user. When CO 25 receives the last of the dialed digits, it then routes the call towards its destination via a trunk selected as a function of the dialed telephone number." *Doshi*, col. 4, lines 31-39.
Claim 3	
3. The method of claim 2 further comprising the step of: placing said second telephone call using said public switched telephone network.	*Doshi* discloses placing a second telephone call from the port of module 235 to set S4 through CO 180 (i.e., through a PSTN). See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "Responsive to receipt of the IAM message via link 156, signal processor 240 of module 235 selects the idle trunk to CO 180 (associated with the trunk from switch 250 to TA 225) and sends an off-hook signal thereto via port 241 of module 235 and the selected trunk. If CO 180 can accept the call, then it returns an off-hook signal via the latter trunk." *Doshi*, col. 9, lines 20-25.

CLAIM ELEMENT	***Doshi* and *RFC 1577***
Claim 4	
4. The method of claim 1 further comprising the step of: placing said second telephone call using a public switched telephone network.	*Doshi* discloses placing a second telephone call from the port of module 235 to set S4 through CO 180 (i.e., through a PSTN). See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "Responsive to receipt of the IAM message via link 156, signal processor 240 of module 235 selects the idle trunk to CO 180 (associated with the trunk from switch 250 to TA 225) and sends an off-hook signal thereto via port 241 of module 235 and the selected trunk. If CO 180 can accept the call, then it returns an off-hook signal via the latter trunk." *Doshi*, col. 9, lines 20-25.
Claim 5	
5. The method of claim 1, wherein said first telephone call is the only call which is required to be placed by said first telephone set to effect communication with said second telephone set.	*Doshi* discloses a single call being the only call placed from the first telephone set S3. See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "More particularly, a CO, e.g., CO 25, responsive to receipt of a telephone call originated by an associated telephone station set, e.g., station set S1, and responsive to a user thereat dialing a telephone number identifying a called telephone station set, e.g., station set S2, collects the digits as they are dialed by user. When CO 25 receives the last of the dialed digits, it then routes the call towards its destination via a trunk selected as a function of the dialed telephone number." *Doshi*, col. 4, lines 31-39. "Referring then to FIG. 6, assume that the user at station set S3 places a call to station set S4 by going off-hook and dialing the telephone number associated with the latter station set." *Doshi*, col. 8, lines 41-44.
Claim 6	
6. The method of claim 2 wherein said computer network is at least a portion of an Internet computer network.	*Doshi* discloses an ATM-based network. ATM is an Internet protocol used to transport packets over the Internet, and the Internet is comprised of ATM-based networks. See ATM Switches 215 and 220 in *Doshi*, FIG. 6. "If not, then the sample is presented to STM/ATM Terminal Adapter 210. TA 210, more particularly, is arranged to pack samples of voice signals as they are received from STM switch 25 via trunk (channel) 1 of trunk group 27 into an ATM cell." *Doshi*, col. 7, lines 27-31. Further, *RFC 1577* explicitly states that ATM is an Internet protocol used to transport packets over the Internet, and the Internet is comprised of ATM-based networks. "The goal of this specification is to allow compatible and interoperable implementations for transmitting IP datagrams and

CLAIM ELEMENT	*Doshi* and *RFC 1577*
	ATM Address Resolution Protocol (ATMARP) requests and replies over ATM Adaptation Layer 5." *RFC 1577*, page 2. "This memo considers only the application of ATM as a direct replacement for the 'wires' and local LAN segments connecting IP end-stations ('members') and routers operating in the 'classical' LAN-based paradigm." *RFC 1577*, page 1. Also, see *RFC 1577*, Abstract, page 1.
Claim 13	
13. A system for routing a full duplex telephone call between a first telephone set and a second telephone set using a public computer network as at least part of a communication link connecting said first and second telephone sets, comprising:	*Doshi* discloses an architecture for receiving telephone calls from a PSTN, converting the voice data from a PSTN protocol to an Asynchronous Transfer Mode ("ATM") protocol for transport through a public ATM network, and conversion of the voice data from the ATM protocol to the PSTN protocol to reach the called party. The public ATM network is a computer network containing ATM switches, which are types of computers. See, e.g., *Doshi*, col. 2, line 61 – col. 3, line 19. "Controller 215-5 activates the virtual circuit connection from input port 1 to output port 213-1 so that speech signals originating at station set S1 and destined for station S2 may be transported over 45 switch fabric 215-4 during the associated virtual connection." *Doshi*, col. 6, lines 43-47.
a first computer network access port which receives a first telephone call from a central office placed from said first telephone set initiating said full duplex telephone call, said first telephone call specifying a telephone number of said second telephone set, without specifying additional telephone destinations;	*Doshi* discloses a network access port 241 that receives a call placed from a first telephone set S3 through central office 175. See *Doshi*, FIG. 6. In *Doshi*, the telephone number of the second telephone set is specified without specifying additional destinations. "More particularly, a CO, e.g., CO 25, responsive to receipt of a telephone call originated by an associated telephone station set, e.g., station set S1, and responsive to a user thereat dialing a telephone number identifying a called telephone station set, e.g., station set S2, collects the digits as they are dialed by user. When CO 25 receives the last of the dialed digits, it then routes the call towards its destination via a trunk selected as a function of the dialed telephone number." *Doshi*, col. 4, lines 31-39. "Referring then to FIG. 6, assume that the user at station set S3 places a call to station set S4 by going off-hook and dialing the telephone number associated with the latter station set." *Doshi*, col. 8, lines 41-44. "Echo Canceler 205 receives the digital sample and, in a conventional manner, cancels the sample if it represents an echo of a digital speech sample originating at station S2." *Doshi*, col. 7, lines 24-27. The Echo canceler 205 enables full duplex

CLAIM ELEMENT	*Doshi* and *RFC 1577*
	communication (e.g., from S1 to S2 and from S2 to S1), as known to one of ordinary skill in the art.
a first protocol conversion module converting data received from the central office to an Intenet [*sic*] protocol;	*Doshi* discloses a Terminal Adapter 210 for converting the data received from the central office for transport using ATM. ATM is an Internet protocol capable of transmitting data over, on, or across the Internet. See ATM Switches 215 and 220 in *Doshi*, FIG. 6. "If not, then the sample is presented to STM/ATM Terminal Adapter 210. TA 210, more particularly, is arranged to pack samples of voice signals as they are received from STM switch 25 via trunk (channel) 1 of trunk group 27 into an ATM cell." *Doshi*, col. 7, lines 27-31. "Assuming that TA 255 accepts the call, then CO 175 begins to transmit the dialed telephone number and caller's ANI via the selected trunk (digital channel of path 176)." *Doshi*, col. 8, lines 52-54. Further, *RFC 1577* explicitly states that ATM is an Internet protocol capable of transmitting data over, on, or across the Internet. "The goal of this specification is to allow compatible and interoperable implementations for transmitting IP datagrams and ATM Address Resolution Protocol (ATMARP) requests and replies over ATM Adaptation Layer 5." *RFC 1577*, page 2. "This memo considers only the application of ATM as a direct replacement for the 'wires' and local LAN segments connecting IP end-stations ('members') and routers operating in the 'classical' LAN-based paradigm." *RFC 1577*, page 1. Also, see *RFC 1577*, Abstract, page 1.
a communication link over a public computer network between said first computer network access port and a second computer network access port;	*Doshi* discloses a communication link between module 235 (containing a first computer network access port) and module 245 (containing a remote second computer network access port) as illustrated in FIG. 6. The communication link is established through ATM network 200. ATM network 200 contains ATM switches, which are types of computers. ATM network 200 is accessed by Local Exchange Carriers (LECs) 325 and 300, which are components of a Public Switched Telephone Network. As a result, ATM network 200 is both a computer network and a public network. See also the description of FIG. 6 at *Doshi*, col. 8, line 41 – col. 9, line 48.
a calling circuit which places a second telephone call from said second	*Doshi* discloses a calling circuit which places a second telephone call from the port of module 235 to set S4 through CO 180 (i.e., through a PSTN). See *Doshi*, FIG. 6.

CLAIM ELEMENT	***Doshi* and *RFC 1577***
computer network access port to said second telephone set using a PSTN;	"Responsive to receipt of the IAM message via link 156, signal processor 240 of module 235 selects the idle trunk to CO 180 (associated with the trunk from switch 250 to TA 225) and sends an off-hook signal thereto via port 241 of module 235 and the selected trunk. If CO 180 can accept the call, then it returns an off-hook signal via the latter trunk." *Doshi*, col. 9, lines 20-25.
a second protocol conversion module converting data received from the public computer network from Internet protocol to a PSTN protocol; and	*Doshi* discloses conversion module TA 225 for converting data received from the public computer network 200 from an Internet protocol (e.g., ATM) to a PSTN protocol for transmission to the CO 180. See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "TA 225 then unpacks the payload of 48 octets of the received cell and supplies them to the so-called ATM Adaptation Layer (AAL) implemented in TA 225. The AAL (a) buffers the received octets, (b) removes the AAL header, if any, (c) performs AAL functions with respect to the received octets, and (d) then sends each octet in sequence to CO 50 via EC 230 and translated trunk and subgroup of path 52." *Doshi*, col. 8, lines 14-22.
a call management circuit which connects said first telephone call, said communication link and said second telephone call to thereby establish a telephone call between said fist [*sic*] telephone set and said second telephone set.	Doshi discloses communication between telephone set S3 and telephone set S4. See *Doshi*, FIG. 6. "When the station S4 user answers the call, then the station S3 user may begin to communicate with the station S4 user via the virtual connections that are respectively established by switches 215 and 220 as they are needed." *Doshi*, col. 9, lines 44-48.
Claim 14	
14. The system of claim 13 further comprising: a public switched telephone network interface circuit which receives said first telephone call through said public switched telephone network.	*Doshi* discloses receiving a telephone call from set S3 through Local Exchange Carrier (LEC) 325 containing Central Office (CO) 175. LECs and COs are components of a public switched telephone network (PSTN), as known to one of ordinary skill in the art. The call is received at the interface connecting LEC 325 and module 245. See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "More particularly, a CO, e.g., CO 25, responsive to receipt of a telephone call originated by an associated telephone station set, e.g., station set S1, and responsive to a user thereat dialing a telephone number identifying a called telephone station set, e.g., station set S2, collects the digits as they are dialed by user. When CO 25 receives the last of the dialed digits, it then routes the call towards its destination via a trunk selected as a function of the dialed telephone number." *Doshi*, col. 4, lines 31-39.
Claim 15	

CLAIM ELEMENT	***Doshi* and *RFC 1577***
15. The system of claim 14 further comprising: a second public switched telephone network interface circuit which places said second telephone call through said public switched telephone network.	*Doshi* discloses placing a second telephone call from the port of module 235 to set S4 through CO 180 (i.e., through a PSTN). The call is placed at the interface connecting LEC 300 and module 235. See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "Responsive to receipt of the IAM message via link 156, signal processor 240 of module 235 selects the idle trunk to CO 180 (associated with the trunk from switch 250 to TA 225) and sends an off-hook signal thereto via port 241 of module 235 and the selected trunk. If CO 180 can accept the call, then it returns an off-hook signal via the latter trunk." *Doshi*, col. 9, lines 20-25.
Claim 16	
16. The system of claim 13 wherein said public switched telephone network interface circuit places said second telephone call through said public switched telephone network.	*Doshi* discloses placing a second telephone call from the port of module 235 to set S4 through CO 180 (i.e., through a PSTN). See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "Responsive to receipt of the IAM message via link 156, signal processor 240 of module 235 selects the idle trunk to CO 180 (associated with the trunk from switch 250 to TA 225) and sends an off-hook signal thereto via port 241 of module 235 and the selected trunk. If CO 180 can accept the call, then it returns an off-hook signal via the latter trunk." *Doshi*, col. 9, lines 20-25.
Claim 17	
17. The system of claim 13, wherein said first telephone call is the only call which is required to be placed by said first telephone set to effect communication with said second telephone set.	*Doshi* discloses a single call being the only call placed from the first telephone set S3. See *Doshi*, FIG. 6. Also see *Doshi*, FIG. 1. "More particularly, a CO, e.g., CO 25, responsive to receipt of a telephone call originated by an associated telephone station set, e.g., station set S1, and responsive to a user thereat dialing a telephone number identifying a called telephone station set, e.g., station set S2, collects the digits as they are dialed by user. When CO 25 receives the last of the dialed digits, it then routes the call towards its destination via a trunk selected as a function of the dialed telephone number." *Doshi*, col. 4, lines 31-39. "Referring then to FIG. 6, assume that the user at station set S3 places a call to station set S4 by going off-hook and dialing the telephone number associated with the latter station set." *Doshi*, col. 8, lines 41-44.
Claim 18	
18. The system of claim 14 wherein said computer network comprises an Internet computer network	*Doshi* discloses an ATM-based network. ATM is an Internet protocol used to transport packets over the Internet, and the Internet is comprised of ATM-based networks.

CLAIM ELEMENT	*Doshi* and *RFC 1577*
connection.	See ATM Switches 215 and 220 in *Doshi*, FIG. 6. "If not, then the sample is presented to STM/ATM Terminal Adapter 210. TA 210, more particularly, is arranged to pack samples of voice signals as they are received from STM switch 25 via trunk (channel) 1 of trunk group 27 into an ATM cell." *Doshi*, col. 7, lines 27-31. Further, *RFC 1577* explicitly states that ATM is an Internet protocol used to transport packets over the Internet, and the Internet is comprised of ATM-based networks. "The goal of this specification is to allow compatible and interoperable implementations for transmitting IP datagrams and ATM Address Resolution Protocol (ATMARP) requests and replies over ATM Adaptation Layer 5." *RFC 1577*, page 2. "This memo considers only the application of ATM as a direct replacement for the 'wires' and local LAN segments connecting IP end-stations ('members') and routers operating in the 'classical' LAN-based paradigm." *RFC 1577*, page 1. Also, see *RFC 1577*, Abstract, page 1.

1. A person of ordinary skill in the art would have been motivated to combine *Doshi* with *RFC 1577*

When considering the obviousness of a combination of known elements, the operative question is: "whether the improvement is more than the predictable use of prior art elements according to their established functions."[1] The recent *KSR* decision cautions against applying the "teaching-suggestion-motivation" test in an overly rigid manner.[2] The combination of *Doshi* with *RFC 1577* was nothing more than the predictable use of known prior art elements according to their established functions, and therefore renders the claimed invention obvious.

It would have been obvious to one of ordinary skill in the art at the time of the claimed invention to combine the teachings of *Doshi* with the disclosure of *RFC 1577* that ATM is an Internet protocol for transporting packets over the Internet. *Doshi* describes an architecture for receiving telephone calls from a central office, converting data received from the central office

[1] *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740 (2007); *see also* M.P.E.P. § 2141 (Rev. 6, Sept. 2007).
[2] *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007); *see also* M.P.E.P. § 2141 (Rev. 6, Sept. 2007).

to an Asynchronous Transfer Mode ("ATM") protocol for transport through a public ATM network, and converting the data back from the ATM protocol to a PSTN protocol to reach the called party. One of ordinary skill in the art would have consulted *RFC 1577* as a standard reference in the art for providing further information regarding the cited use of ATM in *Doshi*. *RFC 1577* is part of a series of "Request for Comments" (RFCs) which are universally known among those in the field of computer networking as standard references.

Therefore, a substantial new question of patentability exists with respect to claims 1-6 and 13-18 based upon the combination of *Doshi* and *RFC 1577*.

V. Conclusion

Because the analysis above demonstrates two substantial new questions of patentability with respect to claims 1-6 and 13-18 of U.S. Patent 6,243,373, the Director is asked to grant this Request for Reexamination.

Respectfully Submitted,
Third-party Requester
Electronic Frontier Foundation

Date: October 14, 2009

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Dated: October 14, 2009

By: /Nikhil Iyengar/
Nikhil Iyengar, Reg. No. 60,910

APPENDIX 1

US006243373B1

(12) United States Patent
Turock

(10) **Patent No.:** **US 6,243,373 B1**
(45) **Date of Patent:** **Jun. 5, 2001**

(54) **METHOD AND APPARATUS FOR IMPLEMENTING A COMPUTER NETWORK/INTERNET TELEPHONE SYSTEM**

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(73) Assignee: **Telecom Internet Ltd.**, Gerrard's Crossing (GB)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **08/548,323**

(22) Filed: **Nov. 1, 1995**

(51) **Int. Cl.**[7] **H04L 12/66**; H04L 12/28; H04M 1/64

(52) **U.S. Cl.** **370/352**; 370/401; 379/88.17

(58) **Field of Search** 379/220, 221, 379/207, 112, 113, 114, 88, 67, 100.15, 100, 90.01, 93.09, 93.01; 370/351, 450, 389, 392, 352, 485, 458, 404, 401, 394, 747; 395/200.01, 200.02, 200.03

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,630,262	*	12/1986	Callens	370/474
4,771,425	*	9/1988	Baran et al.	370/458
4,866,704	*	9/1989	Bergman	370/452
5,115,431	*	5/1992	Williams	370/394
5,483,589	*	1/1996	Ishida et al.	379/220
5,526,353	*	6/1996	Henley et al.	370/392
5,594,784	*	1/1997	Velius	379/88
5,608,786	*	3/1997	Gordon	379/100
5,726,984	*	3/1998	Kubler et al.	370/348
5,764,741	*	6/1998	Barak	379/114

OTHER PUBLICATIONS

Yang, C., "RFC 1789: INETPhone–Telephone Services and Servers on Internet." Apr. 1995. <http://ds.internic.net/rfc/rfc1789.txt>(Feb. 12, 1997).*

Cerf, V., et al. "A Protocol for Packet Network Intercommunication." IEEE Transactions on Communications, vol. COM–22. No. 5, May 1974.*

(List continued on next page.)

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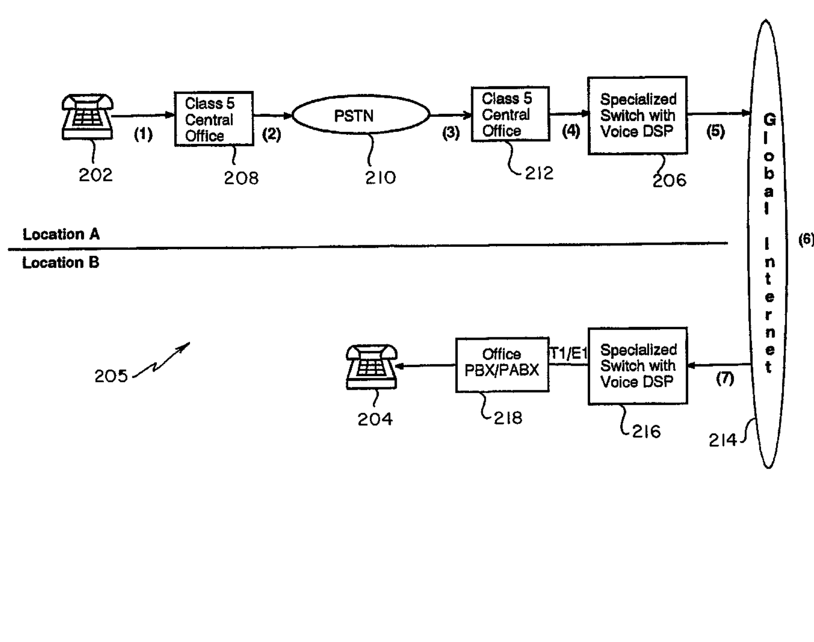
(57) **ABSTRACT**

A method and apparatus are provided for communicating audio information over a computer network. A standard telephone connected to the public switched telephone network (PSTN) may be used to communicate with any other PSTN-connected telephone, where a computer network, such as the Internet, is the transmission facility instead of conventional telephone transmission facilities, such as the interexchange or intralata facilities. In addition to telephone-telephone communication, telephone-computer and computer-telephone communication is also possible. The originator of a conversation (calling party) dials the number of an access port for the computer network. The call is routed to a central office switching system which is connected to the PSTN and then to the access port which is a specialized computer system (ITS node). The caller transmits the number of the desired party (the called party) to the specialized computer system (ITS node) which interfaces between the telephone switching system and the computer network. The specialized computer system (ITS node) receives the number of the called party and establishes a two-way, fill duplex communications link via the computer network to a corresponding remote access port or specialized computer system (ITS node) in the vicinity of the called party. This specialized computer system (ITS node) at the receiving end is connected to the local PSTN in the region of the called party, and uses the local PSTN to connect the call to the called party. Once the call is answered at the called party, the calling and called party may communicate as if the call had been established using the conventional telephone system.

24 Claims, 10 Drawing Sheets



OTHER PUBLICATIONS

Weinstein, C., et al. "Experience with Speech Communication in Packet Networks." IEEE Journal on Selected Areas in Communications, vol. SAC–1, No. 6, Dec. 1983.*
Baran, P., "On Distributed Communications Networks." IEEE Transactions on Communications Systems, manuscript received Oct. 1963, Mar. 1964.*
Aras. C., et al. "Real–Time Communication in Packet–Switched Networks." Proceedings of the IEEE, vol. 82, No. 1, Jan. 1994.*
"Dialing without dollars" by Fred Hapgood, Inc. vol. 17, No. 4, p. 8, Journal code : INO, Jul. 1995.*
"Internet phone calls are cheap but limited", New Media Markets, Newsletter, Feb. 23, 1995.*
"Internet's international phone calls are cheap but limited", Telecom markets, Newsletter, Mar. 2, 1995.*
"Internet phone saves 50% on long distance", 411 Newsletter, vol. 17, No. 15, Aug. 5, 1996.*
"Internet access: Internet phone–to–phone technology now a reality . . . ", EDGE publishing, Aug. 12, 1996.*
"Internet telephony seems to be evolving fast . . . ", Computergram International, No. 2980, Aug. 19, 1996.*
"Competition heats up in Internet phone call wars", Newsbytes News network, Jun. 2, 1995.*
"VocalTec Telephony Gateway", posted on the Internet, viewd on Jan. 15, 1997.*
"Netspeak corporation introduces WebPhone, . . . ", Internet, Mar. 18, 1996.*
"Phone Service Via the Internet May Slash Rates", The Washington Post, by Mike Mills, p. A4, Aug. 11, 1996.*
Clifford et al, Experience with Speech Communication in Packet Networks, IEEE, p. 963–978, 1983.*
Yang, INETPhone, RFC, pp. 1–6, Apr. 1995.*
WO9620553, Gordon, Unified message and Long distance communication system, Apr. 7, 1996.*

* cited by examiner

FIG. 1
PRIOR ART

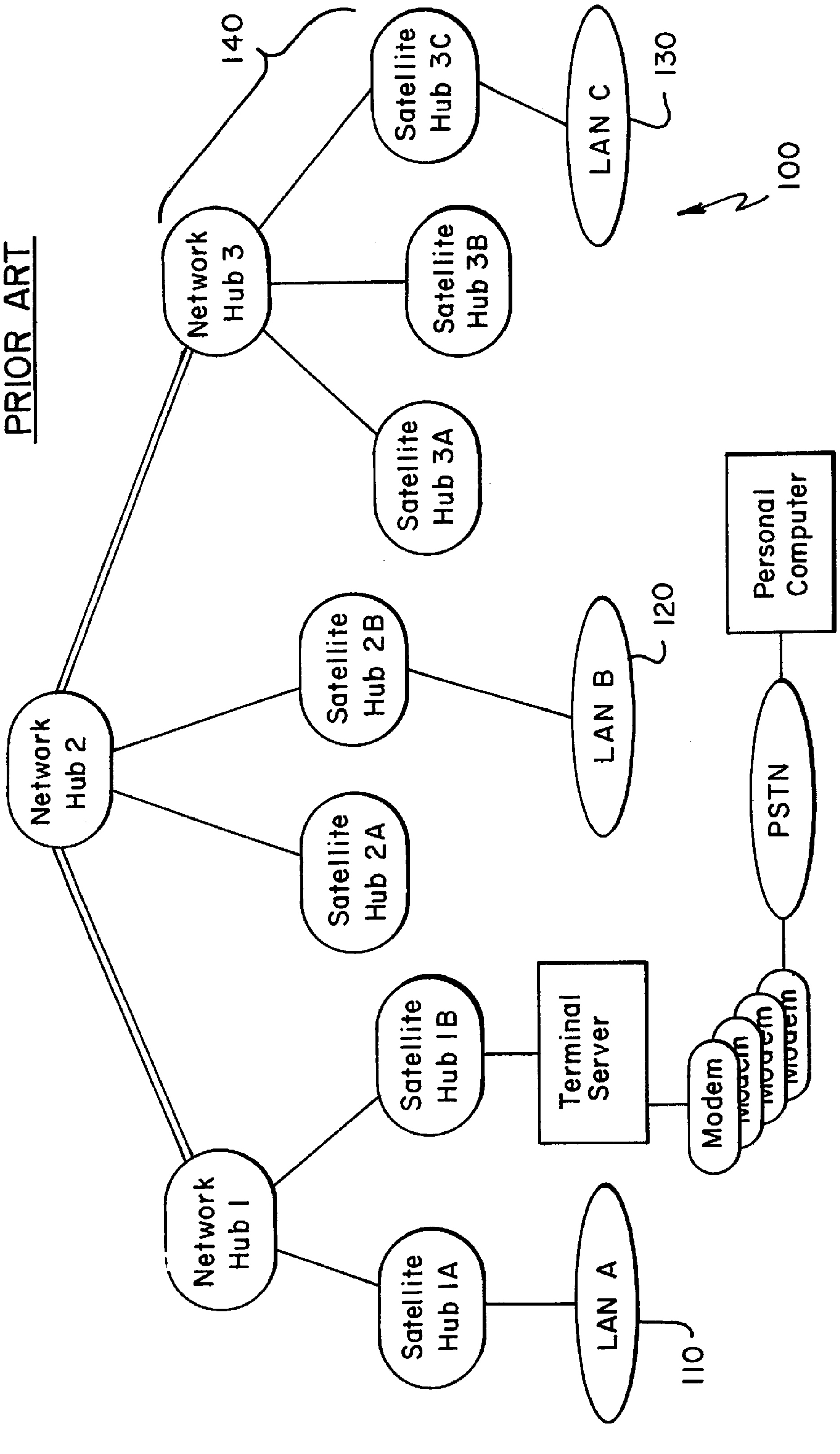


FIG. 2

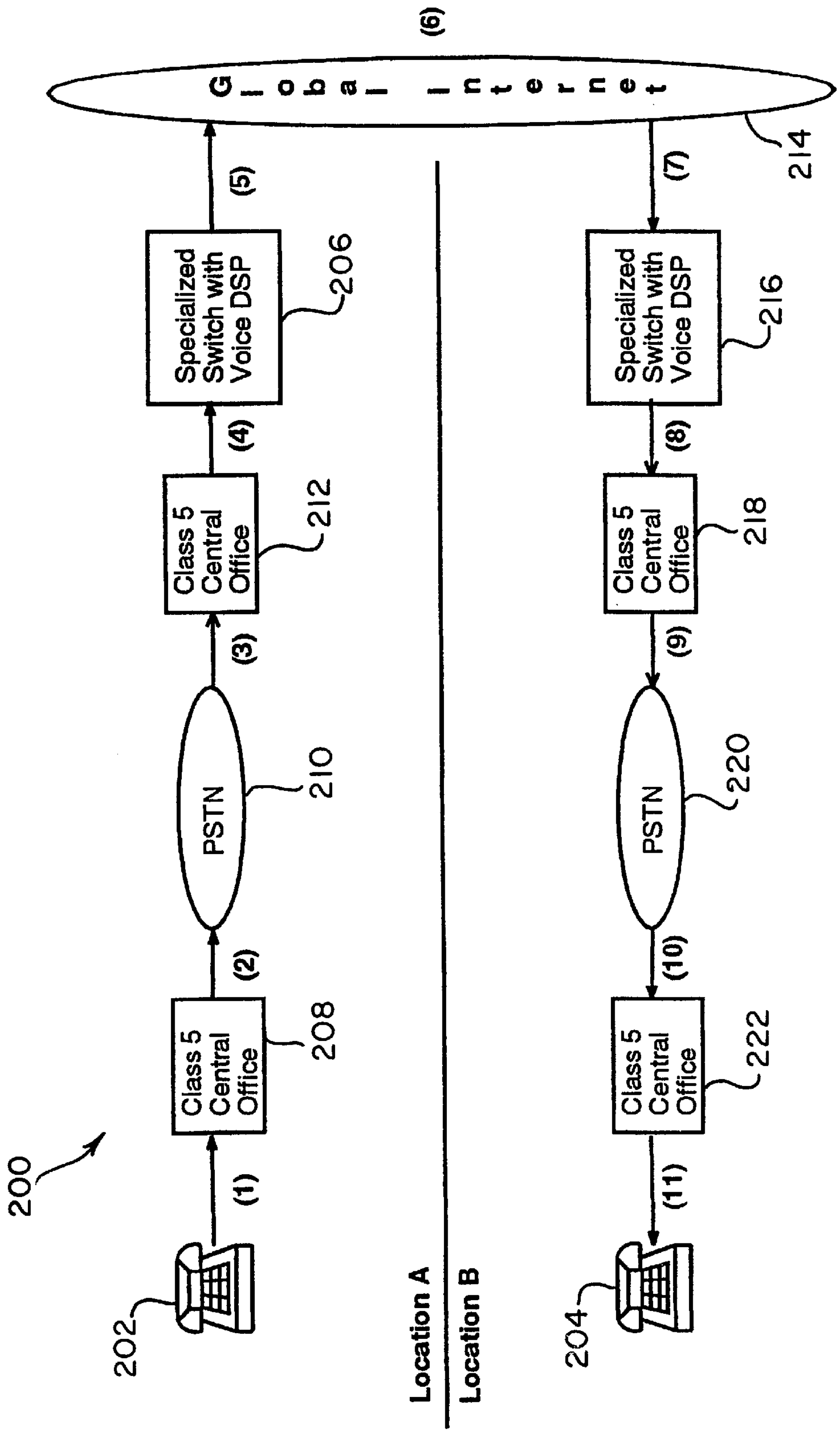
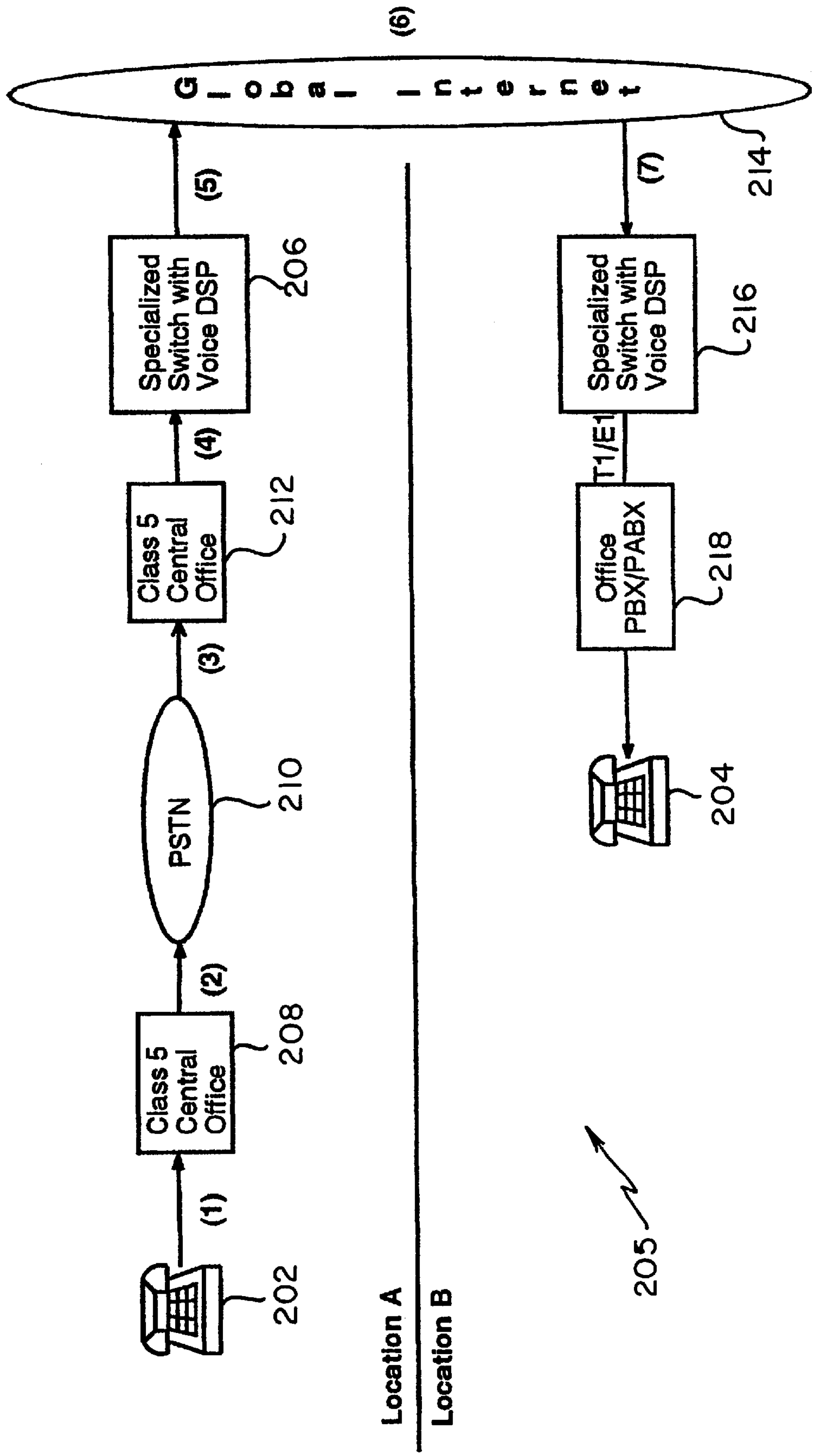
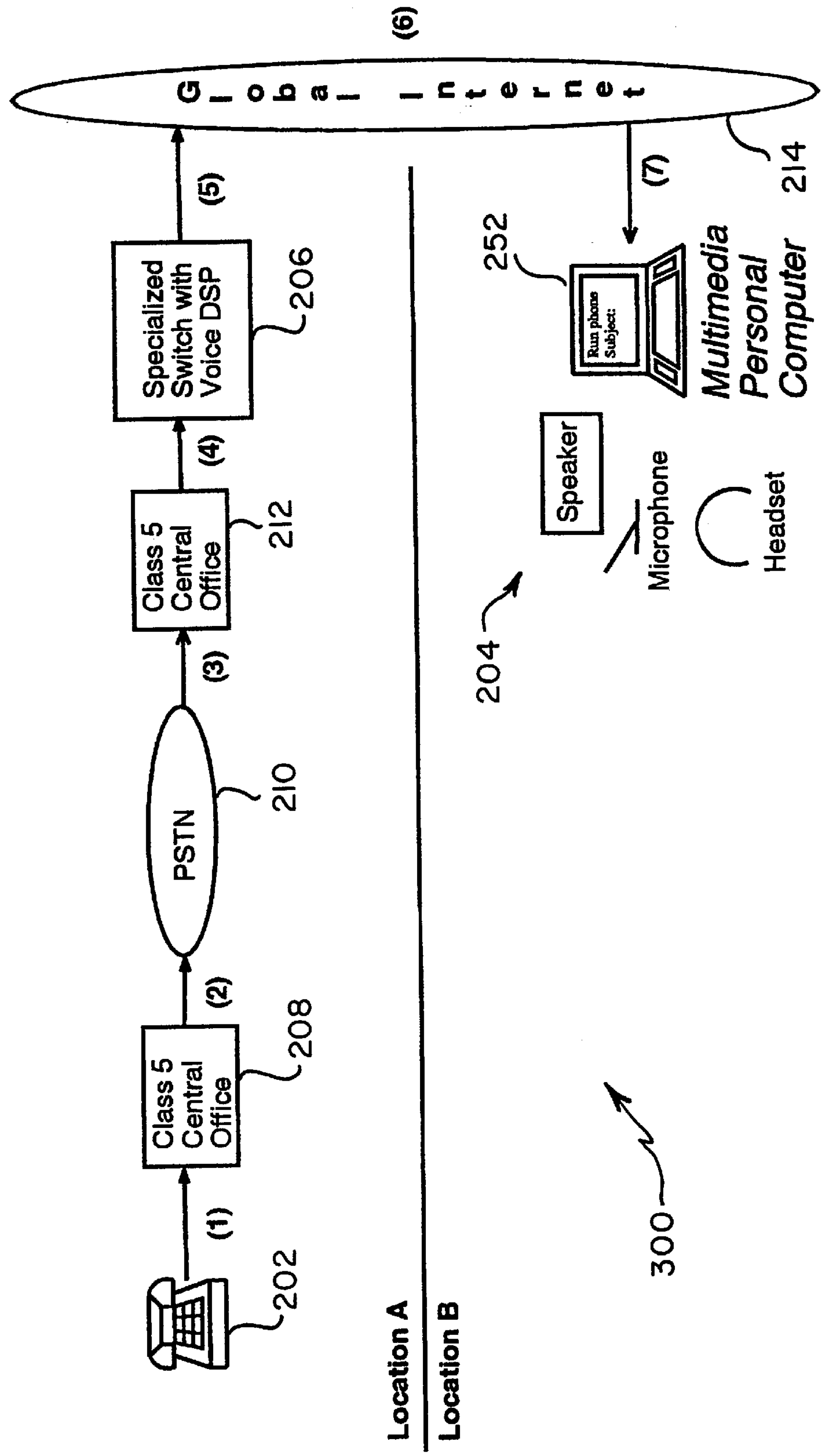

200
202
(1)
Class 5 Central Office
208
(2)
PSTN
210
(3)
Class 5 Central Office
212
(4)
Specialized Switch with Voice DSP
206
(5)
(6)
Global Internet
214
(7)
Specialized Switch with Voice DSP
216
(8)
Class 5 Central Office
218
(9)
PSTN
220
(10)
Class 5 Central Office
222
(11)
204
Location A
Location B

FIG. 3



Global Internet
(6)
214
(5)
Specialized Switch with Voice DSP
206
(4)
Class 5 Central Office
212
(3)
PSTN
210
(2)
Class 5 Central Office
208
(1)
202
Location A
Location B
(7)
Specialized Switch with Voice DSP
216
T1/E1
Office PBX/PABX
218
204
205

FIG. 4



Global Internet
(6)
214
(5)
Specialized Switch with Voice DSP
206
(4)
Class 5 Central Office
212
(3)
PSTN
210
(2)
Class 5 Central Office
208
(1)
202
Location A
Location B
(7)
252
Run phone
Subject:
Multimedia Personal Computer
Speaker
Microphone
Headset
204
300

FIG. 5

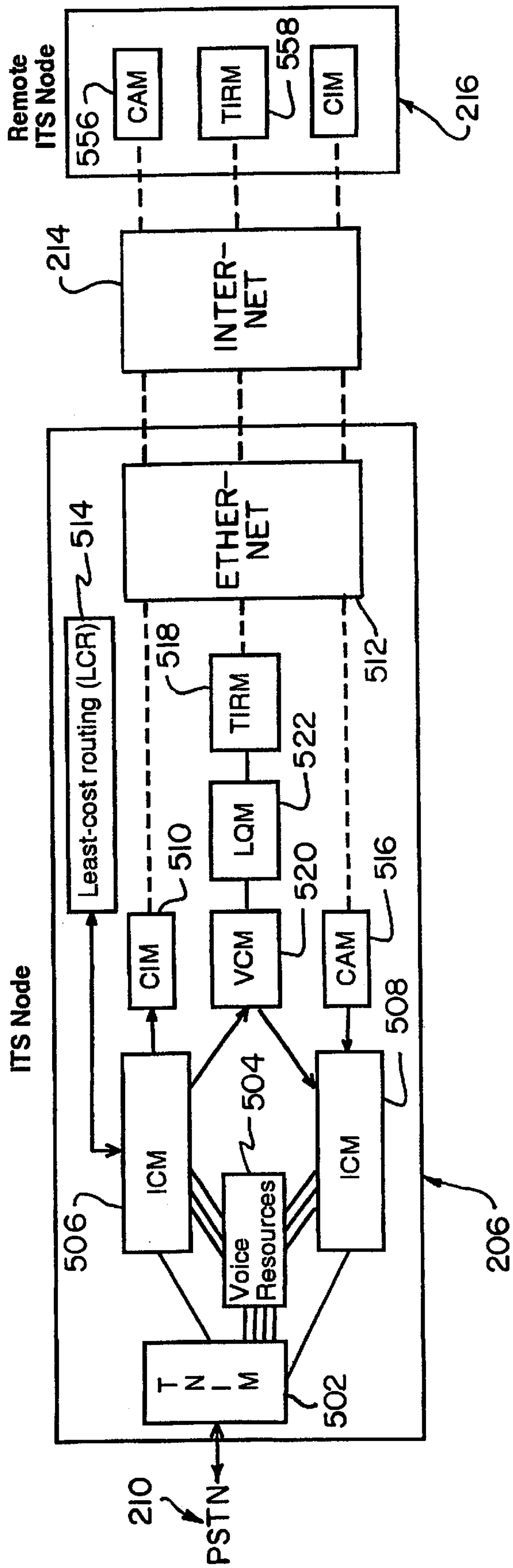

Remote ITS Node
CAM
TIRM
CIM
556
558
216
INTER-NET
214
ITS Node
Least-cost routing (LCR)
514
ETHER-NET
512
518
TIRM
522
LQM
520
510
516
CIM
VCM
CAM
508
ICM
504
ICM
Voice Resources
506
206
TNIM
502
210
PSTN

FIG. 6A

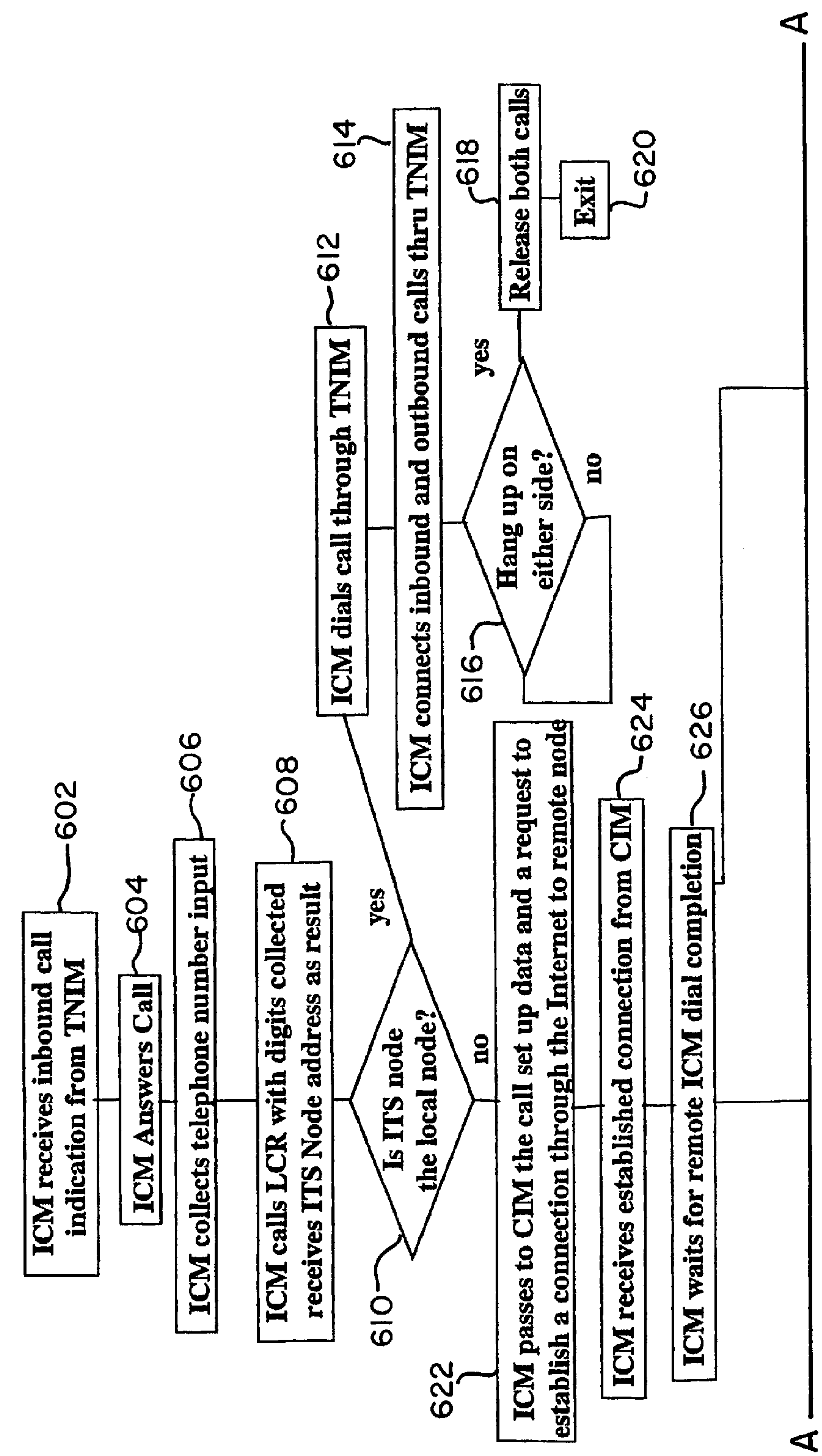

ICM receives inbound call indication from TNIM
602
ICM Answers Call
604
ICM collects telephone number input
606
ICM calls LCR with digits collected receives ITS Node address as result
608
Is ITS node the local node?
610
yes
no
ICM dials call through TNIM
612
ICM connects inbound and outbound calls thru TNIM
614
Hang up on either side?
616
yes
no
Release both calls
618
Exit
620
ICM passes to CIM the call set up data and a request to establish a connection through the Internet to remote node
622
ICM receives established connection from CIM
624
ICM waits for remote ICM dial completion
626
A
A

FIG. 6B

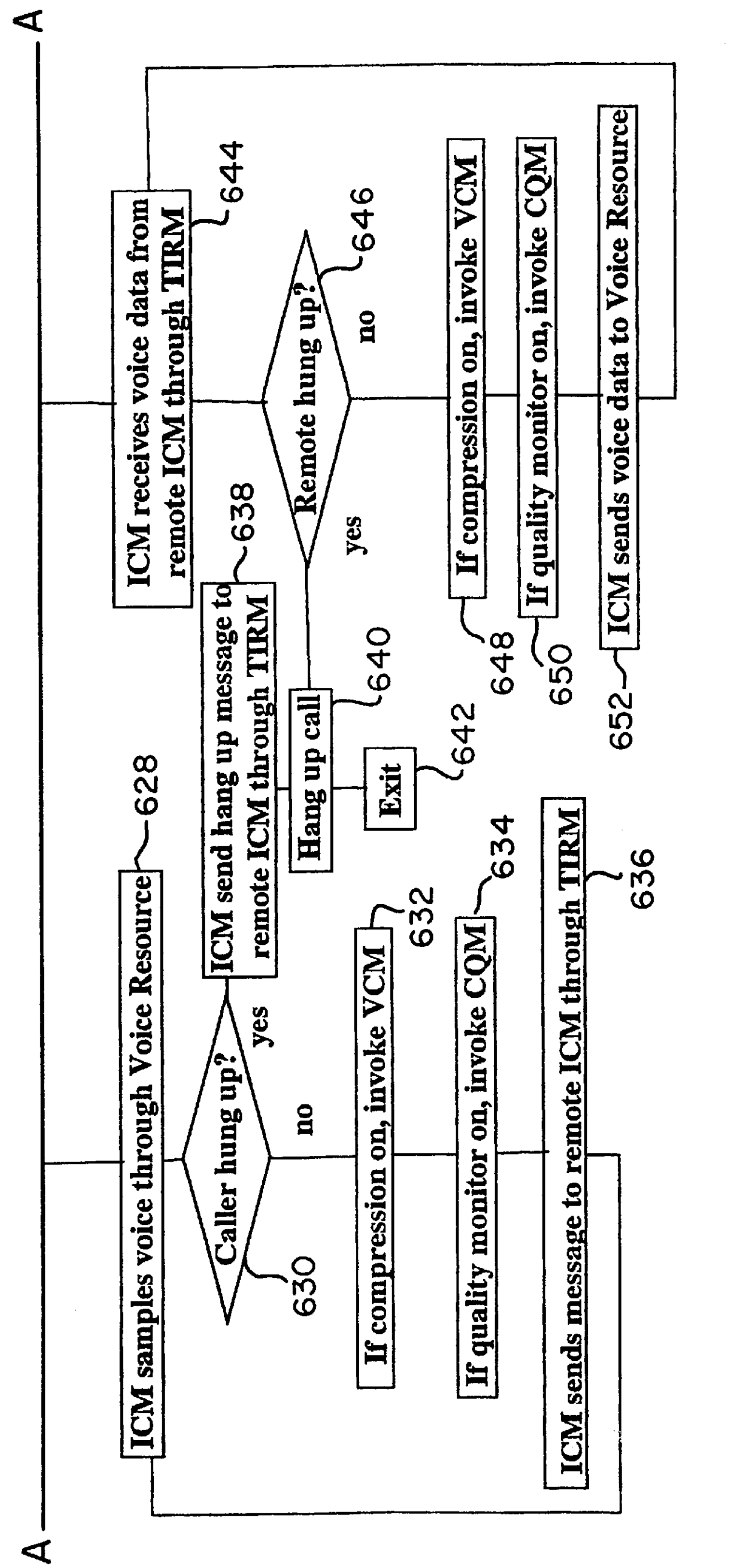

A
ICM samples voice through Voice Resource
628
Caller hung up?
630
yes
no
ICM send hang up message to remote ICM through TIRM
638
Hang up call
640
Exit
642
If compression on, invoke VCM
632
If quality monitor on, invoke CQM
634
ICM sends message to remote ICM through TIRM
636
ICM receives voice data from remote ICM through TIRM
644
Remote hung up?
646
yes
no
If compression on, invoke VCM
648
If quality monitor on, invoke CQM
650
ICM sends voice data to Voice Resource
652
A

FIG. 7

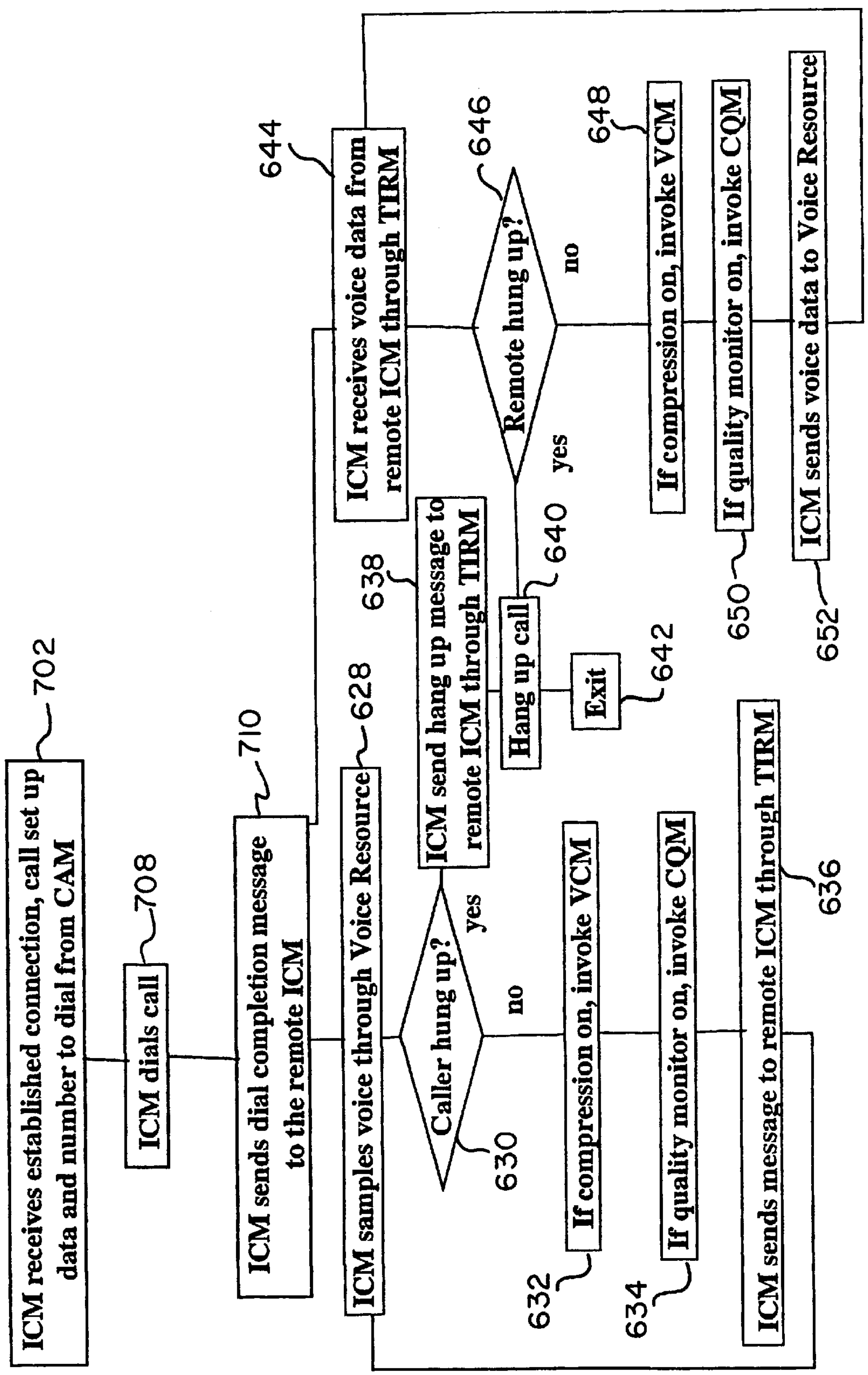

ICM receives established connection, call set up data and number to dial from CAM
702
ICM dials call
708
ICM sends dial completion message to the remote ICM
710
ICM samples voice through Voice Resource
628
Caller hung up?
630
yes
no
ICM send hang up message to remote ICM through TIRM
638
Hang up call
640
Exit
642
If compression on, invoke VCM
632
If quality monitor on, invoke CQM
634
ICM sends message to remote ICM through TIRM
636
ICM receives voice data from remote ICM through TIRM
644
Remote hung up?
646
yes
no
If compression on, invoke VCM
648
If quality monitor on, invoke CQM
650
ICM sends voice data to Voice Resource
652

FIG. 8

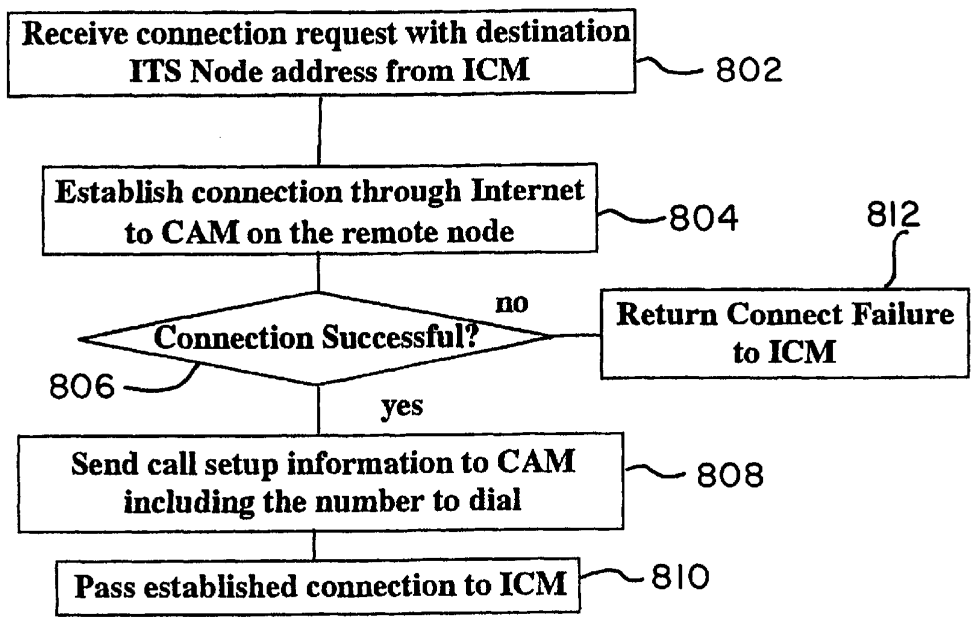

Receive connection request with destination ITS Node address from ICM
802
Establish connection through Internet to CAM on the remote node
804
812
no
Return Connect Failure to ICM
Connection Successful?
806
yes
Send call setup information to CAM including the number to dial
808
Pass established connection to ICM
810

FIG. 9

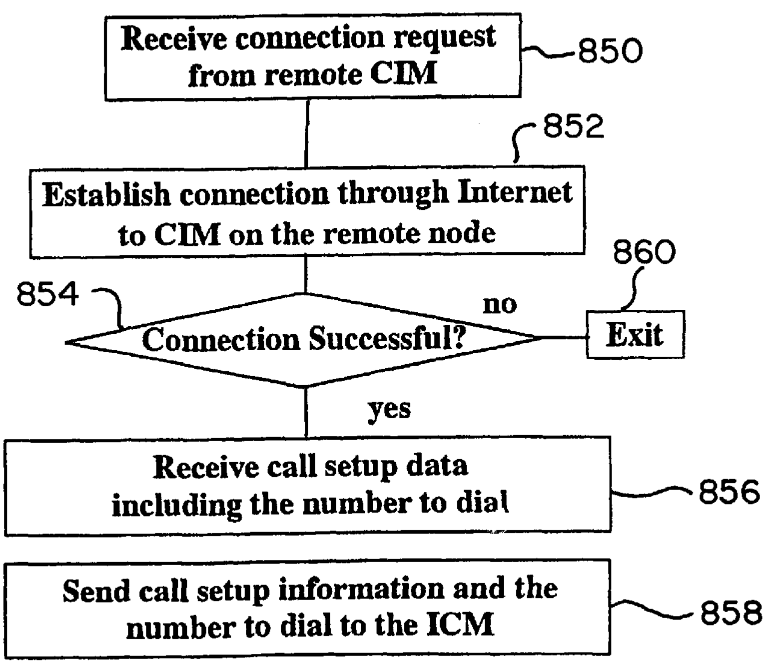
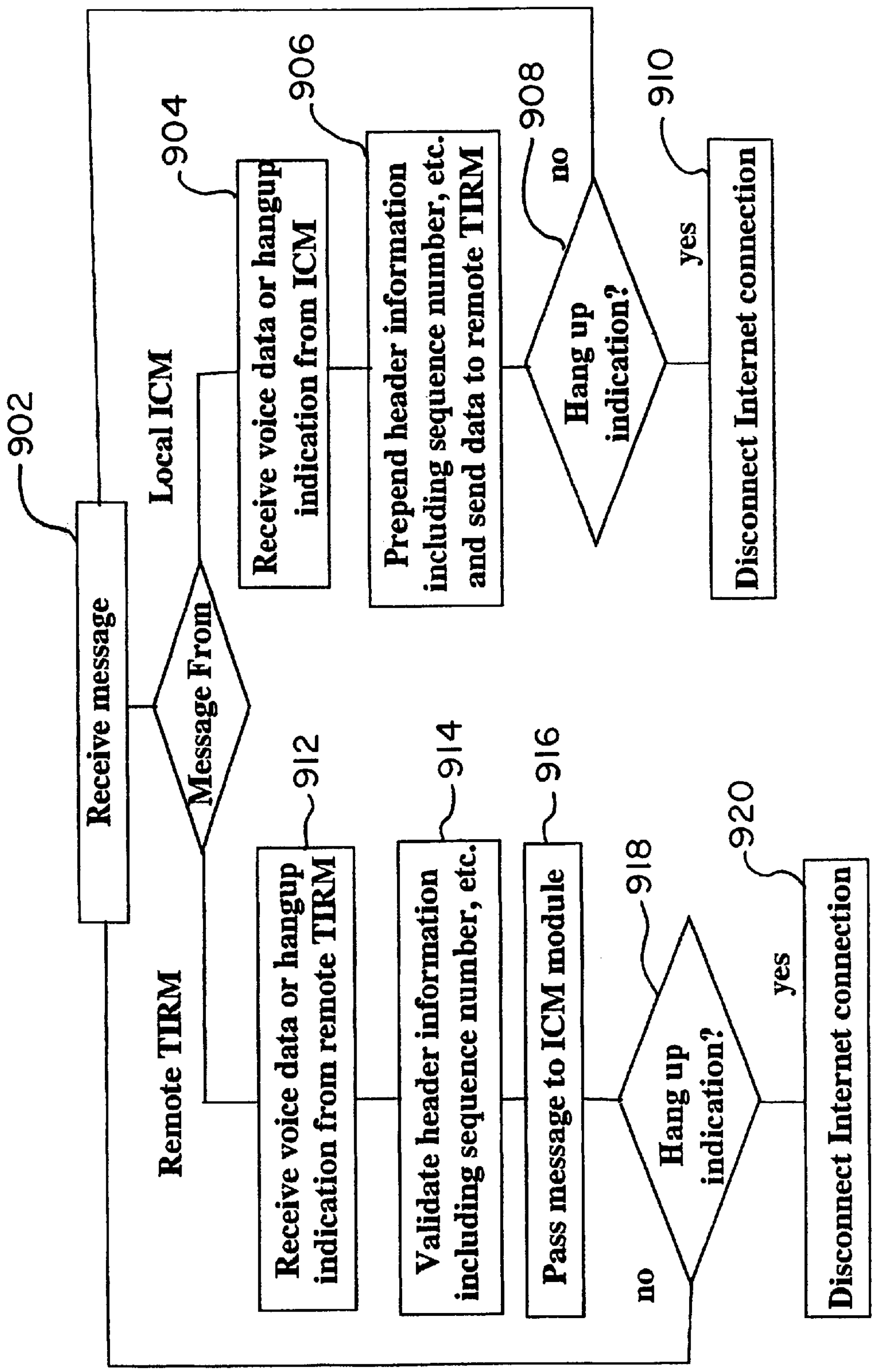

Receive connection request from remote CIM
850
852
Establish connection through Internet to CIM on the remote node
860
854
no
Connection Successful?
Exit
yes
Receive call setup data including the number to dial
856
Send call setup information and the number to dial to the ICM
858

FIG. 10



902
Receive message
Message From
Local ICM
904
Receive voice data or hangup indication from ICM
906
Prepend header information including sequence number, etc. and send data to remote TIRM
908
Hang up indication?
no
yes
910
Disconnect Internet connection
Remote TIRM
912
Receive voice data or hangup indication from remote TIRM
914
Validate header information including sequence number, etc.
916
Pass message to ICM module
918
Hang up indication?
no
yes
920
Disconnect Internet connection

METHOD AND APPARATUS FOR IMPLEMENTING A COMPUTER NETWORK/ INTERNET TELEPHONE SYSTEM

FIELD OF THE INVENTION

The present invention generally relates to the field of telecommunications. More specifically, the present invention concerns a method and apparatus for transmitting telephone calls to or from a standard telephone set using a computer network such as the Internet.

BACKGROUND OF THE INVENTION

Communication systems for transmitting telephone calls have become an integral, indispensable part of everyday life. The first roots of telephony were planted in 1876 with the invention of the first practical telephone by Alexander Graham Bell. As the number of calling stations or customer lines (telephones) in the system began to grow, the wiring system interconnecting the telephones became extremely complicated and unwieldy. One solution to this problem was the introduction of switching systems. Each customer line terminated in a local switching system commonly referred to as a central office (CO). The central office then performed the task of connecting each of the telephone lines it served to a corresponding telephone line in order to complete a call. If the two parties to a call were serviced by the same central office, then the connection could be completed by the same central office without having to resort to other portions of the telecommunications network. If the call required connection to a telephone line serviced by a distant central office, then a connection between the central offices was carried out using a trunk, i.e., a connection between two central offices.

As the number of central offices increased, higher level switching was required to perform the interconnections between central offices. Essentially, each central office was treated as a line to a higher level switching system for switching traffic between the central offices. In this manner, a call from a first subscriber at one location to a second subscriber at a distant location is routed from the first subscriber to the central office servicing the first subscriber. The call is then routed from the first subscriber's central office to a higher level switching office and on to the second subscriber's central office. From the second subscriber's central office, the call is finally routed to the second subscriber.

Each switching system or central office includes equipment for providing signalling, control and switching functions. The signalling equipment monitors the activity of the various lines connected to the central office and forwards control information associated with each line to the control equipment. The control equipment receives the control information and establishes the appropriate connections by way of the switching equipment. The switching equipment is functionally a crosspoint matrix for completing connections between selected input lines and selected output lines. Prior to the introduction of digital switching systems, a number of crossbar switches were used to implement the crosspoint matrix. More recently, digital switching systems, such as the AT&T 5ESS, have been used in place of mechanical or electromechanical switching systems. The essentials of digital telephone switching systems, as well as digital telephony in general, are described in John Bellamy, *Digital Telephony* (John Wiley & Sons 1991), the contents of which are incorporated herein by reference.

Recently, the volume of telephone traffic between central offices has been growing more rapidly than local telephone traffic. As a result, so called "T-carriers" have evolved as a cost efficient method of transmission between central offices. T-carriers, such as T1, T1C, T1D, T2, T3 and T4, are all digital carriers which require the conversion of analog telephone signals into digital format before they are transmitted over the carrier to the remote end. The most common type of T-carrier is the T1, and as such will be used in the present specification. At the remote end, the digital signals are converted back into analog format and routed through the telephone system. The transmission of digital signals over the T1 carrier may be accomplished using time division multiplexing (TDM) wherein a high bandwidth communications link, such as a 1.544 Mbit/S T1 carrier, is divided into a number of lower bandwidth communication channels, such as 64 Kbit/S channels. Each 64 Kbit channel is assigned a time slot of the T1 carrier. In this way, the high bandwidth T1 carrier is periodically available for a restricted portion of time, enough for each channel to transmit at an effective rate of 64 Kbit/S.

Telephone customers are charged for their usage of the telephone network, with such charges typically being proportional to the amount of time used and the distance from the calling party to the called party. Thus, calls placed over long distances will usually cost more than calls placed over shorter distances. Additionally, local calls which do not involve higher level switching or routing within the system are oftentimes charged at a flat rate independent of the actual customer usage. To a lesser extent, flat rate charges may be established for long distance calls. This may be accomplished by way of a "leased line" wherein the customer leases a dedicated communications link from one location to another. For a fixed fee, the customer is able to place calls between the two locations. The number of calls the customer is able to place is then limited by the bandwidth of the leased line or communications link.

Another type of flat rate service is Wide Area Telephone Service (WATS) wherein a customer selects a certain geographic area for either receiving or transmitting calls. A flat rate is charged for this type of telephone service, depending on the size of the selected area and whether full time WATS service or measured time WATS service, i.e., a certain number of hours per month, is selected.

For the average customer, WATS service or leased line service is economically impractical, since such services are only cost effective for high volume users such as corporations and other institutions. Thus, the average customer is relegated to paying for telephone service on a per minute or per usage basis and is not able to enjoy the benefits of flat rate telephone usage.

An alternative to telephone communication is data communication using computer technology. One way of data communication between computers is by way of modem. Specifically, a modem is used to transmit information or data from one computer to another computer similarly equipped with a modem. However, the transmission medium for modem communication is again the telephone network. Thus, there is effectively no real economic benefit. More recently, as the number of computers in use has increased, computer networks have been used to interconnect large numbers of computers in order to provide data communication. Although access to the computer networks is by way of the telephone system, the access point to the computer network for most users is often a local call which is usually charged at a flat rate. The interconnection and routing of data once it has reached the computer network is typically by way of lower cost lines, such as leased lines, since there is now sufficient traffic to justify the cost associated with a leased line.

The Internet computer network in use today had its beginnings more than twenty years ago as a government project. Originally, the computer network was referred to as ARPANET (Advanced Research Projects Agency Network) and was constructed by identifying a small group of locations or cites across the United States that would function as network hubs. Each hub was directly connected to each other hub over a dedicated leased line running at 56 Kbps. In this way, all the sites were connected to each other by way of high speed carriers and locally connected using the local telephone network to other terminal sites not having a direct connection to any other site. The resulting configuration was in effect, a national computer network.

As the network expanded, there was a significant increase in the number of additional terminal sites locally connected to a network site, which site was itself interconnected to other sites. The number of major hubs remained relatively constant while the terminal sites connected to them began to function as intermediate satellites for providing network access to other sites. In effect, a "tree" type network evolved. Moreover, connections to countries other than the United States were established, thereby creating an international or world wide network. As the size of the network increased, the amount of data traffic also increased. This increase in traffic was the impetus for an increase in the bandwidth or capacity of the communications medium interconnecting the various hubs of the network. Today, in order to accommodate the increased traffic, fiber optic links are the primary communications link for most, if not all, of the interconnections among the network hubs. Satellite locations interface to the hubs primarily via fiber optic or T1 telephone link. Similarly, end users connected to the satellite locations are connected by way of modems or T1 lines. Currently, network control and operation is primarily administered by private or commercial organizations, as opposed to direct government involvement.

FIG. **1** illustrates a typical segment **100** of the Internet network topology. Each individual connection to the Internet is made through a router (not shown), such as part no. Cisco 4000 available from Cisco of Menlo Park, Calif. or part no. 8230 available from NewBridge of Herndon, Va. The router insulates local area networks (LAN) at specific sites from the numerous data packets being sent across the Internet which are of no interest to the particular LAN. For example, if a connection is established over the Internet from LAN **110** to LAN **120**, any information exchanged between LAN **110** and LAN **120** is probably of no interest to LAN **130**. The router thus prevents such information from reaching LAN **130**. Conversely, if LAN **120** desires to transmit information to LAN **130**, the router is sufficiently intelligent to allow this information to reach LAN **130** by way of the LAN **140** to which LAN **130** is connected.

The communications protocols used by computers on the Internet to communicate information include TCP (Transmission Control Protocol) and UDP (User Datagram Protocol). TCP is a connection-oriented protocol that provides a reliable data path between two communicating entities. In contrast, UDP is a connectionless protocol that does not guarantee delivery of messages. Although messages are typically delivered successfully in UDP, this may not be the case in the event of network failure or congestion. Both the TCP and UDP protocols are built on top of a lower layer protocol known as the IP (Internet Protocol). IP is used to format and route TCP and UDP messages. TCP/IP and UDP/IP have become worldwide de facto standards for interprocess communication and provide the underlying transport mechanism in use on the Internet. A detailed description of the principles and protocol of TCP/IP communication is set forth in Douglas E. Comer, *Internetworking with TCP/IP Volume 1 Principle Protocols and Architecture*, (Prentice Hall 1991).

Computer networks such as the Internet, which are capable of transmitting generic data or information between locations, have been used to transmit audio information between computers. At the transmitting computer, a person's voice may be digitized using an analog to digital (A/D) converter and transmitted to the receiving location where it is passed through a digital to analog (DIA) converter and presented as audio. This type of audio connectivity is arguably similar to flat rate telephony, in that audio information may be transmitted from one location to another by way of a high bandwidth, flat rate communications medium. However, this type of computer telephony system suffers from several major disadvantages. First, the system is limited to only those customers who have access to the Internet. While Internet access has now widely proliferated, it has not reached the near universal accessibility of POTS ("Plain Old Telephone Service") service. Such a system is utterly useless if it is desired to communicate with someone who does not have access to the Internet.

Second, such systems provide only half duplex communication, viz., that information can only be transmitted in one direction at any given point in time. There is no simultaneous, two way transfer of information. Third, user access to such a system is only by way of a computer, which is still significantly more expensive than a telephone. Fourth, user access is extremely inconvenient in comparison with corded, cordless, portable, mobile or cellular telephones, in that access may only be provided at a location where a computer is physically located. Fifth, communication with a particular individual may only be made by addressing the information to their computer network address, not to their standard telephone number.

While attempts have been made to remedy some of these deficiencies, the resulting systems are still inadequate. For example, the "Internet Phone" device available from VocalTec of Northvale, N.J., is a computer-based Windows device which provides full duplex audio connectivity across the Internet. However, the system is extremely cumbersome and impractical to use and also suffers from several disadvantages. Specifically, the Internet Phone does not use standard telephone numbers to address individuals; it requires a computer at both transmitting and receiving ends; and both transmitting and receiving locations must call in to establish a connection between the two parties. More important however, the system does not allow spontaneous communication since the communication sessions must be scheduled in advance. Each potential receiving end must state their time availability and specify a computer or machine location where they may be reached.

OBJECTS OF THE INVENTION

It is an object of the present invention to provide a method and apparatus capable of efficiently communicating audio information over a computer network.

It is an object of the present invention to provide a method and apparatus capable of efficiently communicating audio information over a computer network which is able to transmit the information at essentially a flat rate or charge.

It is an additional object of the present invention to provide a method and apparatus capable of communicating audio information over a computer network between users who do not have direct access to the computer network.

It is a further object of the present invention to provide a method and apparatus capable of communicating audio information over a computer network in full duplex format.

It is yet another object of the present invention to provide a method and apparatus capable of communicating audio information over a computer network without requiring the use of a computer at the user location.

It is an additional object of the present invention to provide a method and apparatus capable of communicating audio information over a computer network without requiring that the user be located at a computer location.

It is a further object of the present invention to provide a method and apparatus capable of communicating audio information over a computer network using standard user telephone numbers to direct the information transmitted.

SUMMARY OF THE INVENTION

According to the present invention, a novel method and apparatus are provided for communicating audio information over a computer network. The present invention allows anyone with a standard telephone connected to the public switched telephone network (PSTN) to communicate with any other telephone, using a computer network, such as the Internet, as the transmission facility in lieu of conventional telephone transmission facilities, such as the interexchange or intralata facilities.

In using an illustrative embodiment of the present, invention, the originator of a conversation (calling party) dials the number of an access port of the present system. The call is routed to a central office switching system which is connected to the PSTN. When the connection to the access port is established, a specialized computer system (ITS node) at the access port signals the user to transmit the number of the party that is to be called (the called party). The specialized computer system (ITS node) interfaces between the telephone switching system and a computer network, such as the Internet. The specialized computer system (ITS node) receives the number of the called party and establishes a two-way, full duplex communications link via the computer network to a corresponding specialized computer system (ITS node) at an access port in the vicinity of the called party. This specialized computer system (ITS node) at the receiving end is connected to the local PSTN in the region of the called party, and uses the local PSTN to connect the call to the called party. Once the call is answered at the called party, the calling and called party may communicate as if the call had been established using the conventional telephone system.

Since the access ports are connected over the computer network, even if the call is over long distances, the user would only have to pay for the local calls to the access ports, as well as the reduced or flat rate cost for use of the computer network.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the invention discussed in the above brief explanation will be more clearly understood when taken together with the following detailed description of an embodiment which will be understood as being illustrative only, and the accompanying drawings reflecting aspects of that embodiment, in which:

FIG. **1** is a block diagram of a prior art Internet computer network topology;

FIG. **2** is a block diagram of a computer network telephone transmission system according to the present invention illustrating telephone to telephone communication;

FIG. **3** is a block diagram of an alternative embodiment of the computer network telephone transmission system according to the present invention illustrating telephone to telephone communication;

FIG. **4** is a block diagram of an alternative embodiment of the computer network telephone transmission system according to the present invention illustrating telephone to computer communication;

FIG. **5** is a block diagram of a specialized computer system (ITS node) according to the present invention which interfaces the PSTN to a computer network;

FIG. **6** is a flowchart illustrating the inbound call operation of the specialized computer system (ITS node) of FIG. **5**;

FIG. **7** is a flowchart illustrating the outbound call operation of the specialized computer system (ITS node) of FIG. **5**;

FIG. **8** is a flowchart illustrating the operation of the Call Initiation Module (CIM);

FIG. **9** is a flowchart illustrating the operation of the Call Acceptance Module (CAM); and

FIG. **10** is a flowchart illustrating the operation of the Telephony Internet Router Module (TIRM).

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The overall operation of the present invention will first be described with reference to FIG. **2**. FIG. **2** is a block diagram of a computer network telephone transmission system according to the present invention illustrating telephone to telephone communication. As shown in FIG. **2**, computer network telephone transmission system **200** is used to provide telephone service between calling station **202** and called station **204**. Initially, the user at the calling station dials the number of the specialized computer ITS node **206** at an Internet access port. The local switching office **208** routes the call through PSTN **210** to central office **212** which services specialized computer ITS node **206**. At this point, a call has been established by way of PSTN **210** between the calling station **202** and the specialized computer ITS node **206**.

Specialized computer ITS node **206** prompts the user at the calling station **202** to provide the telephone number of the desired or called aty **204**. Based on the telephone number of the called party **204**, specialized computer ITS node **206** provides a communication link to the called party **204**. This is accomplished by the specialized computer ITS node **206** initiating a series of signalling messages over the Global Internet **214** using the TCP/IP protocol. While the specific embodiment of the present invention shown in FIG. **2** and discussed herein is described as using the Internet, it should be understood that the present invention may be used with any computer network in general. Additionally, specialized computer ITS node **206** can use either TCP/IP or UDP/IP to communicate voice data over the Internet. An advantage to using UDP/IP is that this protocol requires less transmission overhead resulting in faster data transmission. Due to the real-time nature of a telephone call, it is not worthwhile to attempt to redeliver messages initially returned as undeliverable. This is because subsequent messages continually flow and need to be delivered in order to maintain the real-time aspect and flow of the call. It is practically of no use to deliver message portions shifted in time.

The signalling messages are carried by the Internet **214** and delivered to a terminating specialized computer ITS node **216** at a remote access port. Terminating specialized computer ITS node **216** is identical to specialized computer **206**, also referred to as the originating specialized computer ITS node, except that the originating specialized computer ITS node **206** is used to transmit a call, while the terminating specialized computer ITS node **216** is used to receive a call. Both originating and terminating specialized computers ITS node **206** and **216**, respectively, are equipped with transmission circuits and receiving circuits and are capable of handling calls in either direction.

Terminating specialized computer ITS node **216** outdials a call through central office **218** to which it is connected. Central office **218** in turn, routes the call through PSTN **220** to central office **222** which services the called party **204**. The telephone at the called party **204** is rung by central office **222** and a communications link between calling party **202** and called party **204** is established.

In an alternative embodiment according to the present invention shown as **250** in FIG. **3**, the need for dialing the telephone' number of the specialized switch and then transmitting the telephone number of the called party **204** may be eliminated, by combining this operation into one step. Essentially, in this embodiment, specialized computer ITS node **216** connects directly to a central office or a private branch exchange (PBX) **218**. In this situation, if the calling party is located at **204**, which is directly connected to specialized computer ITS node by way of PBX **218**, then the calling party at **204** need only dial the telephone number of the called party located at **202**, since all calls originating from the central office or PBX **218** are routed directly to specialized computer ITS node **216**. There is no need to access specialized computer ITS node **216** by way of a PSTN. Of course, calls placed at location **202** must still first dial the telephone number of specialized switch **206**, as described above.

A further alternative embodiment according to the present invention shown as **300** in FIG. **4** allows for computer to telephone communication via Internet **214**. In this situation, the telephone number of called party **204** corresponds to the telephone number associated with computer **252**. In this situation, specialized computer ITS node **206** must know that the called party is a computer so that it does not direct the Internet call to an Internet access port in the vicinity of computer **252**.

Referring now to FIG. **5**, therein is shown a block diagram of the specialized computer ITS node **206** at the Internet access port, also referred to as the Internet telephony switch (ITS) which is used for placing a call. Also shown is terminating specialized computer ITS node **216**, also referred to as the Remote ITS Node used for receiving a call. ITS Node **206** interfaces to the PSTN **210** using Telephone Network Interface Module (TNIM) **502**. TNIM **502** receives calls from the PSTN **210** and answers those calls under the control of Internet Call Manager or ICM **506**. The calls received from PSTN **210** are actually outgoing calls that are to be routed through the Internet. The calls received from PSTN **210** are routed to an ICM **506** (discussed in more detail below) for routing over the Internet. When ITS Node **206** serves as a terminating specialized computer ITS node, TNIM **502** is used to place outbound calls on PSTN **210** in order to service incoming calls received over the Internet. TNIM **502** may be implemented using a Dialogic Digital Telephony Interface DTI/211 T-1 Network Interface Board available from Dialogic Corporation of Parsippany, N.J., running the appropriate software to carry out the described functions. The Dialogic DTI/211 is described in Dialogic Products and Services Guide 12.20, the contents of which are incorporated herein by reference. The DTI/211 interfaces through a T1 connection (a DTI/212 may be used with an E1 connection) to a digital switch in a central office. Alternatively, an analog version of the DTI-211, i.e., the LSI120, may be used to interface to analog telephone lines. The DTI-211 provides the appropriate signalling required to communicate with the PSTN, e.g., G.711 signalling.

Within ITS Node **206**, TNIM **502** is connected to a Voice Resources module **504**. Voice Resources module **504** provides voice call processing, including DTMF (dual tone multifrequency) detection and generation, as well as coding of voice signals using either A-law or μ-law pulse coded modulation (PCM) into 64 Kbit/s data streams. The 64 Kbit/s data rate may be varied down to 24 Kbit/s using data compression. Voice Resources module **504** may be implemented using a Dialogic D/121B 12-Port Voice Processing Board available from Dialogic Corporation of Parsippany, N.J., running the appropriate software to carry out the described functions. The Dialogic D/121B is described in Dialogic Products and Services Guide 11.42, the contents of which are incorporated herein by reference. The D/121B provides the capability to store the digitized voice data received from the PSTN and to play it back out to the computer network. The D/121B includes programmable DSP units for storing and playing the digitized voice data. The D/121B also provides tone detection and generation used in telephone communication.

The D/121B is not provided with any specific telephone functionality per se. Rather, the D/121B communicates with the DTI/211 over a bus, such as the Dialogic SCbus (Signal Computing Bus). The SCbus allows voice data coming in from the PSTN, or to be transmitted out onto the PSTN, to pass from the D/121B to the DTI/211. Additionally, the SCbus may provide the functionality of a switch matrix in order to connect an inbound call from the PSTN directly to an outbound call to the PSTN in the event that it is more efficient to place the call entirely through the PSTN rather than through the computer network.

Voice Resources module **504** interfaces to two separate Internet Call Managers (ICM) **506** and **508**. Internet Call Manager **506** is used to process outgoing calls, i.e., those calls received from PSTN **210** and which are to be routed via the Internet to a called party. Conversely, Internet Call Manager **508** is used to process incoming calls from the Internet, i.e., those calls which originated at a remote site and were routed through the Internet and are to be connected to a called party by way of TNIM**502** and PSTN **210**. An ICM may be implemented in hardware, software or a combination of both. In either event, the ICM function needs to be performed for each call which is being processed. If the ICM is being implemented in software, then an instance of the ICM must be created for each call. Alternatively, the ICM may be capable of handling multiple time slots and thus capable of simultaneously handling multiple calls. Similarly, if the ICM is being implemented in hardware, then a sufficient number of ICM modules should be provided to handle a desired volume of call traffic based on statistical usage. The ICM utilizes the digital signal processing (DSP) of the Voice Resources module to sample the incoming voice data stream and convert it to messages or packets which are then transmitted over the Internet. Each of ICMs **506** and **508** is directly connected to TNIM **502** for communicating call signalling information. The actual voice data is communicated between TNIM **502** and Voice Resources module **504** and then between Voice Resources module **504** and ICM **506** or **508**.

Internet Call Manager **506** accepts calls from TNIM **502** and prompts the calling party for the telephone number of the called party it is desired to reach. Internet Call Manager **506** then passes this information to Connection Initiation Module (CIM) **510**, which in turn establishes a data connection over Internet **214** and negotiates the various call setup and establishment parameters. Once the Internet data call is established by CIM **510**, the data stream for the voice call is passed through an appropriate Ethernet interface **512** for transmission to Internet **214**.

In order to establish the call, CIM **510** communicates with a Call Acceptance Module (CAM) **556** associated with the Remote ITS Node at the receiving end. During this call negotiation and set up phase, CIM **510** and CAM **556** exchange parameters such as the destination telephone number to be dialed, and whether or not the packetized voice data stream is to be filtered through the Voice Compander Module (discussed below) and/or the Line Quality Module (discussed below) before being transmitted over Internet **214**. In addition, the particular protocol used for the data transmission between ITS Node **206** and ITS Node **216** is established. The data transmission protocol is typically either TCP/IP or UDP/IP, since these are the primary protocols supported by Internet **214**. Once the initial call setup parameters have been exchanged between ITS Nodes **206** and **216**, ICM **506** waits for an indication from Remote ITS Node **216** that the destination telephone number has been dialed by Remote ITS Node **216**.

Before establishing an Internet voice connection, ITS Node **206** utilizes Least Cost Routing (LCR) module **514** in order to locate the ITS Node that can route the call at the receiving end in the most cost efficient manner. To perform this function, LCR **514** first matches the characteristics of the destination telephone number (called party telephone number) with data stored in a local database. This may be carried out using a hierarchical search to locate the ITS node in the region of the dialed telephone number. Thus, long distance numbers are detected by parsing out an initial "1" in the dialed number (similarly, a "011" would indicate an international call). Next, the area code is parsed to determine the geographical region. Continuing, the exchange numbers are parsed to determine the specific geographical region and the ITS node serving that region. In addition to or in place of the hierarchical search or matching, LCR **514** may include lists of specific telephone numbers and their associated ITS nodes. While this may be less efficient in general, it may be more efficient in specific situations, such as frequently dialed telephone numbers. After searching the database, LCR **514** indicates the optimal location of the receiving ITS Node for processing the particular call. Additionally, the above database may also include alternate ITS node information so that LCR **514** may also provide CIM **514** with the next most optimal ITS Node, and so on, so that if the optimal ITS Node is unavailable or cannot handle the call, CIM **510** can then attempt to place the call using the next most optimal receiving ITS Node.

Additionally, LCR **514** determines whether the destination telephone number may be dialed more efficiently (based on the cost of the call, node availability and other system parameters) through the PSTN. If the call can be placed more efficiently through the PSTN, LCR **514** indicates this to ICM **506**, which then dials the destination telephone number using PSTN **210** by way of TNIM **502**. The inbound PSTN call and the outbound PSTN call are then bridged together in a crosspoint switch matrix in the TNIM **502**. This situation may occur where both the calling and called parties are in the vicinity of the same ITS Node.

A full duplex voice path is established between ITS Node **206** and Remote ITS ode **216** over Internet **214** using Telephony Internet Router Module (IRM) **518** located at ITS Node **206**. When TIRM **518** is used in ITS Node **206** to place a call (as contrasted with receiving a call in Remote ITS Node **216**), TIRM **518** functions to capture and route the packetized voice data to a corresponding TIRM **558** located at Remote ITS Node **216**. Similarly, when a TIRM is used to receive calls, e.g., TIRM **558** located at Remote ITS Node **216**, it functions to receive the packetized voice data and direct it to an ICM to service the call. The ICM in turn sends the digital voice data to the TNIM. In turn, the TNIM converts the digital voice data into an analog audio signal to be transmitted by the PSTN to the called party. Alternatively, the digital data may be provided directly from the TNIM to the PSTN without conversion to analog in the event that the particular PSTN is capable of handling digital data.

Voice data continues to be exchanged between the two ITS Nodes **206** and **216** until either the calling or called party terminates the call. When a call is terminated, a supervisory signal is received by the TNIM and passed to the ICM at the ITS Node where the call termination was initiated. The ICM at the terminating location notifies the TIRM at the terminating location to "tear down" or disconnect the call connection. In order to "tear down" the connection, the TIRM at the terminating location (ITS Node) notifies the counterpart TIRM at the other ITS Node. The ICM at each location then frees up the voice processing DSP associated with the call, so that the DSP resources may be used for subsequent calls.

Additional voice call processing elements may be incorporated into each ITS Node in order to enhance the overall performance of the ITS Node. Specifically, a Voice Compander Module (VCM) **520** may be added to provide data compression and expansion functionality. Data compression is performed on the transmitted data stream in order to reduce the bandwidth required for transmission of the digitized voice data over the Internet. Similarly, when the received data stream over the Internet has been compressed, it must first be expanded before further processing.

Additionally, a Line Quality Monitor (LQM) **522** may be included in order to monitor line quality characteristics, such as echo and noise, and then to perform necessary filtering functions to reduce or eliminate such deleterious effects. Further, a Call Security Module may be included to encrypt the conversation in order to prevent electronic eavesdropping over the Internet.

When receiving a call, an ITS Node waits for another ITS Node to contact it using its TIRM and ICM and to request that a telephone call be initiated on behalf of a calling party who has dialed into the other ITS Node. Reception of the Internet voice call at Remote ITS Node **216** will now be described in detail using the receiver portion of ITS Node **206**. In an actual system, the receiving portion of ITS Node **216** would process a voice call received from the Internet.

A telephone call is initiated when the CIM of a Remote ITS Node sends a connection request to the CAM of the local ITS Node. When receiving a call from the Internet **214** via Ethernet interface **512**, the data stream associated with the particular call is first received by Connection Acceptance Module (CAM) **516**. Connection Acceptance Module **516** receives the call setup parameters associated with the particular call and passes the call on to Internet Call Manager **508**, which performs the reverse operation of Internet Call Manager **506**. Specifically, Internet Call Manager **508** receives the destination telephone number and places a call to the destination telephone number using the TNIM **502** and PSTN **210**. ICM **508** then transmits an acknowledgement or "call dialed" indication to the Remote ITS Node ICM.

Each ITS Node may be implemented using a Hewlett Packard HP 9000/743 Telepace platform. The Telepace platform acts as the central processor for coordinating the tasks carried out by the individual modules, e.g., TNIM and ICM. All of the hardware components of the ITS Node are interconnected by a signalling bus which enables call and voice resource routing as required. The particular bus used may be, for example, the Dialogic SCbus. Alternatively, a standard computer platform may be used to implement an ITS Node, both for single user and multiple call applications, depending on the particular hardware capabilities of the computer. In this situation, the Dialogic hardware may be used in a personal computer (instead of the HP Telepace platform) to provide multiple user service. This latter approach may be less efficient than using the HP Telepace platform; however, it may be more cost effective depending on the particular application. In yet another alternative configuration, an ITS node may be implemented using a computer equipped with a sound card capable of simultaneously sampling and playing speech, i.e., processing speech signals in both transmit and receive directions, as well as having a connection to the Internet. Alternatively, an ITS node may be implemented using a computer equipped with the appropriate DSP processing, e.g., in the form of a DSP chip, capable of performing the ITS functions discussed herein. In the computer implementations, a headset or microphone/speaker combination may be used for the user audio interface.

Voice resources module **504** (FIG. **5**) receives digitized voice data from the ICM and routes this data to the TNIM over the bus connecting these two modules, such as the Dialogic SCbus. This data is then transmitted by the TNIM out onto the PSTN using standard T1/E1 signalling. This is data which has been received from the remote ITS node. Similarly, the Voice resources module **504** receives digitized voice data originating from the PSTN by way of the TNIM. This data is then passed to the ICM for transmission over the computer network. The Voice resources module **504** also performs the necessary tone generation and detection, such as DTMF tones, used to dial the digits of a telephone number.

TNIM **502** monitors the time slots used for the various telephone lines. Each line is monitored for a number of events, including, a hang up by the calling or called party and inbound call notifications from the central office. The TNIM notifies the ICM upon the occurrence of any of these events. Also, the TNIM processes requests from the ICM, such as, taking a timeslot off hook to dial an outgoing call and releasing an inbound or outbound call in the event of a hang up.

Voice compander module **520** provides data compression for the incoming data received from the PSTN before it is transmitted over the computer network. Since the resources of a computer network are limited, these resources may be overwhelmed during periods of high volume traffic. Potentially, data throughput may be decreased to the point where there is a noticeable delay between transmission and reception. Such a situation is extremely undesirable for real-time telephone communication. Data compression is used to reduce the overall amount of data being transmitted over the computer network, in order to reduce the data delay problems. Of course, the data transmission should not be applied to the point where it greatly affects the audio quality of the data being transmitted. When receiving compressed data which has been transmitted over the computer network, VCM **520** performs the inverse function of expanding the compressed data. The compression used in VCM **520** typically involves 8-bit μ law PCM (Pulse Coded Modulation) having variable compression ratios. The types of compression used may be GSM (Global System for Mobile Communication), CELP (Code Excited Linear Prediction) or ADPCM (Adaptive Differential Pulse Code Modulation). While this is not an exhaustive list, any similar compression technique may be used, such as, for example, any of the compression techniques used by the Netscape Navigator software available from Netscape Communications Corporation of Mountain View, Calif. As the compression ratio increases, the voice quality typically decreases.

Line Quality Monitor or LQM **522** examines the sampled voice data and applies a number of different techniques to improve the voice quality. For example, an echo cancellation filter may be used to minimize the echo effects inherent in long distance telephone calls. Additionally, variable attenuation may be applied to the voice data signal to prevent echo. Because this technique only needs to be applied to the voice data one time between the two endpoints, either the calling party node or the called party node may modify the signal. If the calling party modifies the signal, then the LQM at the receiving node is notified to take no further action. Otherwise, the default situation is to have the receiving node perform the echo cancellation.

The logical flow of a call through an ITS Node from the calling party's perspective will now be described with reference to FIG. **6**. A call is first initiated when the calling party dials. a telephone number which connects him directly to an ITS Node via the PSTN. Referring now to FIG. **6**, the ICM receives an inbound call indication from the TNIM at step **602**. This indicates that the calling party has initiated a telephone call. At step **604**, the ICM instructs the TNIM to answer the call. At step **606** the ICM (through the TNIM) receives information from the PSTN relating to the calling and called parties. Specifically, the PSTN provides Dialed Number Identification Service (DNIS) digits specifying the destination or called party telephone number, as well as Automatic Number Identification (ANI) digits identifying the calling party. The DNIS and ANI are provided to the ICM, which in turn provides this information to the Least Cost Routing or LCR Module at step **608**. Based on the DNIS and/or ANI, the LCR specifies to the ICM the ITS node that can most efficiently complete the call to the destination telephone number.

At step **610**, if the local ITS Node, i.e., the ITS Node associated with the calling party, is determined to be the most efficient node for routing the call, then the call is dialed back out on the PSTN using the TNIM, by branching out under the "yes" condition to step **612**. At step **614**, the ICM instructs the TNIM to connect the inbound call from the calling party with the outbound call placed by the local ITS Node. In this manner, a communication channel is established between the calling and called parties. This call remains active as long as neither party has terminated the call. If a call termination is detected at either calling or called party locations at step **616**, then the call is broken at step **618** and the calling and called parties are released at step **620**.

Alternatively, if a remote ITS Node, i.e, not the local ITS Node, is specified by the LCR as being the most efficient node for routing the call, then this optimal call path is established using the Internet. This is shown as the "no" branch at step **610**. At step **622**, the ICM at the local ITS Node passes the call setup data and requests the local CIM to connect through the Internet to the CAM at the remote ITS node in order to establish a connection through the Internet to a counterpart ICM at the Remote ITS Node. Step **622** involves first identifying the Internet address of the

Remote ITS Node, and then transmitting an initial message in order to establish a communications path between the ICM of the local ITS Node and the ICM at the Remote ITS Node. For example, if a call is being placed from New York City to a number in the United Kingdom, the Internet address of the node in the UK is used to establish a connection to that node. If there is more than one node in the UK, the LCR module determines the most optimally located node based on the destination telephone number. This node location is returned by the LCR module, as well as optionally, additional nodes in decreasing order of preference based on efficiency or other criteria.

As stated above, the call setup parameters used to establish the call include the destination telephone number and whether or not the voice data is to be passed through the Voice Compander Module and/or the Call Quality Module before being transmitted over the Internet. The specific protocol which is used to communicate the actual voice data between the two ITS nodes is configured at installation, and is either TCP/IP or UDP/IP. Once the connection between the local CIM and the remote CAM has been established, the local CIM indicates this to the local ICM at step **624**. After the initial parameters have been established between the two ITS nodes, the local ICM waits for the remote ICM to dial the destination telephone number and return an indication to the local ICM that the destination telephone number has been dialed. This occurs at step **626**.

At step **628**, both the local ICM and remote ICM begin to simultaneously capture voice data from their respective PSTN through their respective Voice Resources Modules. While in this mode, the ITS node tests at step **630** to determine whether either of the calling and/or called parties have terminated the call. If a call termination is not detected, the system executes step **632** and performs compression if data compression has been turned on. Similarly, the system proceeds to execute step **634** and perform line quality monitoring and correction if that feature is also turned on. The ICM then proceeds at step **636** to segment the voice data into messages or packets which are then transferred over the Internet to the remote ICM through the local TIRM. The system then loops back to step **628** to continue the procedure discussed above. In this manner, voice data continues to be transmitted to the remote end. Similarly, voice data is also being received from the remote end, as will be discussed in detail below, such that voice data is being communicated in full duplex mode, i.e., both transmit and receive directions.

If a call termination or hang up is detected at step **630**, the "yes" branch from step **630** is followed to step **638**, where a call supervision signal from the PSTN where the call termination occurred is first received by the ICM at the terminating location and then transmitted by the TIRM at the terminating location to the ICM at the other location. System execution then proceeds to step **640** where the necessary procedures are carried out to hang up or "tear down" the call. Finally, the system exits at step **642** and essentially frees up the resources that were associated with the particular call so that they are available to process another call.

Steps **628** through **636** of FIG. **6** represent the data transmission portion of a full duplex telephone call. Reception of data from the remote location begins at step **644**, which is executed right after step **626**, i.e., after the remote ICM has indicated that the destination telephone number has been successfully dialed. Execution of step **644** and the subsequent steps associated with data reception are performed in parallel with the data transmission function, i.e., steps **628–636**. After the local ICM receives each data packet from the remote ICM through the TIRM at step **644**, the system tests at step **646** to determine if the call has been terminated by the remote party hanging up. If a call termination is detected, system execution proceeds along the "yes" branch of step **646** to steps **640** and **642** and the appropriate hang up and exit procedures are performed, as indicated above.

If a call termination is not detected at step **646**, the system executes step **648** and performs decompression if data compression has been turned on at the remote end. Similarly, the system proceeds to execute step **650** and perform line quality monitoring and correction if that feature is also turned on. Finally, the processed voice data packet is sent by the local ICM through the Voice Resources Module to the TNIM at step **652** so that it may then be delivered by way of the PSTN to the user. System operation then loops back to step **644** in order to receive and process a subsequent voice data packet.

The logical flow of a call through a local ITS Node located at a called party location, i.e., from the called party perspective, will now be described with reference to FIG. **7**. As shown in FIG. **7**, the ICM at step **702** receives an indication that a call has been established through the Internet. It also receives the call setup data and telephone number of the called party and proceeds to dial that number through the CAM at step **708**. Once the call to the destination telephone number has been completed, the local ICM transmits a dial completion message at step **710** to the remote ICM.

At this point, the communications link between the calling and called parties has been established, and the local and Remote ITS Nodes proceed to exchange voice data packets. This is shown in the remaining portion of FIG. **7**, which is identical to the data exchange portion of FIG. **6** discussed above. The steps shown in FIG. **7** that correspond to those steps discussed above in connection with FIG. **6** have been given the same designation numerals. Accordingly, the description of these steps in FIG. **7** need not be repeated here, since they correspond to the same steps carried out in FIG. **6**.

The detailed operation of the individual blocks of FIG. **5** will now be explained with reference to FIGS. **8** to **10**. Referring now to FIG. **8**, therein is shown a flowchart of the operation of the CIM module. At step **802**, the CIM module receives a connection request from the ICM. This connection request includes the destination address of the remote ITS Node. At step **804**, the CIM proceeds to establish an Internet connection through the Internet to the CAM located at the remote ITS Node. At step **806**, the CIM tests to see if the connection was successful. If the connection was successfully established, then the CIM transmits to the CAM a call initiation message indicating that a new call needs to be serviced. The call initiation message includes information such as any special configuration information indicating the communications protocol to be used, whether compression has been turned on, and if so, what type, whether echo cancellation has been turned on, and any other information needed to properly service the call. The call initiation message also includes the destination telephone number of the called party. At step **810**, the CIM informs the ICM that a connection has been successfully established with the CAM at the remote ITS Node. The ICM then waits for an indication that the destination number has been successfully dialed by the remote ICM. If at step **806** a successful connection was not completed, the CIM proceeds at step **812** to notify the ICM of the failure to successfully connect to the remote ITS Node.

Referring now to FIG. **9**, therein is shown a flowchart of the operation of the CAM module. At step **850**, the CAM module waits for and receives a connection request from a CIM module located at a remote ITS node. At step **852**, the CAM proceeds to establish a connection through the Internet to the CIM located at the remote ITS node. The CAM determines at step **854** whether a successful connection has been established. If the connection has been successfully established, the CAM proceeds at step **856** to receive the call setup data from the CIM at the remote ITS node. As indicated above, this call setup data includes such information as the destination telephone number of the called party. The received call setup information and destination telephone number are then transmitted by the CAM to the ICM, which in turn instructs the TNIM to out dial the destination telephone number.

Referring now to FIG. **10**, therein is shown a flowchart of the operation of the TIRM module. At step **902**, the TIRM receives messages which have come either from the ICM located locally at the same node or via the Internet from a counterpart TIRM module located at the remote ITS node. If the message has come from the local ICM, the TIRM receives this message at step **904**. The message from the local ICM may include voice data. Alternatively, the message may include other information such as the destination telephone number, caller hangup information, etc. At step **906**, the TIRM packetizes this message into data packets of appropriate length and format and prepends a message header which may include message size, data type (voice, telephone number, etc.) or message sequence number. The packet or message is then sent to the remote ITS node over the established Internet connection. The TIRM then proceeds at step **908** to determine if a hangup indication has been received. If a hangup indication has not been received, i.e., the current call is still active and additional data needs to be transmitted, the TIRM loops back to step **902** to receive further messages. If there is a hangup indication at step **908**, TIRM breaks the Internet connection at step **910**.

Alternatively, if the message received at step **902** is from the remote TIRM, the local TIRM proceeds to step **912** to receive voice data or hangup information from the remote TIRM. The header information, including sequence number, are validated at step **914**. Validation of the sequence number insures that the messages have arrived in the proper order. Received messages, such as voice data, are handed off to the ICM at step **916**. The TIRM then proceeds at step **918** to determine if a hangup indication has been received. If a hangup indication has not been received, i.e., the current call is still active and additional data needs to be transmitted, the TIRM loops back to step **902** to receive further messages. If a hangup indication is received at step **918**, the Internet connection is terminated at step **920**. Processing of steps **904–910** is carried out in parallel with the processing of steps **912–920** since messages are being received simultaneously from the local ICM as well as from the remote TIRM.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A method of routing a full duplex telephone call between a first telephone set and a second telephone set using a public computer network as at least part of a communication link connecting said first and second telephone sets, comprising the steps of:

receiving at a first computer network access port a first telephone call from a central office placed from said fist telephone set initiating said full duplex telephone call, said first telephone call specifying a telephone number of said second telephone set, without specifying additional telephone destinations;

converting data received from the central office to an Intenet protocol;

establishing a communication link over said public computer network between said first computer network access port and a remote second computer network access port;

placing a second telephone call from said second computer network access port to said second telephone set using a PSTN;

converting data received from the public computer network from Intenet protocol to a PSTN protocol; and

connecting said first telephone call, said communication link and said second telephone call to thereby establish a telephone call between said first telephone set and said second telephone set.

2. The method of claim **1** further comprising the step of:

receiving said first telephone call from a public switched telephone network.

3. The method of claim **2** further comprising the step of:

placing said second telephone call using said public switched telephone network.

4. The method of claim **1** further comprising the step of:

placing said second telephone call using a public switched telephone network.

5. The method of claim **1**, wherein said first telephone call is the only call which is required to be placed by said first telephone set to effect communication with said second telephone set.

6. The method of claim **2** wherein said computer network is at least a portion of an Internet computer network.

7. The method of claim **6** wherein said first and second computer network access ports are first and second telephone switches and further comprising the steps of:

using a telephone network interface device to receive said first telephone call;

using a computer network call manager device to answer said first telephone call;

routing said first telephone call from said telephone network interface device to a voice resources module for processing and then routing said first telephone call to said computer network call manager device;

using a call initiation module to establish a connection through said computer network to said second computer network telephone switch;

transmitting call setup information from said call initiation module to said second computer network telephone switch; and

transmitting information contained in said first telephone call from said computer network call manager device to said second computer network telephone switch.

8. The method of claim **7** further comprising the step of:

determining the least cost routing procedure for routing said first telephone call from said first computer network telephone switch to said second telephone set.

9. The method of claim **8** further comprising the step of:

routing said first telephone call from said first computer network telephone switch to said second telephone set using said public switched telephone network based on the least cost routing procedure.

10. The method of claim **8** wherein the determining step comprises the further step of:

performing a hierarchical search based on information indicative of said second telephone set.

11. The method of claim 7 further comprising the step of:

performing at least one of data compression, echo cancellation and noise filtering on the information contained in said first telephone call.

12. The method of claim 7 further comprising the steps of:

receiving, at a call acceptance module, information contained in said second telephone call from said second computer network telephone switch;

routing said information contained in said second telephone call to said computer network call manager and then to said voice resources module for processing; and

routing said information contained in said second telephone call from said voice resources module to said telephone network interface device for transmission to said first telephone set as part of said first telephone call.

13. A system for routing a full duplex telephone call between a first telephone set and a second telephone set using a public computer network as at least part of a communication link connecting said first and second telephone sets, comprising:

a first computer network access port which receives a first telephone call from a central office placed from said first telephone set initiating said full duplex telephone call, said first telephone call specifying a telephone number of said second telephone set, without specifying additional telephone destinations;

a first protocol conversion module converting data received from the central office to an Intenet protocol;

a communication link over a public computer network between said first computer network access port and a second computer network access port;

a calling circuit which places a second telephone call from said second computer network access port to said second telephone set using a PSTN;

a second protocol conversion module converting data received from the public computer network from Internet protocol to a PSTN protocol; and

a call management circuit which connects said first telephone call, said communication link and said second telephone call to thereby establish a telephone call between said fist telephone set and said second telephone set.

14. The system of claim 13 further comprising:

a public switched telephone network interface circuit which receives said first telephone call through said public switched telephone network.

15. The system of claim 14 further comprising:

a second public switched telephone network interface circuit which places said second telephone call through said public switched telephone network.

16. The system of claim 13 wherein said public switched telephone network interface circuit places said second telephone call through said public switched telephone network.

17. The system of claim 13, wherein said first telephone call is the only call which is required to be placed by said first telephone set to effect communication with said second telephone set.

18. The system of claim 14 wherein said computer network comprises an Internet computer network connection.

19. The system of claim 18 wherein said first and second access ports are first and second telephone switches further comprising:

a telephone network interface device which receives said first telephone call;

a computer network call manager device which answers said first telephone call;

said computer network call manager device routing said first telephone call from said telephone network interface device to a voice resources module for processing and routing said first telephone call to said computer network call manager device;

a call initiation module which establishes a connection through said computer network to said second computer network telephone switch;

a call setup information circuit which transmits call setup information from said call initiation module to said second computer network telephone switch; and

said computer network call manager device transmitting information contained in said first telephone call from said computer network call manager device to said second computer network telephone switch.

20. The system of claim 19 further comprising:

a least cost routing system for determining a least cost routing procedure for routing said first telephone call from said first computer network telephone switch to said second telephone set.

21. The system of claim 20 wherein said computer network call manager device routes said first telephone call from said first computer network telephone switch to said second telephone set using said public switched telephone network based on the least cost routing procedure.

22. The system of claim 20 wherein the least cost routing system comprises a hierarchical search system which searches based on information indicative of said second telephone set.

23. The system of claim 19 further comprising:

at least one of a data compression circuit, an echo cancellation circuit and a noise filter which operates on the information contained in said first telephone call.

24. The system of claim 19 further comprising:

a call acceptance module which receives information contained in said second telephone call from said second computer network telephone switch;

said computer network call manager device routing said information contained in said second telephone call to said voice resources module for processing and then to said telephone network interface device for transmission to said first telephone set as part of said first telephone call.

* * * * *

APPENDIX 2

US005568475A

United States Patent [19]

Doshi et al.

[11] **Patent Number: 5,568,475**

[45] **Date of Patent: *Oct. 22, 1996**

[54] **ATM NETWORK ARCHITECTURE EMPLOYING AN OUT-OF-BAND SIGNALING NETWORK**

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[73] Assignee: **Lucent Technologies Inc.**, Murray Hill, N.J.

[*] Notice: The term of this patent shall not extend beyond the expiration date of Pat. No. 5,483,527.

[21] Appl. No.: **360,897**

[22] Filed: **Dec. 21, 1994**

[51] **Int. Cl.**[6] **H04L 12/64**

[52] **U.S. Cl.** **370/58.2**; 370/60.1; 370/79; 370/110.1; 370/94.2; 379/220; 379/230; 379/246

[58] **Field of Search** 370/58.2, 58.3, 370/60, 60.1, 79, 94.1, 94.2, 110.1; 379/219, 220, 224, 229, 230, 235, 236, 237, 240, 246, 339, 353

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,086,461	2/1992	Thorn et al.	379/230
5,220,563	6/1993	Grenot et al.	370/94.1
5,282,244	1/1994	Fuller et al.	379/230
5,345,445	9/1994	Hiller et al.	370/60.1
5,363,433	11/1994	Isono	370/94.1 X
5,384,840	1/1995	Blatchford et al.	379/229
5,400,339	3/1995	Sekine et al.	370/94.2
5,422,882	6/1995	Hiller et al.	370/60.1

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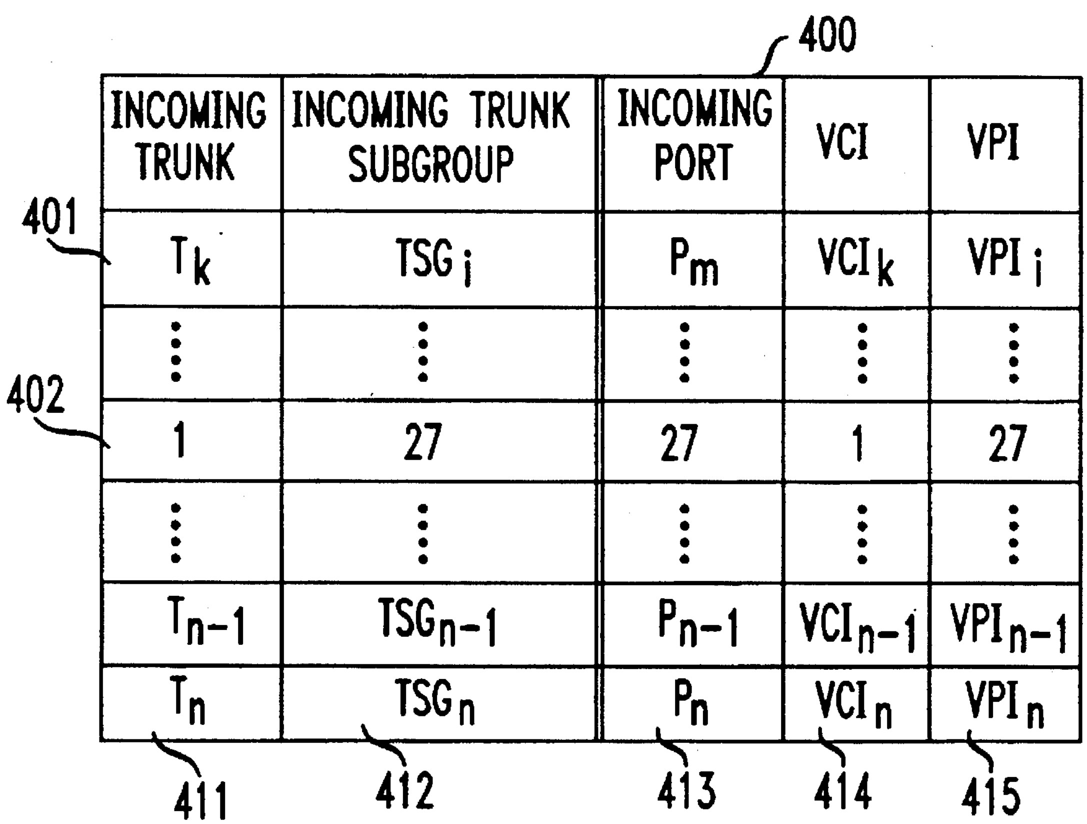
Assistant Examiner—Russell W. Blum
Attorney, Agent, or Firm—Frederick B. Luludis

[57] **ABSTRACT**

An Asynchronous Transfer(ATM) network comprising a plurality of ATM switches may be arranged so that it receives calls from Synchronous Transfer Mode (STM) switches that employ out-of-band signaling such that the ATM switches communicate telephone call signaling information between each other and the STM switches via an out-of-band signaling network associated with the ATM network and interface with out-of-band networks associated with the STM switches.

17 Claims, 5 Drawing Sheets



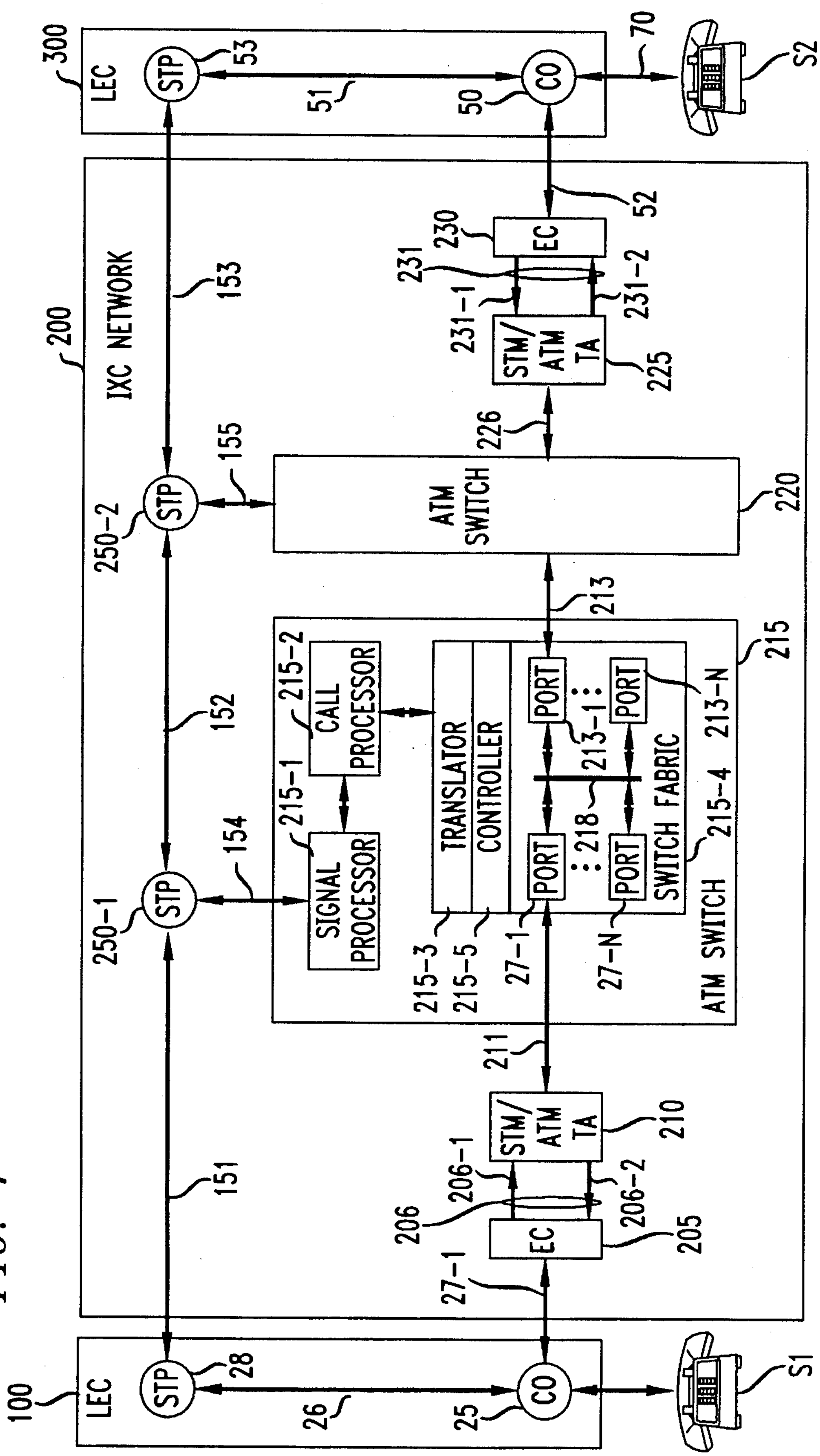

LEC
STP
CO
IXC NETWORK
EC
STM/ ATM TA
ATM SWITCH
SIGNAL PROCESSOR
CALL PROCESSOR
TRANSLATOR
CONTROLLER
PORT
SWITCH FABRIC
100
300
200
25
26
28
50
51
52
53
70
S1
S2
151
152
153
154
155
205
206
206-1
206-2
210
211
213
213-1
213-N
215
215-1
215-2
215-3
215-4
215-5
218
220
225
226
230
231
231-1
231-2
250-1
250-2
27-1
27-N

FIG. 1

FIG. 2

TRUNK	TRUNK SUBGROUP	BUSY(1)/ IDLE(0)
T_1	TSG_p	1
⋮	⋮	⋮
T_n	TSG_p	0
T_1	TSG_t	0
T_2	TSG_t	1
T_3	TSG_t	1
⋮	⋮	⋮
T_{n-x}	TSG_t	0
⋮	⋮	⋮

FIG. 3

400

	INCOMING TRUNK	INCOMING TRUNK SUBGROUP	INCOMING PORT	VCI	VPI
401	T_k	TSG_i	P_m	VCI_k	VPI_i
	⋮	⋮	⋮	⋮	⋮
402	1	27	27	1	27
	⋮	⋮	⋮	⋮	⋮
	T_{n-1}	TSG_{n-1}	P_{n-1}	VCI_{n-1}	VPI_{n-1}
	T_n	TSG_n	P_n	VCI_n	VPI_n
	411	412	413	414	415

FIG. 4

500

OUTGOING TRUNK	OUTGOING TRUNK SUBGROUP	OUTGOING PORT	VCI_0	VPI_0
T_a	TSG_b	P_a	VCI_a	VPI_b
⋮	⋮	⋮	⋮	⋮
T_e	TSG_d	P_e	VCI_e	VPI_d
⋮	⋮	⋮	⋮	⋮
501 213-1	60	213-1	213-1	60
⋮	⋮	⋮	⋮	⋮

FIG. 5

600

OUTGOING VCI	OUTGOING VPI	OUTGOING PORT	OUTGOING VCI	OUTGOING VPI
601 1	27	213-1	213-1	60
2	27	–	–	–
⋮	⋮	⋮	⋮	⋮
n	27	x	y	60
⋮	⋮	⋮	⋮	⋮
602	603	604	605	606

FIG. 6

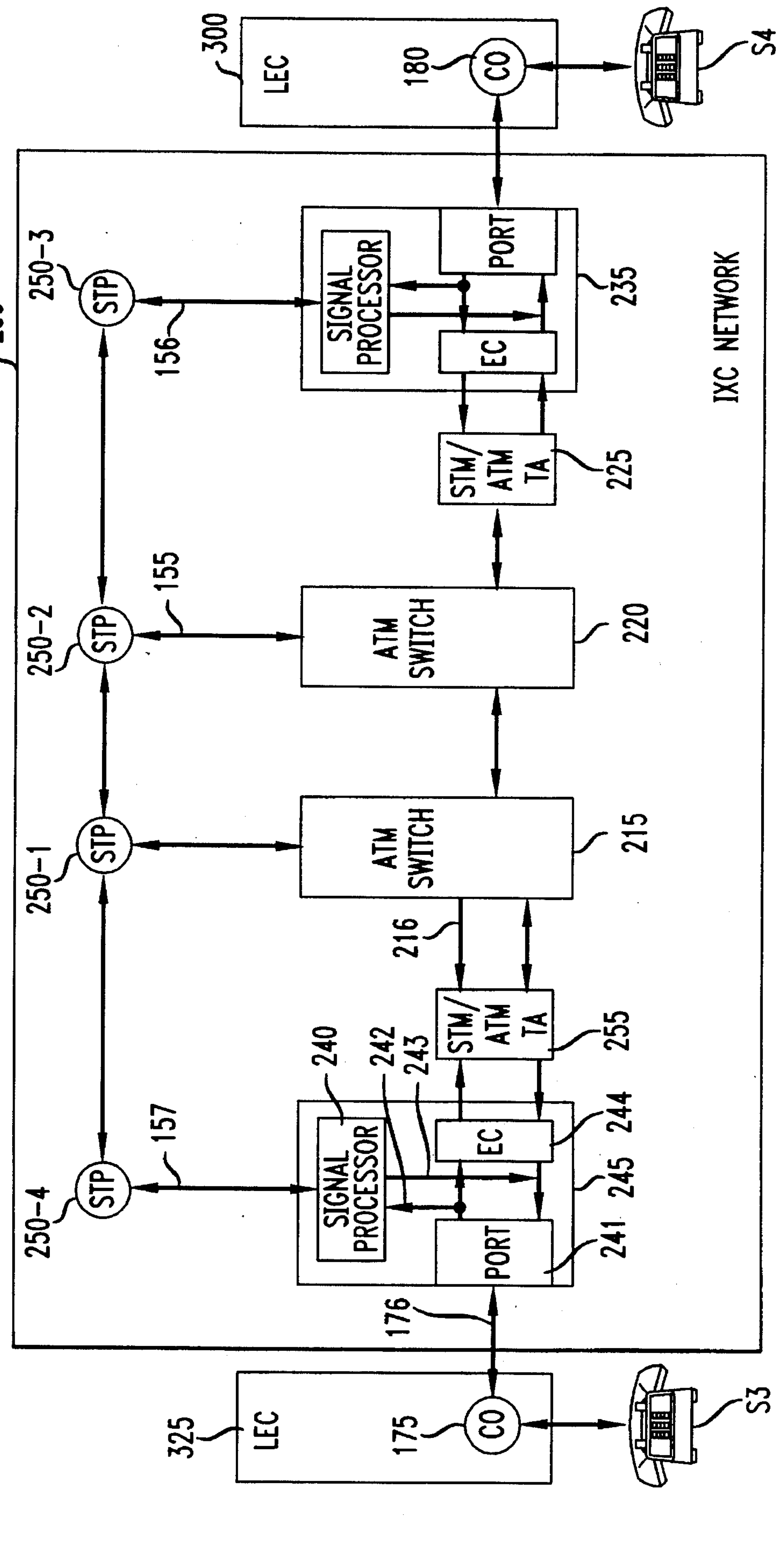
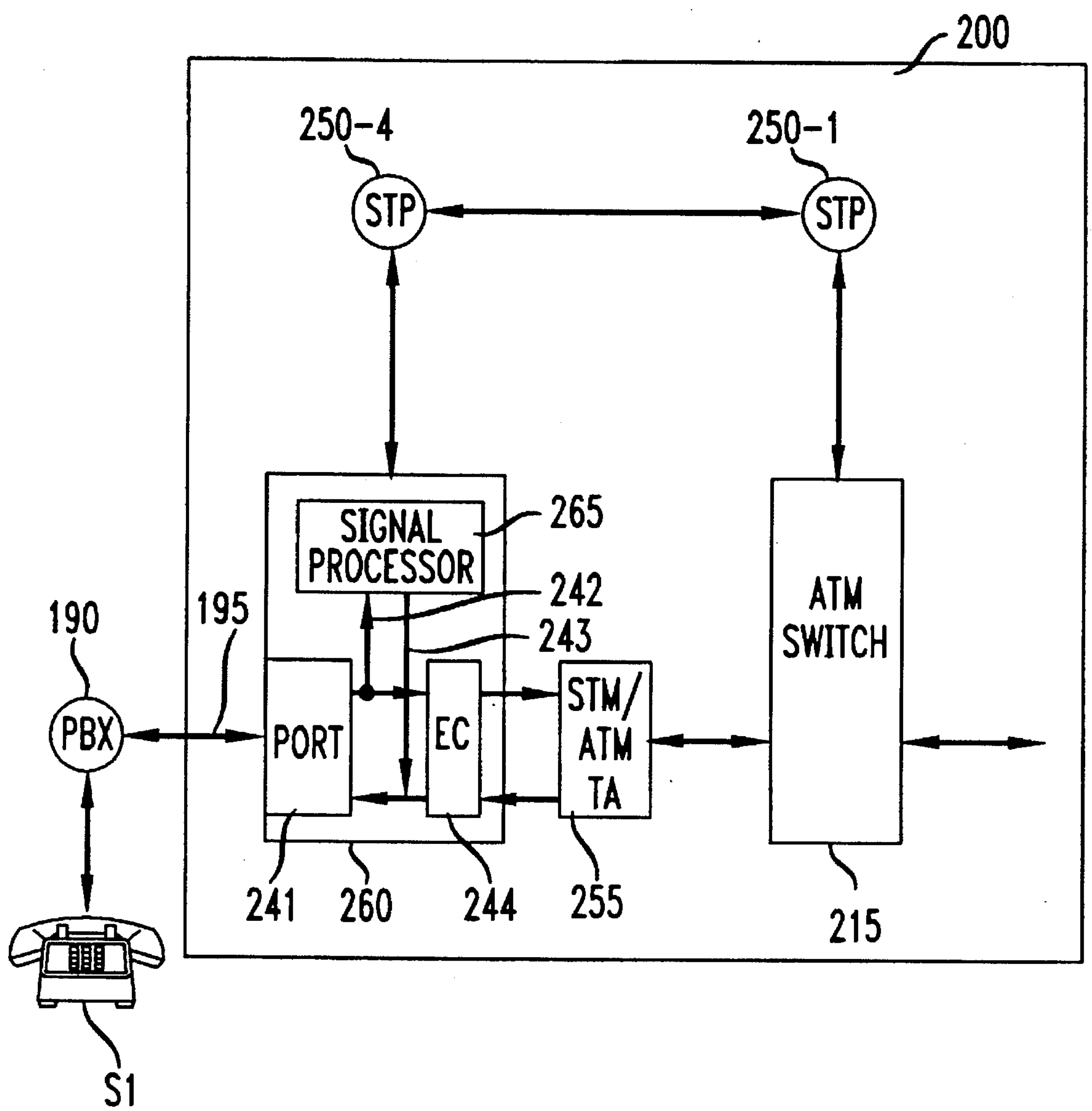

300
LEC
180
CO
S4
200
IXC NETWORK
250-3
STP
156
SIGNAL PROCESSOR
PORT
EC
235
STM/ATM TA
225
250-2
STP
155
ATM SWITCH
220
250-1
STP
ATM SWITCH
215
216
STM/ATM TA
255
240
242
243
250-4
STP
157
SIGNAL PROCESSOR
EC
244
245
PORT
241
176
325
LEC
175
CO
S3

FIG. 7


200
250-4
250-1
STP
STP
SIGNAL PROCESSOR
265
242
243
ATM SWITCH
190
195
PBX
PORT
EC
STM/ ATM TA
241
260
244
255
215
S1

ATM NETWORK ARCHITECTURE EMPLOYING AN OUT-OF-BAND SIGNALING NETWORK

FIELD OF THE INVENTION

The invention relates to an architecture for a telecommunications network comprising Asynchronous Transfer Mode switches interfacing with existing out-of-band signaling networks, such as the SS7 signaling network, as well as Synchronous Transfer Mode transport networks.

BACKGROUND OF THE INVENTION

In telecommunications systems, the vehicle that will most likely be used for offering a wide range of different high-bandwidth services, e.g., multimedia services, will most likely be based on Asynchronous Transfer Mode (ATM) protocols. These protocols define a particular data structure called a "cell", which is a data packet of a fixed size (53 octets, each octet comprising eight bits). A cell is formed by a header (five octets) and payload (48 octets) for transporting routing and user information.

The cell-routing concept in ATM is based on two aspects comprising a routing field in the cell header containing a Virtual Path Identifier (VPI) and Virtual Channel Identifier (VCI). The VCI and VPI pair have only local significance on the link between ATM switches (nodes). ATM switches as well as so-called cross-connect apparatus use routing tables to map VCI and VPI values received via an incoming link to outgoing values and an outgoing link as a way of routing the associated cell through the ATM switch (or cross-connect apparatus). A virtual Circuit Link (VCL) is a logical link between two switches (or a cross-connect nodes) and is identified by a VCI value. Similarly, a Virtual Path Link (VPL) is a logical link between two switches (or cross-connect nodes) identified by a respective VPI value. A virtual Circuit Connection (VCC) is an end-to-end connection between two devices and is formed by the concatenation of VCLs, and a Virtual Path Connection (VPC) is formed by the concatenation of VPLs. If an appreciable number of VCCs follow the same route segment, then it is likely that they will share the same VPC associated with that segment. In such a case, intermediate switches do not change the VCI values, and, therefore, are referred to as VP switches.

Current telephone networks as well as their associated transmission media, routing and cross-connection devices are digital circuit switched facilities, in which the routing of user information, e.g., voice and voice band-data services, from a source to a destination is via an end-to-end switched connection, which is dedicated for the duration of an associated call using the connection. That is, the call is set-up by assigning it to an idle time slot (one for each link) of a frame of time slots that are transported over a digital link(s) interconnecting origination and destination switches. As such, the connection is semi-permanent—lasting only for the duration of the associated call.

In contrast, an ATM network does not use dedicated time slots. Instead, VCCs and VPCs share the network resources asynchronously. An ATM network thus has to ensure that it has sufficient resources to handle the traffic that is transported via the VCCs and/or VPCs that it has established (set up).

It is well-known that current circuit-switched voice and voice-band data services use one of a number of different signaling and messaging techniques for the purpose of establishing a circuit switched connection between Synchronous Transfer Mode (STM) switches or accessing network databases to process special telephone services. Such signaling techniques include in-band signaling using so-called "borrowed bits" associated with a data stream; in-band signaling using Multi-Frequency (MF) tones, and out-of-band signaling using a separate packet network. In-band signaling using "borrowed bits" is used by customer premises equipment (e.g., a private branch exchange) to signal an STM network switch over a digital transmission facility. MF in-band signaling is still used in some of the switches associated with Local Exchange Carriers (LEC) to set up a call connection, but such signaling is being replaced by out-of-band packet signaling, for example, the packet signaling provided by the well-known Signaling System 7 (SS7). SS7 signaling is used by Interexchange Carrier (IXC) networks (e.g., AT&T) to establish call connections over their associated intertoll digital networks and to access network databases. Advantageously, most, but not all, LEC switches are now being provided with the SS7 type of out-of-band signaling capability.

Network switches perform other functions in addition to signaling. These other functions include, for example, Digital Signal Processing (DSP) functions such as detecting special tones, playing recorded announcements, canceling echoes, etc.

Presently, the designers of telecommunications networks are seriously considering replacing the STM switching and associated transport facilities with Broadband ISDN (B-ISDN) based on ATM as the underlying technology. What this means is that the circuit switched structure, associated signaling systems, databases, operations systems, etc., will be replaced by systems using ATM based transport, signaling and messaging. At this point in time, it appears that changing the STM switched transport to ATM transport may be relatively easy and could be accomplished in the near future. However, network signaling and messaging have been designed and developed over many years to guarantee that critical network applications will operate correctly. It is therefore unlikely that the entire signaling network will be converted at once to broadband signaling. It is also unlikely that a telecommunications carrier (LEC or IXC) will replace its entire STM network at once with a B-ISDN/ATM network, but will more likely migrate toward that end in stages such that during intermediate stages of the conversion network may be composed of STM and ATM elements. Accordingly, there will be a need to develop technology that will gracefully interface STM elements with ATM elements and allow ATM type switches to interface with the different types of existing signaling networks. The need for such interfacing has been recognized, but has been limited to the transport of user information only. Accordingly, the relevant technology has only advanced to the point of defining a Terminal Adapter (TA) function to implement appropriate ATM Adaptation Layer (AAL) protocols to interface conventional circuit-switched-transport protocols (e.g., time slot protocols for voice and dedicated circuits) with ATM based transport protocols.

SUMMARY OF THE INVENTION

The art of telephone switching is advanced in accord with an aspect of the invention by arranging an ATM switch of an ATM network (and cross-connect apparatus) so that it exchanges signaling information with an STM switch and/or another ATM switch via a signaling mechanism that is employed by the STM switch to forward a call to a destination, for example, out-band signaling. In particular, we achieve an advantage by interconnecting the ATM switch with an out-of-band signaling mechanism, for example, the SS7 network, and, then, in response to receiving from a STM or ATM switch via the signaling network a message containing, inter alia, an identity of a trunk that the sending switch will use to forward a telephone call to the ATM switch, translating the trunk identity into an identifier understood by the ATM switch, i.e., a virtual circuit identifier indicative of a virtual circuit over which information associated with the call will be received at an incoming port.

In accord with an aspect of the invention, the translation may be done on a one-to-one basis such that the virtual circuit identifier is made to be equivalent to the identity of the trunk. Similarly, the virtual path identifier is made to be equivalent to the identity of the associated trunk subgroup.

These and other aspects of the invention will be appreciated as they are disclosed in the following detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. **1** is a broad block diagram of an illustrative ATM network in which the principles of the invention may be practiced;

FIG. **2** illustrates a conventional busy/idle status table that is maintained by a call processor of FIG. **1**;

FIG. **3** illustrates a translation table that a call processor of FIG. **1** may use to translate, in accord with the principles of the invention, the address of an incoming trunk and associated trunk subgroup into an incoming port, VCI and VPI;

FIG. **4** illustrates a translation table that a call processor of FIG. **1** may use to translate between, in accord with the principles of the invention, the address of an outgoing trunk and associated trunk subgroup into an outgoing port, VCI and VPI;

FIG. **5** illustrates a table that an ATM input controller of FIG. **1** populates with routing information relating to the routing of incoming VCI and VPI to an outgoing port, VCI and VPI;

FIG. **6** is broad block diagram of an illustrative ATM network arranged to interface with MF inband signaling in accord with an aspect of the principles of the invention;

FIG. **7** is a simplified block diagram of an illustrative ATM network arranged to interface, in accord with an aspect of the invention, a signaling arrangement that is based on the "borrowed bit" scheme.

DETAILED DESCRIPTION

An exemplary embodiment of an ATM network arranged as an InterеXChange Carrier network is shown in FIG. **1**. ATM network **200** includes a plurality of interconnected ATM switches. For the sake of clarity and simplicity only two ATM switches are shown in the FIG., namely ATM switches **215** and **220**. ATM switches **215** and **220** are connected to one another via an ATM intertoll network **213** and are respectively connected to Local Exchange Carrier (LEC) networks **100** and **300**. Network **200** also includes a Signal System 7 (SS7) network connected to the network **200** switches via respective signaling links, e.g., links **154** and **155**, and associated Signal Transfer Points (STP), e.g., STPs **250-1** and **250-2**. In accord with an aspect of the invention, the network **200** ATM switches use the SS7 network to communicate signaling information to each other for the purpose of establishing respective virtual circuits, as will be discussed below in detail. Thus, in accord with an aspect of the invention, the ATM switches use the SS7 network to establish a virtual circuit connection, rather than a circuit switched connection, as is the case in STM networks. The signaling between the LEC CO switch and the IXC ATM switch may be in-band or out-of-band using the SS7 signaling network. In accord with an illustrative embodiment of the invention, a LEC CO switch may also use out-of-band signaling.

As is well-known, a LEC network comprises a plurality of so-called local Central Offices (CO) each of which may be, for example, the No. 5ESS switch available from AT&T and described in the *AT&T Technical Journal,* Vol. 64, No. 6, July/August 1985, pages 1303–1564. For the sake of clarity and simplicity only one CO is shown in each LEC network **100** and **300**. In an illustrative embodiment of the invention, a CO switch operates in a Synchronous Transfer Mode (STM) to transport speech signals associated with a particular call over a circuit-switched connection in digital form. That is, a CO samples analog speech signals that it receives from a telephone station set at an 8 khz rate and supplies the resulting digital signals (samples) synchronously at a 64 kbs rate over the associated connection, in which each such sample is formed by, for example, eight bits (8-bit byte). Conversely, A CO converts digital signals that it receives over a circuit switched connection into analog signals and then supplies the resulting signals to a telephone line connected to a respective telephone station set engaged in the call.

More particularly, a CO, e.g., CO **25**, responsive to receipt of a telephone call originated by an associated telephone station set, e.g., station set **S1**, and responsive to a user thereat dialing a telephone number identifying a called telephone station set, e.g., station set **S2**, collects the digits as they are dialed by user. When CO **25** receives the last of the dialed digits, it then routes the call towards its destination via a trunk selected as a function of the dialed telephone number. The selected trunk, in turn, connects CO **25** to a next switch that will form part of the connection from the calling station to the called station set. As is well known, and as discussed to some extent above, a CO alerts the next switch, i.e., ATM switch **215**, by sending a call set-up message thereto via a signaling path. As mentioned above, such signaling may be inband signaling, out-of-band signaling, etc. Assume at this point that the CO uses out-of-band signaling which is sent over an associated SS7 network. With this signaling mechanism, a call set-up message contains, inter alia, (a) the dialed telephone number, (b) ANI identifying the calling station, (c) identifiers respectively identifying the trunk and associated trunk subgroup that will be used to route the call to switch **215**, (d) a request for an end-to-end connection and (e) the address of switch **215**. It will be assumed at this point that CO **25** transmits the message via link **26** and STP **28** of the LEC **100** SS7 network. (The transmitted call set-up message will also be referred to herein as an Initial Address Message (IAM).)

Responsive to receipt of the IAM, STP **28** forwards the message to a destination STP—STP **250-1**—identified as a function of the address contained in the received message. In a similar manner, STP **250-1** forwards the message to switch **215** via data link **154**, which supplies the message to signal processor **215-1** interfacing ATM switch **215** with the SS7 network. Signal processor **215-1**, in turn, presents the received IAM to call processor **215-2**. Call processor **215-2** stores the IAM in associated memory and, identifies, as a function of the dialed number, the next, or destination, switch that may be used to establish the next or last segment of the connection to the destination CO, e.g., CO **50**. Since the called station set is station S2, then call processor **215-2** identifies ATM switch **220** as the destination IXC switch and identifies an idle one of its outgoing trunks and associated trunk subgroup that may be used to forward the incoming call to switch **220** via transmission path **213**. Call processor **215-2** does this by first translating the dialed number into the Network Switch Number (NSN) assigned to switch **220**. Call processor **215-2** then selects an idle outgoing trunk that may be used to forward the call to switch **220**. Call processor **215-2** selects such a trunk by translating the determined NSN into one or more trunk subgroups. Call processor **215-2** then consults a trunk subgroup status map which it maintains in its associated memory to identify an outgoing trunk in one of the latter subgroups that is idle and may be used to forward the call to the destination switch. (An example of such status map is shown in FIG. **2**, which is self explanatory.)

Assuming that the selected outgoing trunk and subgroup are, for example, outgoing trunk **213-1** of subgroup **60** (not shown in the FIG.), then controller **215-2** forms its own IAM message containing the call information and identities (i.e., **213-1** and **60**) of the trunk and subgroup that will be used to forward the call to switch **220**. Call processor **215-2** then sends the latter IAM to STP **250-1** via signal processor **215-2** and data link **154** for forwarding to switch **220**. STP **250-1**, in turn and in a conventional manner, sends the message to STP **250-2** for delivery to ATM switch **220** vial link **155**. Similarly, the switch **220** call processor (not shown) locates an idle outgoing trunk that may be used to connect the call to CO **50** and similarly creates its own IAM message for transmission to CO **50** via link **155**, STP **250-2**, LEC **300** STP **53** and data link **51**.

CO **50**, responsive to receipt of the IAM determines if the telephone connection **70** to station S2 is busy. If so, then CO **50** returns a busy message indicative thereof to switch **220** via the LEC **300** SS7 network. In response to receipt of the message, the call processor of switch **220** releases its outgoing trunk to CO **50** and forwards the busy message to switch **215** via the network **200** SS7 network. Similarly, call processor **215-2** releases outgoing trunk **213-1** of subgroup **60** and forwards the message to CO **25** via the SS7 networks of network **200** and LEC **100**. CO **25**, in turn, supplies busy tone to station S1 and releases its outgoing trunk to switch **215**.

If, on the other hand, telephone line **70** is not busy, then CO **50** returns a call complete message indicative thereof to switch **220** via the aforementioned SS7 network, and supplies ringing voltage to telephone line **70**. Switch **220**, responsive to receipt of the call complete message passes the message to its associated call processor. The switch **220** call processor then (a) forwards the call complete message to switch **215** via its associated signal processor and the SS7 network of network **200**, (b) changes the status of its incoming trunk and outgoing trunk that will be involved in routing the call through its associated switching fabric to busy and (c) advises its associated translator circuit (not shown) of the connection involving the switch **220** incoming and outgoing trunks. (Since the architecture and operation of switch **220** is similar to that of switch **215**, any discussion relating to switch **215** equally pertains to switch **220**. Therefore, the following discussion of the operation of controller **215-3** equally pertains to the switch **220** controller, translator, etc., (not shown).)

In particular, signal processor **215-1** upon receipt of the call complete message via data link **154** passes the message to call processor **215-2**. Similarly, processor **215-2** (a) forwards the call complete message to CO **25** via processor **215-1**, STP **250-1** and the LEC **100** SS7 network, (b) changes the status of incoming trunk **27-1** and outgoing trunk **213-1** that will be involved in routing the call through its associated switching fabric to busy and (c) advises its associated translator circuit **215-3** of the connection that should be established between incoming trunk **1** of subgroup **27-1** and outgoing trunk **213-1** of subgroup **60**. Translator **215-3**, more particularly, translates the incoming trunk and trunk subgroup identifiers received from call processor **215-2** into a form that is "understood" by conventional ATM switch controller **215-5**. That is, in accord with an aspect of the invention, translator **215-3** translates the identifiers—**1**, and **27-1**—associated with the incoming trunk into (a) respective predetermined VC and VP identifiers and (b) an incoming port circuit, e.g., port **27-1**. Translator **215-3** does this using translation Table **400** shown in FIG. **3**. Briefly, Table **400** comprises a plurality of entries in which each entry comprises five fields **411** through **415** containing associated translation data. Referring to entry **401**, for example, a data entry includes a trunk identifier (Tk) and associated trunk subgroup identifier (TSGi) in fields **411** and **412**, respectively, which are translated into a predetermined incoming port (Pi), and VCIi and VPIi contained in fields **413** through **415**, respectively. In accord with an aspect of the invention, such a translation is done on a one-to-one basis as shown for entry **402**, which translator **215-3** accesses to translate the trunk and trunk subgroup identifiers that it receives from call processor **215-2**. For example, trunk and trunk subgroup identifiers **1** and **27-1**, respectively, are translated on a one-to-one basis into a VCI of **1** and VPI of **27-1**, respectively, as shown by the data inserted in fields **414** and **415** of entry **402**. The trunk and TSG are also mapped into an identifier identifying an incoming port, i.e., incoming port **27**, as shown by the contents of field **413** of entry **402**. (Translator **215-3** uses a similar table to translate the outgoing trunk and outgoing trunk subgroup identifiers (**213-1** and **60**, respectively) into an outgoing port identifier, VCIo and VPIo. An illustrative example of such a table is shown in FIG. **4**, in which entry **501** is used to do the latter translation.) Translator **215-3** then supplies the results of the translation to controller **215-5**.

Controller **215-5** activates the virtual circuit connection from input port **1** to output port **213-1** so that speech signals originating at station set **S1** and destined for station **S2** may be transported over **45** switch fabric **215-4** during the associated virtual connection. Controller **215-5** does this by supplying the input VCI/VPI (**1/27**) to output VCI/VPI (**213-1/60**) mapping to input port **27**. Port **27**, in turn, enters the output VCI/VPI mapping data in a routing map. An example of the latter map is shown in FIG. **5**. In particular, each of the switch **215** (**220**) port circuits stores a routing map **600** in its associated port memory (not shown). The contents of fields **602** and **603** of each entry in the table, e.g., entry **601**, respectively contain a virtual channel and virtual path identifiers. That is, the virtual channels associated with a particular virtual path are entered in field **602** of sequential entries in the table, as shown for entry **601** and the following entries. Thereafter, when a port receives routing information from its associated controller **215-5**, it enters the routing information in an appropriate one of the table **600** entries. For example, it is seen that routing information has been entered in fields **604** through **606** of entry **601**. Thereafter, when input port **1** receives an ATM cell bearing a VCI and VPI of **1** and **27**, respectively, then it processes the cell in accord with the contents of entry **601** of routing table **600**, as will be explained below in detail.

Controller **215-5** also activates another, but opposite, virtual connection from port **213-1** to port **27** to transport speech or data signals that originate at station **S2** and received via switch **220** and destined for station **S1**. Accordingly, an opposite virtual connection may be so activated when a cell carrying samples of station **S2** speech samples (or voice-band data) are received via switch **220**. (It is noted that switch **220** performs similar routing functions in response to receipt of the call complete message.)

When CO **25** receives the call complete message, it supplies an alerting tone to telephone line **26** to notify the user thereat that the call connection has been completed and that a ringing signal is being supplied to station **S2**. When the user at station **S2** answers the call, then he/she may communicate with the station **S1** user in which the ensuing speech (or voice-band data) will be transported via ATM network **200**. Specifically, first considering speech signals received at CO **25** from station **S1**, CO **25** digitizes such signals in the manner described above and outputs the result to its associated trunk **1** of TSG **27**. (It is noted that the latter trunk and TSG respectively correspond to a channel (channel **1**) and group of channels (group **27**) of a time frame during which CO transmits a digital sample of a station **S1** speech signal over path **27-1**. Echo Canceler **205** receives the digital sample and, in a conventional manner, cancels the sample if it represents an echo of a digital speech sample originating at station **S2**. If not, then the sample is presented to STM/ATM Terminal Adapter **210**. TA **210**, more particularly, is arranged to pack samples of voice signals as they are received from STM switch **25** via trunk (channel) **1** of trunk group **27** into an ATM cell. TA **210** maintains a predetermined table which it uses to map between trunks and VCIs and between trunk subgroups and VPIs transported over link **211**. When a payload of 47 or 48 octets (depending on the particular ATM adaptation layer) have been so collected, then TA **210**, in accord with an aspect of the invention, translates the trunk address and trunk group address over which the samples were received into a VCI, VPI and incoming port address. In accord with another aspect of the invention, such a translation is done at TA **210** (similarly so at TA **225**) on a one-to-one basis. Accordingly, TA **210** translates a trunk address of **1** and a TSG address of **27** into a VCI of **1** and VPI of **27**, respectively. TA **210** then forms a cell header of five octets including the translated VCI and VPI values and prepends (prefixes) the header to the 48 octet payload to form an ATM cell. TA **210** then supplies the resulting ATM cell to originating port **27-1** of switch **215**. Port **27-1**, responsive to receipt of the cell, checks its associated routing table **600** to determine if routing translation information has been stored therein for the VCI and VPI contained in the received cell. If not, port **27-1** discards the cell. Otherwise, port **27-1** translates the VCI and VPI contained in the cell into an outgoing address. In the instant case, port **27-1** translates the VCI and VPI of **1** and **27**, respectively, into an outgoing port address of **213-1**, VCI of **213-1** and VPI of **60** based on the contents of entry **601** of table **600** (FIG. **5**). Port **27-1** then substitutes the latter VC and VP identifiers for the VCI and VPI identifiers contained in the received cell and presents the result to switch fabric **215-4** for routing, in a conventional manner. That is, switch fabric **215-4** routes the cell to port **213-1** via a virtual circuit connection identified by the VC and VP identifiers attached to the routed cell. Upon receipt of the cell from switch fabric **215-4**, output port **213-1** stores the cell in a queue (e.g., a First-In, First-Out memory) associated with high-speed transmission path **213**. When the data cell reaches the top of queue, it is then unloaded from the queue and transmitted, either by itself or part of a so-called super frame, over path **213** to destination ATM switch **220**. ATM switch **220** then, using its own table **500**, similarly translates the VC and VP identifiers in the received cell into output VC and VP identifiers and then routes the cell via its associated switch fabric and virtual circuit identified as a function of the latter identifiers. Upon receipt of the cell via the associated switch fabric, the switch **220** output port stores the cell in an associated queue. When the cell is thereafter unloaded from the queue it is transmitted over path **226** connected to TA **225**. TA **225**, in turn, translates the VC and VP identifiers contained in the received cell into trunk and trunk subgroup identifiers, in accord with an aspect of the invention. In accord with above mentioned aspect of the invention, such translation is done on a one-to-one basis. TA **225** then unpacks the payload of 48 octets of the received cell and supplies them to the so-called ATM Adaptation Layer (AAL) implemented in TA **225**. The AAL (a) buffers the received octets, (b) removes the AAL header, if any, (c) performs AAL functions with respect to the received octets, and (d) then sends each octet in sequence to CO **50** via EC **230** and translated trunk and subgroup of path **52**. As mentioned above, the latter trunk and trunk subgroup may be a time slot of a group of time slots, in which the such transmission of octets over path **231-1** occurs during the identified time slot.

As mentioned above, an STM switch may employ in-band MF signaling to communicate signaling information to an IXC. We have recognized that ATM network **200** may be readily adapted to receive such information via in-band signaling and then, in accord with an aspect of the invention, present such information to the originating ATM switch, e.g., switch **215**, via another signaling network, e.g., the SS7 network. Thus, the architecture of network **200** does not have to change to interface with a signaling technique different from the signaling technique employed by the SS7 network. Advantageously, then, ATM network **200** may interface with central offices using different signaling techniques to communicate signaling information to a next switch, wherein the next switch may be an ATM switch rather than an STM switch.

Referring then to FIG. **6**, assume that the user at station set **S3** places a call to station set **S4** by going off-hook and dialing the telephone number associated with the latter station set. When CO **175** has collected the last of the dialed digits and has determined that the call is to be routed via network **200**, it selects an idle trunk connecting to network **200** and transmits an off-hook signal thereto over the selected trunk and path **176**. Signal processor **240** of module **245** monitors the signals received via the selected trunk of port **241** and returns a signal over the trunk to CO **175** if the call can be accepted by TA **255** (referred to as TA **210** in FIG. **1**). Assuming that TA **255** accepts the call, then CO **175** begins to transmit the dialed telephone number and caller's ANI via the selected trunk (digital channel of path **176**). Interface port **241** of module **245** multiplexes the contents (eight bit byte) of each trunk (channel) to a respective signal path **242** extending to an associated EC **244**, which then presents the byte to Terminal Adapter (TA) **255**. TA **255**, in turn, accumulates such bytes as they are received from the source trunk to form a cell and then presents the cell to an associated input port of switch **215**, as described above. However, the input port discards the cell since a virtual circuit connection for the call has not yet been activated. If, on the other hand, the data byte contains signaling information (e.g., dialed digits), then port **241** extracts the signaling information and sends it to signal processor **240** via path **242**. Signal processor **240**, responsive to data indicative of a MF signal appearing on path **242**, collects the data and succeeding such data until it has accumulated the signals indicative of at least the called telephone number. Signal processor **240** then, as described above, forms an SS7 IAM message containing, inter alia, (a) the dialed telephone number, (b) ANI identifying the calling station, if acquired (c) identifiers respectively identifying the trunk and associated trunk subgroup over which the calling information was received, (d) a request for an end-to-end connection and (e) the address of switch **215**. Signal processor **245** then transmits the message via data link **157** and STP **250-4**. Switch **215** and then switch **220** process the IAM message in the manner discussed above. That is, the switch **220** call processor locates an idle outgoing trunk that may be used to route the call to the destination CO and then creates its own IAM message for transmission via link **155** and STP **250-2** to the network **200** signal transfer point that interfaces with that CO. The latter STP, in turn, retransmits the message to STP **250-3** for delivery to signal processor **240** of module **235**. Responsive to receipt of the IAM message via link **156**, signal processor **240** of module **235** selects the idle trunk to CO **180** (associated with the trunk from switch **250** to TA **225**) and sends an off-hook signal thereto via port **241** of module **235** and the selected trunk. If CO **180** can accept the call, then it returns an off-hook signal via the latter trunk. Signal processor **240** of module **235** responds to the off-hook by transmitting the called number contained in the received IAM message over the selected trunk to CO **180**. In addition, signal processor **240** of module **235** returns a call complete message to switch **220** via the network **200** SS7 network, in which the latter message contains the trunk and TSG of the trunk selected by the latter signals processor. ATM switch **220** processes the call complete message in the manner described above and transmits a call complete message to switch **215**, which similarly processes the message in the manner described above. As also mentioned above, switch **215** returns an SS7 call complete message to the originating CO. However, in the instance case, the latter message is sent via signal processor **240** of module **245**. Signal processor, in turn, sends an off-hook (wink) signal to CO **175** via the trunk that CO **175** selected to route the station set **S3** call to network **200**. As is well-known, the latter wink signal is a functional equivalent of the SS7 call complete message. When the station **S4** user answers the call, then the station **S3** user may begin to communicate with the station **S4** user via the virtual connections that are respectively established by switches **215** and **220** as they are needed.

When either the station set **S3** or **S4** user terminates the call—"hangs up", then CO **175** or **180**, as the case may be, sends an on-hook signal to network **200**. Assuming that the on-hook signal is sent by CO **175** over the selected trunk connecting to module **245**, then signal processor **240** of module **245**, responsive to receipt of the on-hook signal (sent by port **241** of module **245**), forms an SS7 network call termination message containing, inter alia, the identity of the latter trunk and its associated TSG and then sends the message to switch **215** via data link **157** and the SS7 network. Upon receipt of the termination message, the switch **215** call processor (a) directs the input port associated with the call to clear the entry that it made in its translation Table **600** for the call, (FIG. **5**), (b) sets the status of the trunk to idle in the status table (FIG. **2**) associated with switch **215** and (c) sends a call termination message to switch **220**, in which the latter message identifies the trunk and TSG identifiers that translate to VCI and VPI that are used to route the call from switch **215** to switch **220**. The switch **220** call processor responds similarly to the receipt of the latter message and sends a call termination message to the destination CO via link **155** and STP **250-2** such that the message is instead delivered to signal processor **240** of module **135** via STP **250-3** and link **156**. The latter signal processor, in turn, transmits an on-hook signal to CO **180**. CO **180** sets the status of the return path of the trunk connecting to module **235** to idle and then waits for the station set **S4** user to "hang-up".

As mentioned above, an incoming port of an ATM switch discards a data cell if a virtual circuit connection for the associated call has not been activated. Alternatively, such discarding may be done at the Terminal Adapter, e.g., TA **255**, **210**. etc., at the direction of the call processor of the associated ATM switch, e.g., switch **215**. Specifically, TA **255** (**210**, etc.,) may be arranged so that it receives control instructions from the associated call processor via a communications path connecting the TA to the call processor. Such a path may comprise a virtual circuit connection from the call processor through the switch fabric to a control port connecting connections to the TA via path **216**. In this way, the call processor may instruct the TA not to accumulate data received via a particular trunk, i.e., an idle trunk. Thereafter, when the trunk become busy and a virtual circuit has been assigned thereto, then the call processor instructs the TA to begin forming data cells from the data received via the trunk.

As also mentioned above, the architecture of network **200** does not change to interface with a method of signaling different than Signaling System **7**. ATM network **200** may thus interface with central offices, or other entities, that use different signaling techniques, as discussed above in connection with in-band signaling. One such entity that is commonly referred to as a nodal, for example, a Private Branch Exchange (PBX), uses a "bit borrowing" scheme to transmit signaling information. Turning then to FIG. **7**, there is shown nodal (PBX) **190** connected to network **200** via communications path **195**, in which the latter path **195** may be a so-called **T1** carrier transmission line. As is well-known, the transmission protocol that is used in a **T1** carrier system is a 125 microsecond frame composed of 24 channels in which each channel comprises eight bits. A telephone call is routed via the **T1** carrier system via a channel assigned to the call. For example, PBX **190** routes long distance calls originating at PBX **190** to network (or IXC) **200** by assigning each such call to a respective one of the aforementioned channels for the duration of the call. In this sense a channel is either busy (off-hook) or idle (on-hook). Signaling information indicative of whether a channel is off-hook or on-hook is transmitted over the channel by "borrowing" one bit (i.e., the least significant bit) from the channel every sixth and twelfth frames, in which the latter frames correspond to A and B signaling messages. Each signaling bit of each of the 24 channels relates only to the associated channel. As is well-known, the borrowed signaling bit of a channel is available more than 1300 times each second, which suffices to transmit supervisory signals (e.g., off-hook and on-hook) and other signaling information.

With the foregoing in mind, assume that a user causes terminal **S1** to go off-hook and dials a telephone number that will route the associated call through network **200**. PBX **190**, responsive to the off-hook accumulates the dialed digits and then determines that the call is to be routed over path **195**, and therefor, assigns the call to an idle channel of path **195**. As result of the assignment, **T1** carrier equipment (not shown) located and interfacing with PBX **190** changes the state of the signaling bit of the assigned channel in the sixth and twelfth frames to a one. PBX **190** then outputs each of the dialed digits to path **195** via the latter equipment and assigned channel. Interface port circuit **241** of module **260** multiplexes the contents (eight bit byte) of each of the twenty four channels to respective signaling paths **242** extending to an associated EC **244**, which then sends the signaling bits to a respective input port of switch **215** and to the associated signal processor **265**. Signal processor **265** of module **260** monitors the contents of the aforementioned assigned channel and responds upon receipt of signaling information via the borrowed bits. That is, signal processor **240** associates the assigned channel with a trunk identifier and associates the 24 channels with a TSG identifier. Signal processor **240** then begins to accumulate the digits that will be transmitted via succeeding ones of the assigned channel. When signal processor receives the last of the dialed digits it then forms an IAM message addressed to switch **215**, in which the message also contains, inter alia (a) the trunk and TSG identifiers that have been associated with the assigned channel, (b) calling station ANI and (c)dialed digits. Signal processor **240** of module **260** then transmits the message to switch **215** via STP **250-4** and network **200** SS7 network. Switch **215** similarly responds to the receipt of the message in the manner discussed above.

Signal processor **240** performs an opposite function with respect to signaling information (e.g., call complete message, termination message, etc.,) that it receives from switch **215**. For example, responsive to receipt of a call complete message, signal processor **240** of module **260** converts the messages into the **T1** carrier protocol and then transmits the message to nodal **190** one bit at a time using the borrowed signaling bit of a return channel assigned to the call.

The foregoing is merely illustrative of the principles of the invention. Those skilled in the art will be able to devise numerous arrangements, which, although not explicitly shown or described herein, nevertheless embody those principles that are within the spirit and scope of the invention. For example, one or more of the analog type telephone stations sets shown in the FIGs. may be ISDN type station sets. As another example, a CO switch may be an ATM based switch and one or more IXC switches may be a STM based switch.

We claim:

1. A method of establishing a connection for a call that is being forwarded from an origination STM switch to an intended destination switch via an ATM network formed from a plurality of interconnected ATM switches, said method comprising the steps of

at said first STM switch, transmitting routing information associated with said call to a first one of said ATM switches via an out-of-band signaling network, said routing information including at least a called telephone number and identity of a trunk over which said STM switch will forward said call to said first ATM switch,

providing an interface between each of said ATM switches and said out-of-band signaling network to translate an identity of a trunk contained in routing information received via said out-of-band signaling network into at least a predetermined virtual channel identifier, and

receiving said routing information associated with said call at said first ATM and translating the trunk identity contained in such routing information into a particular virtual channel identifier and routing said call through said first ATM switch as a function of said particular virtual channel identifier.

2. The method of claim **1** wherein said step of translating includes the step of translating said trunk identity into said particular virtual channel identifier on a one-to-one basis such that said particular virtual channel identifier is made to equal said trunk identity.

3. The method of claim **1** wherein said routing information associated with said call includes an identity of a trunk subgroup associated with trunk identified in the routing information and wherein said step of translating includes the step of translating the identity of said trunk subgroup into a virtual path identifier.

4. The method of claim **3** wherein said step of translating the identity of said trunk subgroup includes the step of translating said trunk subgroup identity into said virtual path identifier on a one-to-one basis such that said virtual path identifier is made to equal said trunk subgroup identity.

5. The method of claim **4** wherein said method further comprises the step of translating said virtual circuit and virtual path identifiers into output virtual circuit and virtual path identifiers as a function of a called number associated with said call and wherein said step of routing includes the step of routing said call through said first ATM switch as a function Of said output virtual circuit and virtual path identifiers.

6. The method of claim **5** further comprising the steps of

at said first ATM switch, deriving, as a function of at least said output virtual circuit identifier, an identity of an outgoing trunk and associated trunk subgroup defining a path to a second one of said ATM switches that will forward said call to said destination,

generating a call set-up message containing at least (a) the identity of said outgoing trunk and (b) said called number, and

sending said call set-up message to said second ATM switch via said out-of-band signaling network.

7. The method of claim **6** further comprising the steps of

receiving said call set-up message at the interface interfacing said second ATM switch with said out-of-band signaling network, and

responsive to receipt of said call-set up message, translating the identity of the outgoing trunk and associated trunk subgroup contained in said message into an input port, virtual circuit and virtual path identifiers, respectively,

determining, as a function of the called number, at least an identity of an output port, and output virtual circuit and virtual path identifiers that may be used at said second switch to forward said call to said destination and supplying the identity of said output port and output virtual circuit and virtual path identifiers to said second switch input port so that voice signals received via said first ATM switch and associated with said call may be routed to said output port via a virtual connection derived as a function of said second switch outgoing virtual circuit and virtual path identifiers.

8. The method of claim **7** further comprising the steps of

at said second ATM switch, respectively translating said second switch output virtual circuit and virtual path identifiers into an outgoing trunk and associated trunk subgroup defining a path to said destination,

generating a call set-up message containing at least (a) identifiers respectively identifying said outgoing trunk and associated trunk subgroup, and (b) said called number, and

sending said call set-up message toward said destination via said out-of-band signaling network.

9. The method of claim 1 further comprising the steps of

at a terminal adapter interfacing said first ATM switch with said trunk, accumulating voice signals received over said trunk and forming the accumulated signals into a message having a format acceptable to said first ATM switch,

translating said trunk identity and identity of an associated trunk subgroup into respective virtual channel and virtual path identifiers and affixing said identifiers to said accumulated signals, and

supplying the resulting message to an input of said first ATM switch.

10. The method of claim 8 further comprising the steps of

at a terminal adapter interfacing said output port of said second ATM switch with said destination, responsive to receipt of a data cell containing a sequence of octets from said output port, supplying the payload of the data cell to an ATM adaptation layer function such that the adaptation layer function supplies respective ones of the octets to a trunk of a trunk subgroup associated with a communications path extending to said destination, in which said trunk and trunk subgroup associated with said path are selected as a function of the outgoing virtual circuit and virtual path identifiers determined by said second switch.

11. The method of claim 1, wherein said out-of-band signaling is performed over a Signaling System 7 network.

12. A method of interfacing an ATM switch of an ATM network with an out-of-band signaling network comprising the steps of

interconnecting said ATM switch with said out-of-band signaling network, and

responsive to receiving via said out-of-band signaling network a message containing, inter alia, an identity of a trunk over which voice signals associated with a telephone call will be transported, translating said identity into at least a virtual circuit identifier and an identity of an incoming port which will receive said voice signals at said ATM switch.

13. The method of claim 12 further comprising the step of

determining, as a function of a called number associated with said telephone call, an output port that may be used to forward said voice signals to their intended destination and at least an output virtual circuit identifier identifying an associated virtual circuit connection that may be used to route said voice signals from said input port to said output port.

14. The method of claim 13 further comprising the steps of

translating said output virtual circuit identifier into an identifier identifying an output trunk,

generating a call set-up message containing at least (a) the identifier identifying said output trunk, and (b) said called number, and

sending said call set-up message to a destination switch.

15. A method of a transmitting signaling messages from a first ATM switch to a second ATM switch comprising the steps of

connecting said first and second ATM switches to an out-of-band signaling network via respective signaling interface arrangements,

at each of said interface arrangements, responsive to receipt of a signaling message via said out-of-band network in which the message identifies at least a trunk and associated trunk subgroup over which a respective telephone call is to be routed to the associated one of said ATM switches, translating said trunk and trunk subgroup identities into respective virtual circuit and virtual path identifiers and passing said identifiers to the associated one of said switches, and

responsive to receiving output virtual channel and virtual path identifier from the associated one of said switches, respectively translating said output virtual channel and virtual path identifiers into an output trunk identifier and trunk subgroup identifier and transmitting a signaling message containing said trunk and said trunk group identifiers over said out-of-band signaling network.

16. The method of claim 15 wherein said step of translating said trunk identity and trunk subgroup identity into respective virtual circuit and virtual path identifiers includes the step of performing the translating on a one-to-one basis such that said trunk identity and trunk subgroup identity are made to equal said virtual circuit and virtual path identifiers, respectively.

17. The method of claim 15 wherein said step of translating said output virtual channel and virtual path identifiers into output trunk and trunk subgroup identifiers includes the step of performing the translating on a one-to-one basis such that identities of said output virtual channel and virtual path identifiers are made to respectively equal said output trunk and trunk subgroup identifiers.

* * * * *

APPENDIX 3

Network Working Group
Request for Comments: 1577
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M. Laubach
Hewlett-Packard Laboratories
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Classical IP and ARP over ATM

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Abstract

This memo defines an initial application of classical IP and ARP in an Asynchronous Transfer Mode (ATM) network environment configured as a Logical IP Subnetwork (LIS) as described in Section 3. This memo does not preclude the subsequent development of ATM technology into areas other than a LIS; specifically, as single ATM networks grow to replace many ethernet local LAN segments and as these networks become globally connected, the application of IP and ARP will be treated differently. This memo considers only the application of ATM as a direct replacement for the "wires" and local LAN segments connecting IP end-stations ("members") and routers operating in the "classical" LAN-based paradigm. Issues raised by MAC level bridging and LAN emulation are beyond the scope of this paper.

This memo introduces general ATM technology and nomenclature. Readers are encouraged to review the ATM Forum and ITU-TS (formerly CCITT) references for more detailed information about ATM implementation agreements and standards.

Acknowledgments

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1. Conventions

The following language conventions are used in the items of specification in this document:

- MUST, SHALL, or MANDATORY -- the item is an absolute requirement of the specification.
- SHOULD or RECOMMEND -- this item should generally be followed for all but exceptional circumstances.
- MAY or OPTIONAL -- the item is truly optional and may be followed or ignored according to the needs of the implementor.

2. Introduction

The goal of this specification is to allow compatible and interoperable implementations for transmitting IP datagrams and ATM Address Resolution Protocol (ATMARP) requests and replies over ATM Adaptation Layer 5 (AAL5)[2,6].

Note: this memo defines only the operation of IP and address resolution over ATM, and is not meant to describe the operation of ATM networks. Any reference to virtual connections, permanent virtual connections, or switched virtual connections applies only to virtual channel connections used to support IP and address resolution over ATM, and thus are assumed to be using AAL5. This memo places no restrictions or requirements on virtual connections used for other purposes.

Initial deployment of ATM provides a LAN segment replacement for:

1) Local area networks (e.g., Ethernets, Token Rings and FDDI).

2) Local-area backbones between existing (non-ATM) LANs.

3) Dedicated circuits or frame relay PVCs between IP routers.

Note: In 1), local IP routers with one or more ATM interfaces will be able to connect islands of ATM networks. In 3), public or private ATM Wide Area networks will be used to connect IP routers, which in turn may or may not connect to local ATM networks. ATM WANs and LANs may be interconnected.

Private ATM networks (local or wide area) will use the private ATM address structure specified in the ATM Forum UNI specification [9]. This structure is modeled after the format of an OSI Network Service Access Point Address. A private ATM address uniquely identifies an

ATM endpoint. Public networks will use either the address structure specified in ITU-TS recommendation E.164 or the private network ATM address structure. An E.164 address uniquely identifies an interface to a public network.

The characteristics and features of ATM networks are different than those found in LANs:

- ATM provides a Virtual Connection (VC) switched environment. VC setup may be done on either a Permanent Virtual Connection (PVC) or dynamic Switched Virtual Connection (SVC) basis. SVC call management signalling is performed via implementations of the Q.93B protocol [7,9].

- Data to be passed by a VC is segmented into 53 octet quantities called cells (5 octets of ATM header and 48 octets of data).

- The function of mapping user Protocol Data Units (PDUs) into the information field of the ATM cell and vice versa is performed in the ATM Adaptation Layer (AAL). When a VC is created a specific AAL type is associated with the VC. There are four different AAL types, which are referred to individually as "AAL1", "AAL2", "AAL3/4", and "AAL5". (Note: this memo concerns itself with the mapping of IP and ATMARP over AAL5 only. The other AAL types are mentioned for introductory purposes only.) The AAL type is known by the VC end points via the call setup mechanism and is not carried in the ATM cell header. For PVCs the AAL type is administratively configured at the end points when the Connection (circuit) is set up. For SVCs, the AAL type is communicated along the VC path via Q.93B as part of call setup establishment and the end points use the signaled information for configuration. ATM switches generally do not care about the AAL type of VCs. The AAL5 format specifies a packet format with a maximum size of (64K - 1) octets of user data. Cells for an AAL5 PDU are transmitted first to last, the last cell indicating the end of the PDU. ATM standards guarantee that on a given VC, cell ordering is preserved end-to-end. NOTE: AAL5 provides a non-assured data transfer service - it is up to higher-level protocols to provide retransmission.

- ATM Forum signalling defines point-to-point and point-to-multipoint Connection setup [9]. Multipoint-to-multipoint VCs are not yet specified by ITU-TS or ATM Forum.

- An ATM Forum ATM endpoint address is either encoded as an NSAP Address (NSAPA) or is an E.164 Public-UNI address [9]. In some cases, both an ATM endpoint address and an E.164 Public UNI address are needed by an ATMARP client to reach another host or router. Since the use of ATM endpoint addresses and E.164 public UNI addresses by ATMARP are analogous to the use of Ethernet addresses, the notion of "hardware address" is extended to encompass ATM addresses in the context of ATMARP, even though ATM addresses need not have hardware significance. ATM Forum NSAPAs use the same basic format as U.S. GOSIP NSAPAs [11]. Note: ATM Forum addresses should not be construed as being U.S. GOSIP NSAPAs. They are not, the administration is different, which fields get filled out are different, etc.

This memo describes the initial deployment of ATM within "classical" IP networks as a direct replacement for local area networks (ethernets) and for IP links which interconnect routers, either within or between administrative domains. The "classical" model here refers to the treatment of the ATM host adapter as a networking interface to the IP protocol stack operating in a LAN-based paradigm.

Characteristics of the classical model are:

- o The same maximum transmission unit (MTU) size is used for all VCs in a LIS [2]. (Refer to Section 5.)
- o Default LLC/SNAP encapsulation of IP packets.
- o End-to-end IP routing architecture stays the same.
- o IP addresses are resolved to ATM addresses by use of an ATMARP service within the LIS - ATMARPs stay within the LIS. From a client's perspective, the ATMARP architecture stays faithful to the basic ARP model presented in [3].
- o One IP subnet is used for many hosts and routers. Each VC directly connects two IP members within the same LIS.

Future memos will describe the operation of IP over ATM when ATM networks become globally deployed and interconnected.

The deployment of ATM into the Internet community is just beginning and will take many years to complete. During the early part of this period, we expect deployment to follow traditional IP subnet boundaries for the following reasons:

- o Administrators and managers of IP subnetworks will tend to initially follow the same models as they currently have deployed. The mindset of the community will change slowly over time as ATM increases its coverage and builds its credibility.

- o Policy administration practices rely on the security, access, routing, and filtering capability of IP Internet gateways: i.e., firewalls. ATM will not be allowed to "back-door" around these mechanisms until ATM provides better management capability than the existing services and practices.

- o Standards for global IP over ATM will take some time to complete and deploy.

This memo details the treatment of the classical model of IP and ATMARP over ATM. This memo does not preclude the subsequent treatment of ATM networks within the IP framework as ATM becomes globally deployed and interconnected; this will be the subject of future documents. This memo does not address issues related to transparent data link layer interoperability.

3. IP Subnetwork Configuration

In the LIS scenario, each separate administrative entity configures its hosts and routers within a closed logical IP subnetwork. Each LIS operates and communicates independently of other LISs on the same ATM network. Hosts connected to ATM communicate directly to other hosts within the same LIS. Communication to hosts outside of the local LIS is provided via an IP router. This router is an ATM Endpoint attached to the ATM network that is configured as a member of one or more LISs. This configuration may result in a number of disjoint LISs operating over the same ATM network. Hosts of differing IP subnets MUST communicate via an intermediate IP router even though it may be possible to open a direct VC between the two IP members over the ATM network.

The requirements for IP members (hosts, routers) operating in an ATM LIS configuration are:

- o All members have the same IP network/subnet number and address mask [8].

- o All members within a LIS are directly connected to the ATM network.

- o All members outside of the LIS are accessed via a router.

- o All members of a LIS MUST have a mechanism for resolving IP addresses to ATM addresses via ATMARP (based on [3]) and vice versa via InATMARP (based on [12]) when using SVCs. Refer to Section 6 "Address Resolution" in this memo.

- o All members of a LIS MUST have a mechanism for resolving VCs to IP addresses via InATMARP (based on [12]) when using PVCs. Refer to Section 6 "Address Resolution" in this memo.

- o All members within a LIS MUST be able to communicate via ATM with all other members in the same LIS; i.e., the virtual Connection topology underlying the intercommunication among the members is fully meshed.

The following list identifies a set of ATM specific parameters that MUST be implemented in each IP station connected to the ATM network:

- o ATM Hardware Address (atm$ha). The ATM address of the individual IP station.

- o ATMARP Request Address (atm$arp-req). atm$arp-req is the ATM address of an individual ATMARP server located within the LIS. In an SVC environment, ATMARP requests are sent to this address for the resolution of target protocol addresses to target ATM addresses. That server MUST have authoritative responsibility for resolving ATMARP requests of all IP members within the LIS. Note: if the LIS is operating with PVCs only, then this parameter may be set to null and the IP station is not required to send ATMARP requests to the ATMARP server.

It is RECOMMENDED that routers providing LIS functionality over the ATM network also support the ability to interconnect multiple LISs. Routers that wish to provide interconnection of differing LISs MUST be able to support multiple sets of these parameters (one set for each connected LIS) and be able to associate each set of parameters to a specific IP network/ subnet number. In addition, it is RECOMMENDED that a router be able to provide this multiple LIS support with a single physical ATM interface that may have one or more individual ATM endpoint addresses. Note: this does not necessarily mean different End System Identifiers (ESIs) when NSAPAs are used. The last octet of an NSAPA is the NSAPA Selector (SEL) field which can be used to differentiate up to 256 different LISs for the same ESI. (Refer to Section 5.1.3.1, "Private Networks" in [9].)

4. Packet Format

Implementations MUST support IEEE 802.2 LLC/SNAP encapsulation as described in [2]. LLC/SNAP encapsulation is the default packet format for IP datagrams.

This memo recognizes that other encapsulation methods may be used however, in the absence of other knowledge or agreement, LLC/SNAP encapsulation is the default.

This memo recognizes the future deployment of end-to-end signalling within ATM that will allow negotiation of encapsulation method on a per-VC basis. Signalling negotiations are beyond the scope of this memo.

5. MTU Size

The default MTU size for IP members operating over the ATM network SHALL be 9180 octets. The LLC/SNAP header is 8 octets, therefore the default ATM AAL5 protocol data unit size is 9188 octets [2]. In classical IP subnets, values other than the default can be used if and only if all members in the LIS have been configured to use the non-default value.

This memo recognizes the future deployment of end-to-end signalling within ATM that will allow negotiation of MTU size on a per-VC basis. Signalling negotiations are beyond the scope of this document.

6. Address Resolution

Address resolution within an ATM logical IP subnet SHALL make use of the ATM Address Resolution Protocol (ATMARP) (based on [3]) and the Inverse ATM Address Resolution Protocol (InATMARP) (based on [12]) as defined in this memo. ATMARP is the same protocol as the ARP protocol presented in [3] with extensions needed to support ARP in a unicast server ATM environment. InATMARP is the same protocol as the original InARP protocol presented in [12] but applied to ATM networks. All IP stations MUST support these protocols as updated and extended in this memo. Use of these protocols differs depending on whether PVCs or SVCs are used.

6.1 Permanent Virtual Connections

An IP station MUST have a mechanism (eg. manual configuration) for determining what PVCs it has, and in particular which PVCs are being used with LLC/SNAP encapsulation. The details of the mechanism are beyond the scope of this memo.

All IP members supporting PVCs are required to use the Inverse ATM Address Resolution Protocol (InATMARP) (refer to [12]) on those VCs using LLC/SNAP encapsulation. In a strict PVC environment, the receiver SHALL infer the relevant VC from the VC on which the InATMARP request (InARP_REQUEST) or response (InARP_REPLY) was received. When the ATM source and/or target address is unknown, the corresponding ATM address length in the InATMARP packet MUST be set to zero (0) indicating a null length, otherwise the appropriate address field should be filled in and the corresponding length set appropriately. InATMARP packet format details are presented later in this memo.

Directly from [12]: "When the requesting station receives the InARP reply, it may complete the [ATM]ARP table entry and use the provided address information. Note: as with [ATM]ARP, information learned via In[ATM]ARP may be aged or invalidated under certain circumstances." It is the responsibility of each IP station supporting PVCs to re-validate [ATM]ARP table entries as part of the aging process. See Section 6.5 on "ATMARP Table Aging".

6.2 Switched Virtual Connections

SVCs require support for ATMARP in the non-broadcast, non-multicast environment that ATM networks currently provide. To meet this need a single ATMARP Server MUST be located within the LIS. This server MUST have authoritative responsibility for resolving the ATMARP requests of all IP members within the LIS.

The server itself does not actively establish connections. It depends on the clients in the LIS to initiate the ATMARP registration procedure. An individual client connects to the ATMARP server using a point-to-point VC. The server, upon the completion of an ATM call/connection of a new VC specifying LLC/SNAP encapsulation, will transmit an InATMARP request to determine the IP address of the client. The InATMARP reply from the client contains the information necessary for the ATMARP Server to build its ATMARP table cache. This information is used to generate replies to the ATMARP requests it receives.

The ATMARP Server mechanism requires that each client be administratively configured with the ATM address of the ATMARP Server atm$arp-req as defined earlier in this memo. There is to be one and only one ATMARP Server operational per logical IP subnet. It is RECOMMENDED that the ATMARP Server also be an IP station. This station MUST be administratively configured to operate and recognize itself as the ATMARP Server for a LIS. The ATMARP Server MUST be configured with an IP address for each logical IP subnet it is serving to support InATMARP requests.

This memo recognizes that a single ATMARP Server is not as robust as multiple servers which synchronize their databases correctly. This document is defining the client-server interaction by using a simple, single server approach as a reference model, and does not prohibit more robust approaches which use the same client-server interface.

6.3 ATMARP Server Operational Requirements

The ATMARP server accepts ATM calls/connections from other ATM end points. At call setup and if the VC supports LLC/SNAP encapsulation, the ATMARP server will transmit to the originating ATM station an InATMARP request (InARP_REQUEST) for each logical IP subnet the server is configured to serve. After receiving an InATMARP reply (InARP_REPLY), the server will examine the IP address and the ATM address. The server will add (or update) the <ATM address, IP address> map entry and timestamp into its ATMARP table. If the InATMARP IP address duplicates a table entry IP address and the InATMARP ATM address does not match the table entry ATM address and there is an open VC associated with that table entry, the InATMARP information is discarded and no modifications to the table are made. ATMARP table entries persist until aged or invalidated. VC call tear down does not remove ATMARP table entries.

The ATMARP server, upon receiving an ATMARP request (ARP_REQUEST), will generate the corresponding ATMARP reply (ARP_REPLY) if it has an entry in its ATMARP table. Otherwise it will generate a negative ATMARP reply (ARP_NAK). The ARP_NAK response is an extension to the ARMARP protocol and is used to improve the robustness of the ATMARP server mechanism. With ARP_NAK, a client can determine the difference between a catastrophic server failure and an ATMARP table lookup failure. The ARP_NAK packet format is the same as the received ARP_REQUEST packet format with the operation code set to ARP_NAK, i.e., the ARP_REQUEST packet data is merely copied for transmission with the ARP_REQUEST operation code reset to ARP_NAK.

Updating the ATMARP table information timeout, the short form: when the server receives an ATMARP request over a VC, where the source IP and ATM address match the association already in the ATMARP table and the ATM address matches that associated with the VC, the server may update the timeout on the source ATMARP table entry: i.e., if the client is sending ATMARP requests to the server over the same VC that it used to register its ATMARP entry, the server should examine the ATMARP requests and note that the client is still "alive" by updating the timeout on the client’s ATMARP table entry.

Adding robustness to the address resolution mechanism using ATMARP: when the server receives an ARP_REQUEST over a VC, it examines the source information. If there is no IP address associated with the VC over which the ATMARP request was received and if the source IP address is not associated with any other connection, then the server will add the <ATM address, IP address> entry and timestamp into its ATMARP table and associate the entry with this VC.

6.4 ATMARP Client Operational Requirements

The ATMARP client is responsible for contacting the ATMARP server to register its own ATMARP information and to gain and refresh its own ATMARP entry/information about other IP members. This means, as noted above, that ATMARP clients MUST be configured with the ATM address of the ATMARP server. ATMARP clients MUST:

1. Initiate the VC connection to the ATMARP server for transmitting and receiving ATMARP and InATMARP packets.

2. Respond to ARP_REQUEST and InARP_REQUEST packets received on any VC appropriately. (Refer to Section 7, "Protocol Operation" in [12].)

3. Generate and transmit ARP_REQUEST packets to the ATMARP server and to process ARP_REPLY and ARP_NAK packets from the server appropriately. ARP_REPLY packets should be used to build/refresh its own client ATMARP table entries.

4. Generate and transmit InARP_REQUEST packets as needed and to process InARP_REPLY packets appropriately. InARP_REPLY packets should be used to build/refresh its own client ATMARP table entries. (Refer to Section 7, "Protocol Operation" in [12].)

5. Provide an ATMARP table aging function to remove its own old client ATMARP tables entries after a convenient period of time.

Note: if the client does not maintain an open VC to the server, the client MUST refresh its ATMARP information with the server at least once every 20 minutes. This is done by opening a VC to the server and exchanging the initial InATMARP packets.

6.5 ATMARP Table Aging

An ATMARP client or server MUST have knowledge of any open VCs it has (permanent or switched), their association with an ATMARP table entry, and in particular, which VCs support LLC/SNAP encapsulation.

Client ATMARP table entries are valid for a maximum time of 15 minutes.

Server ATMARP table entries are valid for a minimum time of 20 minutes.

Prior to aging an ATMARP table entry, an ATMARP server MUST generate an InARP_REQUEST on any open VC associated with that entry. If an InARP_REPLY is received, that table entry is updated and not deleted.

If there is no open VC associated with the table entry, the entry is deleted.

When an ATMARP table entry ages, an ATMARP client MUST invalidate the table entry. If there is no open VC associated with the invalidated entry, that entry is deleted. In the case of an invalidated entry and an open VC, the ATMARP client must revalidate the entry prior to transmitting any non address resolution traffic on that VC. In the case of a PVC, the client validates the entry by transmitting an InARP_REQUEST and updating the entry on receipt of an InARP_REPLY. In the case of an SVC, the client validates the entry by transmitting an ARP_REQUEST to the ATMARP Server and updating the entry on receipt of an ARP_REPLY. If a VC with an associated invalidated ATMARP table entry is closed, that table entry is removed.

6.6 ATMARP and InATMARP Packet Format

Internet addresses are assigned independently of ATM addresses. Each host implementation MUST know its own IP and ATM address(es) and MUST respond to address resolution requests appropriately. IP members MUST also use ATMARP and InATMARP to resolve IP addresses to ATM addresses when needed.

The ATMARP and InATMARP protocols use the same hardware type (ar$hrd), protocol type (ar$pro), and operation code (ar$op) data formats as the ARP and InARP protocols [3,12]. The location of these fields within the ATMARP packet are in the same byte position as those in ARP and InARP packets. A unique hardware type value has been assigned for ATMARP. In addition, ATMARP makes use of an additional operation code for ARP_NAK. The remainder of the ATMARP/InATMARP packet format is different than the ARP/InARP packet format.

The ATMARP and InATMARP protocols have several fields that have the following format and values:

```
Data:
  ar$hrd     16 bits  Hardware type
  ar$pro     16 bits  Protocol type
  ar$shtl     8 bits  Type & length of source ATM number (q)
  ar$sstl     8 bits  Type & length of source ATM subaddress (r)
  ar$op      16 bits  Operation code (request, reply, or NAK)
  ar$spln     8 bits  Length of source protocol address (s)
  ar$thtl     8 bits  Type & length of target ATM number (x)
  ar$tstl     8 bits  Type & length of target ATM subaddress (y)
  ar$tpln     8 bits  Length of target protocol address (z)
  ar$sha     qoctets  source ATM number
  ar$ssa     roctets  source ATM subaddress
```

```
     ar$spa     soctets  source protocol address
     ar$tha     xoctets  target ATM number
     ar$tsa     yoctets  target ATM subaddress
     ar$tpa     zoctets  target protocol address
```

Where:

```
     ar$hrd  -  assigned to ATM Forum address family and is
                19 decimal (0x0013) [4].

     ar$pro  -  see Assigned Numbers for protocol type number for
                the protocol using ATMARP. (IP is 0x0800).

     ar$op   -  The operation type value (decimal):
                ARP_REQUEST   = 1
                ARP_REPLY     = 2
                InARP_REQUEST = 8
                InARP_REPLY   = 9
                ARP_NAK       = 10

     ar$spln -  length in octets of the source protocol address. For
                IP ar$spln is 4.

     ar$tpln -  length in octets of the target protocol address. For
                IP ar$tpln is 4.

     ar$sha  -  source ATM number (E.164 or ATM Forum NSAPA)

     ar$ssa  -  source ATM subaddress (ATM Forum NSAPA)

     ar$spa  -  source protocol address

     ar$tha  -  target ATM number (E.164 or ATM Forum NSAPA)

     ar$tsa  -  target ATM subaddress (ATM Forum NSAPA)

     ar$tpa  -  target protocol address
```

The encoding of the 8-bit type and length value for ar$shtl, ar$sstl, ar$thtl, and ar$tstl is as follows:

```
MSB   8     7     6     5     4     3     2     1   LSB
   +-----+-----+-----+-----+-----+-----+-----+-----+
   |  0  | 1/0 |   Octet length of address         |
   +-----+-----+-----+-----+-----+-----+-----+-----+
```

Where:

```
bit.8   (reserved) = 0  (for future use)

bit.7   (type)     = 0  ATM Forum NSAPA format
                   = 1  E.164 format

bit.6-1 (length)   = 6 bit unsigned octet length of address
                      (MSB = bit.6, LSB = bit.1)
```

ATM addresses in Q.93B (as defined by the ATM Forum UNI 3.0 signalling specification [9]) include a "Calling Party Number Information Element" and a "Calling Party Subaddress Information Element". These Information Elements (IEs) SHOULD map to ATMARP/InATMARP source ATM number and source ATM subaddress respectively. Furthermore, ATM Forum defines a "Called Party Number Information Element" and a "Called Party Subaddress Information Element". These IEs map to ATMARP/InATMARP target ATM number and target ATM subaddress respectively.

The ATM Forum defines three structures for the combined use of number and subaddress [9]:

	ATM Number	ATM Subaddress
Structure 1	ATM Forum NSAPA	null
Structure 2	E.164	null
Structure 3	E.164	ATM Forum NSAPA

IP members MUST register their ATM endpoint address with their ATMARP server using the ATM address structure appropriate for their ATM network connection: i.e., LISs implemented over ATM LANs following ATM Forum UNI 3.0 should register using Structure 1; LISs implemented over an E.164 "public" ATM network should register using Structure 2. A LIS implemented over a combination of ATM LANs and public ATM networks may need to register using Structure 3. Implementations based on this memo MUST support all three ATM address structures.

ATMARP and InATMARP requests and replies for ATM address structures 1 and 2 MUST indicate a null ATM subaddress; i.e., ar$sstl.type = 1 and ar$sstl.length = 0 and ar$tstl.type = 1 and ar$tstl.length = 0. When ar$sstl.length and ar$tstl.length =0, the ar$tsa and ar$ssa fields are not present.

Note: the ATMARP packet format presented in this memo is general in nature in that the ATM number and ATM subaddress fields SHOULD map directly to the corresponding Q.93B fields used for ATM call/connection setup signalling messages. The IP over ATM Working Group expects ATM Forum NSAPA numbers (Structure 1) to predominate over E.164 numbers (Structure 2) as ATM endpoint identifiers within ATM LANs. The ATM Forum's VC Routing specification is not complete at this time and therefore its impact on the operational use of ATM Address Structure 3 is undefined. The ATM Forum will be defining this relationship in the future. It is for this reason that IP members need to support all three ATM address structures.

6.7 ATMARP/InATMARP Packet Encapsulation

ATMARP and InATMARP packets are to be encoded in AAL5 PDUs using LLC/SNAP encapsulation. The format of the AAL5 CPCS-SDU payload field for ATMARP/InATMARP PDUs is:

```
Payload Format for ATMARP/InATMARP PDUs:
+------------------------------+
|        LLC 0xAA-AA-03        |
+------------------------------+
|        OUI 0x00-00-00        |
+------------------------------+
|     Ethertype 0x08-06        |
+------------------------------+
|                              |
|   ATMARP/InATMARP Packet     |
|                              |
+------------------------------+
```

The LLC value of 0xAA-AA-03 (3 octets) indicates the presence of a SNAP header.

The OUI value of 0x00-00-00 (3 octets) indicates that the following two-bytes is an ethertype.

The Ethertype value of 0x08-06 (2 octets) indicates ARP [4].

The total size of the LLC/SNAP header is fixed at 8-octets. This aligns the start of the ATMARP packet on a 64-bit boundary relative to the start of the AAL5 CPCS-SDU.

The LLC/SNAP encapsulation for ATMARP/InATMARP presented here is consistent with the treatment of multiprotocol encapsulation of IP over ATM AAL5 as specified in [2] and in the format of ATMARP over IEEE 802 networks as specified in [5].

Traditionally, address resolution requests are broadcast to all directly connected IP members within a LIS. It is conceivable in the future that larger scaled ATM networks may handle ATMARP requests to destinations outside the originating LIS, perhaps even globally; issues raised by ATMARP'ing outside the LIS or by a global ATMARP mechanism are beyond the scope of this memo.

7. IP Broadcast Address

ATM does not support broadcast addressing, therefore there are no mappings available from IP broadcast addresses to ATM broadcast services. Note: this lack of mapping does not restrict members from transmitting or receiving IP datagrams specifying any of the four standard IP broadcast address forms as described in [8]. Members, upon receiving an IP broadcast or IP subnet broadcast for their LIS, MUST process the packet as if addressed to that station.

8. IP Multicast Address

ATM does not support multicast address services, therefore there are no mappings available from IP multicast addresses to ATM multicast services. Current IP multicast implementations (i.e., MBONE and IP tunneling, see [10]) will continue to operate over ATM based logical IP subnets if operated in the WAN configuration.

This memo recognizes the future development of ATM multicast service addressing by the ATM Forum. When available and widely implemented, the roll-over from the current IP multicast architecture to this new ATM architecture will be straightforward.

9. Security

Not all of the security issues relating to IP over ATM are clearly understood at this time, due to the fluid state of ATM specifications, newness of the technology, and other factors.

It is believed that ATM and IP facilities for authenticated call management, authenticated end-to-end communications, and data encryption will be needed in globally connected ATM networks. Such future security facilities and their use by IP networks are beyond the scope of this memo.

There are known security issues relating to host impersonation via the address resolution protocols used in the Internet [13]. No special security mechanisms have been added to the address resolution mechanism defined here for use with networks using IP over ATM.

10. Open Issues

- Interim Local Management Interface (ILMI) services will not be generally implemented initially by some providers and vendors and will not be used to obtain the ATM address network prefix from the network [9]. Meta-signalling does provide some of this functionality and in the future we need to document the options.

- Well known ATM address(es) for ATMARP servers? It would be very handy if a mechanism were available for determining the "well known" ATM address(es) for the client's ATMARP server in the LIS.

- There are many VC management issues which have not yet been addressed by this specification and which await the unwary implementor. For example, one problem that has not yet been resolved is how two IP members decide which of duplicate VCs can be released without causing VC thrashing. If two IP stations simultaneously established VCs to each other, it is tempting to allow only one of these VCs to be established, or to release one of these VCs immediately after it is established. If both IP stations simultaneously decide to release opposite VCs, a thrashing effect can be created where VCs are repeatedly established and immediately released. For the time being, the safest strategy is to allow duplicate VCs to be established and simply age them like any other VCs.

References

[1] Piscitello, D., and J. Lawrence, "IP and ARP over the SMDS Service", RFC 1209, Bell Communications Research, March 1991.

[2] Heinanen, J., "Multiprotocol Encapsulation over ATM Adaptation Layer 5", RFC 1483, Telecom Finland, July 1993.

[3] Plummer, D., "An Ethernet Address Resolution Protocol - or - Converting Network Addresses to 48.bit Ethernet Address for Transmission on Ethernet Hardware", STD 37, RFC 826, MIT, November 1982.

[4] Reynolds, J., and J. Postel, "Assigned Numbers", STD 2, RFC 1340, USC/Information Sciences Institute, July 1992.

[5] Postel, J., and J. Reynolds, "A Standard for the Transmission of IP Datagrams over IEEE 802 Networks", STD 43, RFC 1042, USC/Information Sciences Institute, February 1988.

[6] CCITT, "Draft Recommendation I.363", CCITT Study Group XVIII, Geneva, 19-29 January 1993.

[7] CCITT, "Draft text for Q.93B", CCITT Study Group XI, 23 September - 2 October 1992.

[8] Braden, R., "Requirements for Internet Hosts -- Communication Layers", STD 3, RFC 1122, USC/Information Sciences Institute, October 1989.

[9] ATM Forum, "ATM User-Network Interface Specification Version 3.0.", ATM Forum, 480 San Antonio Road, Suite 100, Mountain View, CA 94040, June 1993.

[10] Deering, S., "Host Extensions for IP Multicasting", STD 5, RFC 1112, Stanford University, August 1989.

[11] Colella, R., and Gardner, E., and R. Callon, "Guidelines for OSI NSAP Allocation in the Internet", RFC 1237, NIST, Mitre, DEC, July 1991.

[12] Bradely, T., and C. Brown, "Inverse Address Resolution Protocol", RFC 1293, Wellfleet Communications, Inc., January 1992.

[13] Bellovin, S., "Security Problems in the TCP/IP Protocol Suite", ACM Computer Communications Review, Vol. 19, Issue 2, pp. 32-48, 1989.

Security Considerations

Security issues are discussed in Section 9.

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APPENDIX 4

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

C2 COMMUNICATIONS TECHNOLOGIES, INC.,	§ § §	
vs.	§	Case No. 2:06-CV-241
AT&T, INC., ET AL.	§ §	

MEMORANDUM OPINION AND ORDER

1. Introduction

In this case, C2 Communications Technologies, Inc. ("C2") asserts various claims from U.S. Patent No. 6,243,373 ("the '373 patent") against the defendants. The '373 patent, entitled "Method and Apparatus for Implementing a Computer Network / Internet Telephone System," was filed on November 1, 1995, and issued on June 5, 2001. Mr. David L. Turock is the only inventor named on the '373 patent.

2. Background of the Technology

The '373 patent is generally directed to methods and equipment for routing duplex telephone calls over the public switched telephone network ("PSTN") and a public computer network, such as the Internet, in a way that is transparent to both the caller and the called party. '373 patent at 7:18-35. The invention accomplishes its directive by integrating a specialized computer system with the traditional PSTN so that calls from a telephone are converted to an Internet protocol, routed over the public computer network, and then converted back to the traditional telephone network protocol to complete the call. '373 patent Abstract, 7:18-35. The specialized computer systems of the invention, which are also called computer access ports or ITS nodes, serve as interfaces between the public computer network (or Internet) and the standard telephone system, thereby enabling the transmission of telephonic voice communications over the Internet.

A full duplex telephone call of the invention can be established by routing the call from a calling party, over the PSTN to a first ITS node, from the first ITS node over the Internet to a second ITS node, and from the second ITS node over the PSTN to the called party. Once the call reaches the called party, a full duplex connection between the callers is established. A goal of the invention is to minimize long distance telephone rates by essentially connecting two local calls via the Internet. In accordance with this goal, each portion of the call between a caller and his or her respective ITS node would incur the charge for a local telephone call, and the communication link over the Internet would replace the traditional long distance portion of the call thereby reducing or eliminating the long distance surcharge normally attendant with long distance telephone calls. In the written description, the '373 patent describes two main embodiments, a two-number dialing embodiment and a one-number dialing embodiment.

In accordance with the two-number dialing embodiment, the caller will place a first telephone call to the first ITS node, which has its own telephone number. This call will be connected through a central office and/or over the PSTN. When the first ITS node answers the call, a complete two-way call between the caller and the first ITS node is established, and the first ITS node will thereafter prompt the caller to enter the telephone number for the called party. Using the provided number, the ITS node will negotiate a call setup with a second ITS node located in the vicinity of the called party, thereby establishing a communications link over the Internet between the first and second ITS nodes. The second ITS node will then place a call to the called party to establish a second, completed telephone call with the called party. Once the called party answers the second telephone call, the two telephone calls and the communications link are joined to establish a full duplex telephone call between the two callers. The ITS node therefore provides call setup capabilities and converts voice data from the traditional protocol of the PSTN to an Internet protocol.

The one-numbering dialing embodiment is similar to the two-number dialing embodiment described above. The main difference between the two embodiments is that the one-number dialing embodiment consolidates the two outbound dialing steps into a single step. In the one-number dialing embodiment, for example, the step of dialing the first ITS node is consolidated with the step of entering the number of the called party at the ITS node. This consolidation of steps adds an additional level of transparency into the claimed call routing system in order to make the system resemble traditional long distance telephony. In a preferred embodiment, the two steps are consolidated by connecting the first ITS node directly to the central office or a private branch exchange ("PBX") that services the caller. This direct connection allows the caller to pick up his or her telephone and dial the number of the called party instead of first dialing the number of the ITS node.

As originally filed, the '373 patent contained two independent claims, each covering both of the calling embodiments described above. During prosecution, Mr. Turock amended both independent claims to exclude the two-number dialing embodiment from their scope. Therefore, the issued claims are directed to the more transparent one-number dialing system described above. Unfortunately, the bulk of Mr. Turock's written description is directed to the operation of the various two-number dialing embodiments. As such, only a small portion of the written description is directed to the claimed one-number dialing embodiments. *See* '373 patent at 7:18-35. In part because of this minimal description, the claims are especially helpful to a garner a full understanding of Mr. Turock's invention. The following independent claim is illustrative:

> 1. A method of routing a full duplex telephone call between a first telephone set and a second telephone set using a public computer network as at least part of a communication link connecting said first and second telephone sets, comprising the steps of:
>
> receiving at a first computer network access port a first telephone call from a central office placed from said first telephone set initiating said full duplex telephone call, said first telephone call specifying a telephone number of said second telephone set, without specifying additional telephone destinations;
>
> converting data received from the central office to an Internet protocol;
>
> establishing a communication link over said public computer network between said first computer network access port and a remote second computer network access port;
>
> placing a second telephone call from said second computer network access port to said second telephone set using a PSTN;
>
> converting data received from the public computer network from Internet protocol to a PSTN protocol; and
>
> connecting said first telephone call, said communication link and said second telephone call to thereby establish a telephone call between said first telephone set and said second telephone set.

'373 patent, claim 1.

3. General Principles Governing Claim Construction

"A claim in a patent provides the metes and bounds of the right which the patent confers on the patentee to exclude others from making, using or selling the protected invention." *Burke, Inc. v. Bruno Indep. Living Aids, Inc.*, 183 F.3d 1334, 1340 (Fed. Cir. 1999). Claim construction is an issue of law for the court to decide. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 970-71 (Fed. Cir. 1995) (*en banc*), *aff'd*, 517 U.S. 370 (1996).

To ascertain the meaning of claims, the court looks to three primary sources: the claims, the specification, and the prosecution history. *Markman*, 52 F.3d at 979. Under the patent law, the specification must contain a written description of the invention that enables one of ordinary skill in the art to make and use the invention. A patent's claims must be read in view of the specification, of which they are a part. *Id.* For claim construction purposes, the description may act as a sort of dictionary, which explains the invention and may define terms used in the claims. *Id.* "One purpose for examining the specification is to determine if the patentee has limited the scope of the claims." *Watts v. XL Sys., Inc.*, 232 F.3d 877, 882 (Fed. Cir. 2000).

Nonetheless, it is the function of the claims, not the specification, to set forth the limits of the patentee's claims. Otherwise, there would be no need for claims. *SRI Int'l v. Matsushita Elec. Corp.*, 775 F.2d 1107, 1121 (Fed. Cir. 1985) (*en banc*). The patentee is free to be his own lexicographer, but any special definition given to a word must be clearly set forth in the specification. *Intellicall, Inc. v. Phonometrics*, 952 F.2d 1384, 1388 (Fed. Cir. 1992). And, although the specification may indicate that certain embodiments are preferred, particular embodiments appearing in the specification will not be read into the claims when the claim language is broader than the embodiments. *Electro Med. Sys., S.A. v. Cooper Life Scis., Inc.*, 34 F.3d 1048, 1054 (Fed. Cir. 1994).

This court's claim construction decision must be informed by the Federal Circuit's decision in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005)(*en banc*). In *Phillips*, the court set forth several guideposts that courts should follow when construing claims. In particular, the court reiterated that "the *claims* of a patent define the invention to which the patentee is entitled the right to exclude." *Id.* at 1312 (emphasis added)(quoting *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1115 (Fed. Cir. 2004)). To that end, the words used in a claim are generally given their ordinary and customary meaning. *Id.* The ordinary and customary meaning of a claim term "is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, *i.e.* as of the effective filing date of the patent application." *Id.* at 1313. This principle of patent law flows naturally from the recognition that inventors are usually persons who are skilled in the field of the invention. The patent is addressed to and intended to be read by others skilled in the particular art. *Id.*

The primacy of claim terms notwithstanding, *Phillips* made clear that "the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification." *Id.* Although the claims themselves may provide guidance as to the meaning of particular terms, those terms are part of "a fully integrated written instrument." *Id.* at 1315 (quoting *Markman*, 52 F.3d at 978). Thus, the *Phillips* court emphasized the specification as being the primary basis for construing the claims. *Id.* at 1314-17. As the Supreme Court stated long ago, "in case of doubt or ambiguity it is proper in all cases to refer back to the descriptive portions of the specification to aid in solving the doubt or in ascertaining the true intent and meaning of the language employed in the claims." *Bates v. Coe*, 98 U.S. 31, 38 (1878). In addressing the role of the specification, the *Phillips* court quoted with approval its earlier observations from *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1250 (Fed. Cir. 1998):

> Ultimately, the interpretation to be given a term can only be determined and confirmed with a full understanding of what the inventors actually invented and intended to envelop with the claim. The construction that stays true to the claim language and most naturally aligns with the patent's description of the invention will be, in the end, the correct construction.

Consequently, *Phillips* emphasized the important role the specification plays in the claim construction process.

The prosecution history also continues to play an important role in claim interpretation. The prosecution history helps to demonstrate how the inventor and the PTO understood the patent.

Phillips, 415 F.3d at 1317. Because the file history, however, "represents an ongoing negotiation between the PTO and the applicant," it may lack the clarity of the specification and thus be less useful in claim construction proceedings. *Id.* Nevertheless, the prosecution history is intrinsic evidence. That evidence is relevant to the determination of how the inventor understood the invention and whether the inventor limited the invention during prosecution by narrowing the scope of the claims.

Phillips rejected any claim construction approach that sacrificed the intrinsic record in favor of extrinsic evidence, such as dictionary definitions or expert testimony. The *en banc* court condemned the suggestion made by *Tex. Digital Sys., Inc. v. Telegenix, Inc.*, 308 F.3d 1193 (Fed. Cir. 2002), that a court should discern the ordinary meaning of the claim terms (through dictionaries or otherwise) before resorting to the specification for certain limited purposes. *Id.* at 1319-24. The approach suggested by *Tex. Digital*–the assignment of a limited role to the specification–was rejected as inconsistent with decisions holding the specification to be the best guide to the meaning of a disputed term. *Id.* at 1320-21. According to *Phillips*, reliance on dictionary definitions at the expense of the specification had the effect of "focus[ing] the inquiry on the abstract meaning of words rather than on the meaning of the claim terms within the context of the patent." *Id.* at 1321. *Phillips* emphasized that the patent system is based on the proposition that the claims cover only the invented subject matter. *Id.* What is described in the claims flows from the statutory requirement imposed on the patentee to describe and particularly claim what he or she has invented. *Id.* The definitions found in dictionaries, however, often flow from the editors' objective of assembling all of the possible definitions for a word. *Id.* at 1321-22.

Phillips does not preclude all uses of dictionaries in claim construction proceedings. Instead, the court assigned dictionaries a role subordinate to the intrinsic record. In doing so, the court emphasized that claim construction issues are not resolved by any magic formula. The court did not impose any particular sequence of steps for a court to follow when it considers disputed claim language. *Id.* at 1323-25. Rather, *Phillips* held that a court must attach the appropriate weight to the intrinsic sources offered in support of a proposed claim construction, bearing in mind the general rule that the claims measure the scope of the patent grant.

4. Discussion

A. telephone call; first telephone call; second telephone call; placing a second telephone call from said second computer network access port to said second telephone set; connecting said first telephone call, said communications link and said second telephone call to thereby establish a telephone call between said first telephone set and said second telephone set

The term "telephone call" appears in seven of the contested phrases and is central to the parties' disagreement over the meanings of those phrases. The parties' proposed construction for this term varies with the seven contested phrases. The essential disagreement of the parties, however, is whether the term "telephone call" requires an actual two-way communication or whether, in certain contexts, it simply refers to a demand to set up a telephone connection. The defendants sponsor the former construction, and the plaintiff urges the latter. The parties' respective constructions are set forth below.

In the context of a "first telephone call" and a "second telephone call," the plaintiff proffers a construction of "a first demand to set up a telephone connection" and "a second demand to set up a telephone connection." The defendants' counter-construction of "first telephone call" is "a telephone call, separate from a second telephone call, which is established before a second telephone call is placed." The defendants' proposed counter-construction of "second telephone call" is "a telephone call, separate from a first telephone call, which is placed after a first telephone call is established."

For the term "connecting said first telephone call, said communication link and said second telephone call to thereby establish a telephone call between said first telephone set and said second telephone set," the plaintiff proposes "connecting the first demand for connection, the physical or logical connection between the first and second computer network access ports, and the second demand for connection to thereby establish an arrangement providing for the telephonic exchange of information between the first telephone set and the second telephone set" as a construction. The defendants' counter-construction is simply "bridging the first telephone call and a separate, second telephone call to establish a telephone call between the first telephone set and the second telephone set via the communication link."

The plaintiff argues that the claim refers to a method for "routing a full duplex telephone call between a first telephone set and second telephone set . . . comprising the steps of . . . ." According to the plaintiff, use of the term "routing" in the preamble implies that the claim is focused on the flow of signals necessary to establish a two-way telephone call. The plaintiff also points to the language of the claim limitations, which require (1) "receiving at a first computer network access port a first telephone call from a central office . . ." and (2) "placing a second telephone call from said second computer network access port to said second telephone set . . . ." The plaintiff maintains that it makes little sense for the claim to require the "receipt" or "placement" of an already *established* two-way telephone call. Finally, the plaintiff bolsters its argument by pointing to the last limitation of claim 1, which states "connecting said first telephone call, said communication link and said second telephone call *to thereby establish a telephone call* between said first telephone set and said second telephone set." The plaintiff argues that the italicized phrase reflects that the call set-up phase has occurred and the connection is complete. At the same time, the plaintiff notes that the claim does not recite the steps for establishing intermediate, two-way connections between the telephone sets and the respective computer network access ports. Plaintiff's Opening Brief at 10.

In response, the defendants assert that term "telephone call" is used multiple times in each of the two independent claims, and that the term should have a consistent meaning throughout the claims. The defendants thus argue that the plaintiff's constructions would result in different meanings for the same claim term. The defendants further assert that the specification and prosecution history supports their construction of this term.

In particular, the defendants suggest that the description of the two-stage dialing embodiment implies that claims require the "establishment" of two separate telephone calls. In describing the two-stage dialing embodiment, the specification states:

> As shown in FIG. 2, computer network telephone transmission system 200 is used to provide telephone service between calling station 202 and called station 204. Initially, the user at the calling station dials the number of the specialized computer ITS node 206 at an Internet access port. The local switching office 208 routes the call through PSTN 210 to central office 212 which services specialized computer ITS node 206. *At this point, a call has been established* by way of PSTN 210 between the calling station 202 and the specialized computer ITS node 206.

'373 patent, 6:33-43 (emphasis added). Although the patentee disclaimed this embodiment, the defendants point to the description of the one-stage dialing embodiment to support their argument. As defendants characterize this embodiment, a calling party's telephone set is "hardwired" to a specialized switch through a private branch exchange. '373 patent, Fig. 3. In such an embodiment, the calling party need only dial the number of the called party–the need to dial the number of the computer node is eliminated through the hardwiring process. According to the defendants, the first telephone call is still established between the calling party's set and the computer node by the direct connection. The defendants also point to the written description in which a call placed from the opposite end of the connection would still need to first dial the number of the specialized switch. '373 patent, 7:33-35 ("Of course, calls placed at location 202 must still first dial the telephone number of specialized switch 206, as described above.").

Although the specification is largely devoted to the two-number dialing embodiment, the description uses the term "telephone call" in the manner that the plaintiff suggests is proper. *See, e.g.*, '373 patent at 12:29-33 ("Referring now to FIG. 6, the ICM receives an inbound call indication from the TNIM at step 602. This indicates that the calling party has *initiated* a telephone call. At step 604, the ICM instructs the TNIM to answer the call.") (emphasis added). This passage suggests that the call that is "initiated" (or placed) need only be the demand for a connection.[1] In view of the language of the claims, read in light of the specification and the prosecution history, it appears that the patent uses the term "telephone call" in different ways, depending on the context in which the

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[1] Similarly, the court rejects the prosecution history estoppel arguments raised by the defendants. The defendants base their arguments on certain statements in the prosecution history that are exemplified by the following passage: "Further, the [claimed] invention . . . requires that a first telephone call be placed from the first telephone set *to a first computer network access port*. Williams [a prior art reference] does not appear to disclose such an element. In contrast, Williams discloses the use of a channel bank . . . which scans the telephone instruments . . . in a 'continuous round robin fashion' to sense an off-hook condition which may initiate a call request . . . . Similarly, the [claimed] invention . . . *requires that a second telephone call be placed from the second computer network access port to the second telephone set*." Defendants' Response at A86 (Appeal Brief dated May 15, 2000) (emphasis added). As is evident from this passage, the claims at issue included several limitations that were relied upon by the patentee to distinguish the Williams reference. Therefore, the patentee's statements do not clearly reflect the patentee's intent to limit the scope of his claims to require separate two-way calls, although portions of those statements, when viewed in isolation, are capable of such a reading. *See Amgen, Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1327 (Fed. Cir. 2003) (noting that an amendment to a claim may indicate the patentee's intent to limit his claims).

term is used. As such, the court construes the term "receiving at a first computer network access port a first telephone call" to mean "receiving at a first computer network access port a first demand to set up a telephone connection." Likewise, the court construes "placing a second telephone call from said second computer network access port to said second telephone set" to mean "placing a second demand to set up a telephone connection from the second computer network access port to the second telephone set." However, the patentee used the term "telephone call" differently in the term "to thereby establish a telephone call." In that instance, the call that is "established" references an actual two way communication of information. As a result, the court construes the term to mean "to thereby establish a two way telephonic exchange of information."[2]

B. public computer network; Internet protocol

The claims require establishing a communications link over a public computer network and converting data received from the central office to an Internet protocol. '373 patent, claim 1 ("establishing a communication link over said public computer network . . ." and "converting data received from the public computer network from Internet protocol to a PSTN protocol."); '373 patent, claim 13 ("a communication link over a public computer network. . ." and "a first protocol conversion module converting data received from the central office to an Internet protocol."). The parties dispute the definitions of the terms "public computer network" and "Internet protocol."

The plaintiff's proposed construction of the term "public computer network" is "a computer network available to the public." The defendants' counter-construction is "the ARPANET or the Internet." The defendants argue that these are the only two public computer networks that have existed since the date of the application; therefore, they argue it is appropriate to limit the scope of

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[2] The court's constructions of "telephone call" apply equally to the similar limitations appearing in claim 13.

the claims to such networks. The plaintiff disagrees and points to the language of certain dependent claims which specifically call out the Internet as the computer network. In light of the language of dependent claim 6, which recites that "said computer network is at least a portion of an Internet computer network," the court rejects the defendants' proposed construction. The court defines the term "public computer network" to mean "a computer network available for use by the general public."

The parties also dispute the meaning of the term "Internet protocol." Originally, the plaintiff contended that the term meant "a communications format used to transmit data on the Internet (e.g. TCP/IP and/or UDP/IP)." The defendants contended that the term meant "Internet Protocol, versions 1 through 9." After the claim construction hearing, the plaintiff filed a notice indicating it agreed to the defendants' proposed construction of this term. Any "agreement" was short-lived, however, as the defendants' response was to withdraw their prior construction. They attempted to adopt the plaintiff's originally proposed construction or the construction suggested by the court at the claim construction hearing. Despite the parties' shifts in positions, the court construes claims as a matter of law and is not bound by the parties' proposals or their agreements. The claim language, read in light of the specification, indicates that the term means "a communications format capable of transmitting data over the Internet."

C. central office

The parties also dispute the meaning of the term "central office." The plaintiff contends that the term means "a switching system that terminates a common carrier's customer lines." The defendants contend that the term means "a local switching system in a telephone company building which connects individual subscriber wires to trunks and to other individual subscriber wires."

The patent states:

> Each customer line terminated in a local switching system commonly referred to as a central office (CO). The central office then performed the task of connecting each of the telephone lines it served to a corresponding telephone line in order to complete a call. If the two parties to a call were serviced by the same central office, then the connection could be completed by the same central office without having to resort to other portions of the telecommunications network. If the call required connection to a telephone line serviced by a distant central office, then a connection between the central offices was carried out using a trunk, i.e., a connection between two central offices.

'373 patent at 1:22-33.

In addition to the explicit discussion in the specification, the patent incorporates by reference certain materials. '373 patent at 1:63-65 (incorporating by reference the contents of John Bellamy, *Digital Telephony* (John Wiley & Sons 1991)). This source includes a glossary defining "central office" as follows:

> **Central office**. Usually used to refer to a local switching system that connects lines to lines and lines to trunks. It may be more generally applied to any *network switching system*. The term is sometimes used loosely to refer to a telephone company building in which a switching system is located and to include other equipment (such as transmission system terminals) that may be located in such a building.

John Bellamy, *Digital Telephony* (John Wiley & Sons 1991) (emphasis original). Read in light of the explicit discussion in the specification, the first definition of "central office" given in the glossary appears to be the most appropriate one. As such, the court construes "central office" to mean "a local switching system that connects customer lines to customer lines and customer lines to trunks."

D. PSTN

The plaintiff contends that no construction of the term "PSTN" is necessary but offers an alternative construction of "a telephone network in which connections are established as and when required and that is supplied, operated, and controlled by one or more telecommunications operating companies to provide telephone service that is available to the public." The defendants contend that the term "PSTN" should be construed to mean "the circuit-switched transmission and switching facilities that link central offices." The defendants' construction would exclude central offices from the PSTN.

The defendants contend that Mr. Turock acted as his own lexicographer when describing the term "PSTN" in his patent's specification. In this regard, the defendants cite to Figures 2, 3, and 4, which depict a "PSTN" as a link between central offices, as opposed to the network which links user telephones. The defendants also point to claim 2, which depends from independent claim 1. Claim 1 requires a "first telephone call" to be received from "a central office." Claim 2 further requires the "first telephone call" to be received from "a public switched telephone network." The defendants therefore contend that claim differentiation requires the "PSTN" to be separate from or exclude the "central offices." In this regard, the defendants argue that claim 1 describes the situation where the "first computer network access port" resides at the central office, and that claim 2 describes the situation where the "first computer network access port" resides a distance from the "central office." Under the latter configuration, the defendants argue, that "the first telephone call" must leave the "central office" and travel over the "PSTN" to reach the "first computer network access port."

In response, the plaintiff contends that the term "PSTN" is commonly understood by one of skill in the art to mean "the entire public telephone network," and that Mr. Turock's use of that term in the specification is consistent with this industry definition. The plaintiff also contends that the specification excerpts cited by the defendants do not clearly redefine the term "PSTN" as proposed by the defendants. *See In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994) (requiring "reasonable clarity, deliberateness, and precision" on the part of the inventor in order to redefine a term that has a commonly understood meaning in the art.). Instead, the plaintiff points to other specification passages that contradict the defendants' proposed construction, such as the following passage which suggests that a "PSTN" includes one or more central offices: "The present invention allows anyone with a standard telephone connected to the public switched telephone network (PSTN) to communicate with any other telephone . . . ." '373 patent at 5:20-23.

The plaintiff also points to claim 1 to support its inclusive definition of a "PSTN," which requires the placement of "a second telephone call" from "a second computer network access port" to "a second telephone set" using a "PSTN." This claimed embodiment, the plaintiff argues, indicates the inclusive nature of a "PSTN" because the claim does not separately require two "central offices," the first near the "second computer network access port" and the second near the "second telephone set." In this regard, the plaintiff contends that one of skill in the art would define "PSTN" to include many "central offices."

In view of the above, the court concludes that Mr. Turock did not assign a special meaning to the term "PSTN" in his patent specification, and that this term should therefore carry its meaning as understood by one of skill in the art. In this regard, Mr. Turock's choice to separately depict and claim certain "central offices" is not necessarily inconsistent with a "PSTN" that includes multiple "central offices." It is instead a reflection of Mr. Turock's choice to highlight certain of the "central offices" that he felt would convey an understanding of the attributes of his claimed invention. The court therefore defines the term "PSTN" to mean "the entire public telephone network that includes both central offices as well as those facilities or equipment that link central offices."

E. said first telephone call specifying a telephone number of said second telephone set

The plaintiff contends that this term means "said first demand for connection specifying the telephone number of the second telephone set." The defendants contend that this term means "dialing the telephone number of the called party, where in-channel signaling is employed to transmit that telephone number via the first telephone call received at the first computer network access port."

The defendants' construction would incorporate two limitations–the requirement that the number be "dialed" as well as a requirement that "in-channel signaling" be used to transmit the telephone number of the called party. The defendants fail to support this latter requirement in their brief, and the claim limitation does not require the number to be "dialed." As a result, and in view of the court's construction of "telephone call," the court adopts the plaintiff's construction for this term.

F. first and second telephone switches; computer network telephone switch.

Claims 7 and 8 are dependent claims. Claim 7 requires in part "[t]he method of claim 6 wherein said first and second computer network access ports *are first and second telephone switches* . . . ." '373 patent, claim 7 (emphasis added). Claim 7 also requires "transmitting call setup information from said call initiation module to *said second computer network telephone switch* . . . ." *Id.* (emphasis added). Claim 8 requires "[t]he method of claim 7 further comprising the step of: determining the least cost routing procedure for routing said first telephone call from said *first computer network telephone switch* to said second telephone set." '373 patent, claim 8 (emphasis added). The plaintiff contends that the term "first telephone switch" is synonymous to "first computer network telephone switch" and the term "second telephone switch" is synonymous to "second computer network telephone switch." The defendants contend that the claims are indefinite because the terms "first and second computer network telephone switches" lack antecedent basis in the claims. The court is persuaded, however, that one of skill in the art would read the claims in the manner proposed by the plaintiff. As such, the court rejects the indefiniteness argument. *Energizer Holdings, Inc. and Eveready Battery Co., Inc. v. International Trade Comm'n*, 435 F.3d 1366, 1370-71 (Fed. Cir. 2006).

Alternatively, the defendants contend that the terms "first and second telephone switches" should be construed to mean "first and second devices used for opening, closing, or changing the connection of one or more circuits related to telephone communications." The plaintiff contends that the term "switch" needs no further construction. The court agrees with the plaintiff. Absent some showing that there is a dispute as to claim scope over the meaning of these terms, the court declines to construe the terms "first and second telephone switch."

G. first protocol conversion module converting data received from the central office to an Internet protocol; second protocol conversion module converting data received from the public computer network from Internet protocol to a PSTN protocol

The "protocol conversion module" terms are present in independent claim 13. The defendants contend that these terms should be construed in accordance with Section 112(6) because of the inclusion of the term "module" within each term. The defendants go on to suggest that the "conversion modules" execute software to achieve the claimed functionality, and that the specification fails to disclose adequate structure corresponding to the software functionality, *i.e.* a software algorithm. The defendants therefore contend that claim 13 is invalid.

The plaintiff contends that the "protocol conversion module" terms are not written in meansplus-function form, and that they are therefore not subject to the provisions of Section 112(6). The plaintiff's proposed construction for "first protocol conversion module converting data received from the central office to an Internet protocol" is "a hardware and/or software module that converts data from a PSTN protocol to an Internet protocol." The plaintiff's proposed construction for "second protocol conversion module converting data received from the public computer network from Internet protocol to a PSTN protocol" is "a hardware and/or software module that converts data received from the public computer network from an Internet protocol to a PSTN protocol."

The court rejects the defendants' contention that Section 112(6) is invoked by the use of the term "module." The relevant limitations do not use to word "means" and therefore a presumption applies that they are outside the scope of Section 112(6). The defendants have not rebutted that presumption in this case. The court therefore defines the term "first protocol conversion module converting data received from the central office to an Internet protocol" to mean "a hardware and/or software module that converts data from a PSTN protocol to an Internet protocol," and the term "second protocol conversion module converting data received from the public computer network from Internet protocol to a PSTN protocol" to mean "a hardware and/or software module that converts data received from the public computer network from an Internet protocol to a PSTN protocol."

H. placed from said first telephone set

The plaintiff contends that no construction of this term is required. The defendants' proposed construction of this term is "placed from a standard telephone (without requiring additional user equipment, *e.g.*, a computer or a modem)." The defendants tersely base their proposed construction on a passage from the specification, and a comment from an interview summary dated

May 6, 1997. The court has carefully reviewed the patentee's specification, as well as the interview summary and corresponding office action and response. *See* Defendants' Response at A244-73. In view of the intrinsic record, the court rejects the defendants' proposed construction and defines "telephone set" to mean a "telephone." *See* Defendants' Response at A270 (January 29, 1997 Amendment and Response to Office Action).

I. telephone network interface device; **public switched telephone network interface circuit**; **voice resources module**; **determining the least cost routing procedure for routing; a hierarchical search based on information indicative of said second telephone set**

The defendants failed to brief their proposed constructions for the above terms, directing the court instead to the Joint Claim Construction and Prehearing Statement. *See* Brief of Defendants at 30, n. 8. The court rejects this approach and declines to construe unbriefed terms.

5. Conclusion

The court adopts the above constructions. The parties are ordered that they may not refer, directly or indirectly, to each other's claim construction positions in the presence of the jury. Likewise, the parties are ordered to refrain from mentioning any portion of this opinion, other than the actual definitions adopted by the court, in the presence of the jury. Any reference to claim construction proceedings is limited to informing the jury of the constructions adopted by the court.

APPENDIX 5

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

C2 COMMUNICATIONS TECHNOLOGIES., INC.,	§ § §	
vs.	§	Case No. 2:06-CV-241
AT&T, INC., ET AL.	§ §	

ORDER

The court has considered the parties' supplemental briefing regarding the term "an Internet protocol." In light of that briefing, the court clarifies that "an Internet protocol" means "a communications format capable of transmitting data over, on, or across the Internet."

The court grants Defendants' Joint Motion in Limine #9(1).

The court denies Plaintiff's Motion in Limine #25.

The court grants Plaintiff's Motion in Limine #26, and excludes any reference and evidence related to any determination by the PTO that the Huang patent was invented before the '373 patent.

APPENDIX 6

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

C2 Communications Technologies, Inc. Plaintiff, v. AT&T, Inc. et al. Defendants.	Civil No. 2:06-CV-241 (TJW)

DEFENDANTS' MOTION FOR SUMMARY JUDGMENT THAT THE ASSERTED CLAIMS ARE INVALIDATED BY THE DOSHI PATENT

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STATUTES AND REGULATIONS

Pursuant to Federal Rule of Civil Procedure 56, Defendants Global Crossing Telecommunications, Inc., Level 3 Communications, LLC and Qwest Communications Corporation ("Defendants") respectfully move for complete summary judgment that asserted claims 1, 2, and 6 of U.S. Patent No. 6,243,373 ("the '373 Patent") are invalid (1) because they are anticipated by U.S. Patent Nos. 5,568,475 ("Doshi") under 35 U.S.C. § 102 and (2) because they are obvious under 35 U.S.C. § 103 in light of Doshi and other prior art.

STATEMENT OF THE ISSUES TO BE DECIDED BY THE COURT

1. Whether Doshi invalidates the asserted claims of the '373 Patent as a matter of law because it discloses every element in those claims.

2. Whether the asserted claims of the '373 Patent are invalid as a matter of law because they are obvious from Doshi in combination with other prior art or elements of digital telephony familiar to persons skilled in the art.

SUMMARY OF GROUNDS FOR MOTION

The undisputed facts show clearly and convincingly that Doshi discloses every element of the claims of the '373 Patent asserted in this case. As a matter of law, therefore, those claims are invalid under 35 U.S.C. § 102 on grounds of anticipation.

The undisputed facts further show clearly and convincingly that any differences between the asserted claims and Doshi would have been obvious to a person skilled in the art from a combination of Doshi with either other prior art or familiar known elements of digital telephony. As a matter of law, therefore, the asserted claims are invalid under 35 U.S.C. § 103 on grounds of anticipation.

STATEMENT OF UNDISPUTED MATERIAL FACTS

I. The Asserted Claims of the '373 Patent

1. The '373 Patent was filed November 1, 1995 and issued June 5, 2001.[1] Ex. A at cover page ['373 Patent].

2. C2 is only asserting claims 1, 2, and 6 of the '373 Patent against the Defendants. Ex. B at Appendices A-C [C2's Second Supplemental Responses to Defendants' Joint Interrogatories served on June 12, 2008].

3. Claim 1 of the '373 Patent is the only independent claim asserted against the Defendants. Claim 1 reads:

> 1. A method of routing a full duplex telephone call between a first telephone set and a second telephone set using a public computer network as at least part of a communication link connecting said first and second telephone sets, comprising the steps of:
> receiving at a first computer network access port a first telephone call from a central office placed from said fi[r]st telephone set initiating said full duplex telephone call, said first telephone call specifying a telephone number of said second telephone set, without specifying additional telephone destinations;
> converting data received from the central office to an Inte[r]net protocol;
> establishing a communication link over said public computer network between said first computer network access port and a remote second computer network access port;
> placing a second telephone call from said second computer network access port to said second telephone set using a PSTN;
> converting data received from the public computer network from Inte[r]net protocol to a PSTN protocol; and
> connecting said first telephone call, said communication link and said second telephone call to thereby establish a telephone call between said first telephone set and said second telephone set.

Ex. A at claim 1 ['373 Patent].

4. In responses to written discovery, C2 contends that Doshi does not disclose two claim limitations: (1) converting data to or from a PSTN format to an Internet Protocol; and (2)

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[1] Pursuant to Local Rule CV-56, Defendants submit summary judgment evidence behind lettered Exhibits to the accompanying Declaration of B.D. Daniel.

a public computer network that is "at least a portion of an Internet computer network," Ex. J at 3-5. Under the current claims construction, however, the evidence demonstrates beyond dispute that Doshi does in fact disclose these limitation.

5. Asserted claim 2 reads: "The method of claim 1 further comprising the step of: receiving said first telephone call from a public switched telephone network." Ex. A at claim 2 ['373 Patent].

6. Asserted claim 6 reads: "The method of claim 2, wherein said computer network is at least a portion of an Internet computer network." Ex. A at claim 6 ['373 Patent].

II. The Doshi Patent

7. U.S. Patent No. 5,568,475, entitled "ATM Network Architecture Employing an Out-of-Band Signaling Network" and identifying Bharat T. Doshi, et al. as inventor, was filed December 21, 1994 and issued October 22, 1996 to Lucent Technologies, Inc.. Ex. D at cover page.

8. Doshi is prior art to the '373 Patent under 35 U.S.C. § 102(e) & (g).

9. Former Defendant Sprint Communications, Inc. ("Sprint") in Invalidity Contentions served under P.R. 3-3 identified the disclosure in Doshi for every element of Independent Claim 1 of the '373 Patent. Defendants' Invalidity Contentions incorporated Sprint's Invalidity Contentions. Ex. E, at 3 & Table 1; Ex. F, at 4.

10. Doshi describes an architecture for receiving telephone calls from a PSTN, converting the voice data from a PSTN protocol to an Asynchronous Transfer Mode ("ATM") protocol for transport through an ATM network, and conversion of the voice data from the ATM protocol to the PSTN protocol to reach the called party. Exhibit D, at 2:61-3:19 ['475 Patent].

11. Under the Court's order construing "Internet protocol" as "a communications format capable of transmitting data over the Internet," an ATM protocol is an "Internet protocol" because packets in ATM format are capable of transmitting data over the Internet. Ex. G, Depo. of Bharat Doshi, at 28-29, 37-38, 42-44; Ex. H, at Abstract [RFC 1577]; Ex. I at Abstract [RFC 1755].

12. As of the filing date of the '373 Patent, it was well-known in the art that Internet Protocol ("IP") traffic could be sent over ATM networks. Ex. J at 1 [C2 Response to RFA 1]; Ex. I at [RFC 1755]; Ex. H at [RFC 1577]. Ex. G at 43-44 [Doshi Dep.].

13. Doshi discloses receiving a first telephone call from a central office. Ex. J at 3. [C2's Response to RFA 5]; Ex. G at 34-35 [Doshi Dep.].

14. Doshi describes a system in which a first demand to set up a telephone connection specifies a second telephone set without specifying additional telephone destinations. Ex. G at 27 [Doshi Dep.]; Ex. J at 3 [C2's Response to D's RFA 6]; Ex. D at 8:41-44 ['475 Patent].

15. Doshi discloses placing a second telephone call from a second computer network access port to a second telephone set using the PSTN. Ex. D at Figures 1 & 6, 9:20-25 ['475 Patent].

16. The Doshi Patent discloses converting data received from the central office to an Internet protocol. See, e.g., Ex. D at Figures 1 & 6, 7:27-31 and 8:52-54 ['475 Patent]; Ex. G at 27-28, 43-44 [Doshi Dep.].

17. In Figure 1, Doshi discloses converting voice signals received from a central office into ATM cells. "[T]he [voice] sample is presented to STM/ATM Terminal Adaptor 210. TA 210, more particularly, is arranged to pack samples of voice signals as they are received from

STM switch 25 via trunk (channel) 1 of trunk group 27 into an ATM cell." See Ex. D at col. 7: 27-31 ['475 Patent].

18. Figure 6 of Doshi likewise discloses converting data from a PSTN network into an Internet protocol. See Ex. G at 32-33 [Doshi Dep.]; Ex. D at Figure 6 ['475 Patent].

19. Doshi discloses converting data from an Internet protocol to a PSTN protocol. Ex. G at 32-33[Doshi Dep.]; Ex. D at Figures 1 and 6 ['475 Patent].

20. Doshi discloses establishing a communication link over a public computer network between a first computer network access port and a second computer network access port. Ex. D at Figures 1 & 6; Ex. G at 25, 30 [Doshi Dep.].

21. Based on the currently ordered construction of "a public computer network" as "a computer network available to the general public," Doshi discloses a public computer network. Ex. G at 21, 25 [Doshi Dep.].[2]

22. Doshi discloses connecting the first telephone call, the second telephone call, and the communication link to thereby establish a telephone call between the first telephone set and the second telephone set: "[w]hen the station S4 [second telephone set] answers the call, the station S3 [first telephone set] user may begin to communicate with the station S4 user via the virtual connections that are respectively established by switches 215 and 220 as they are needed." Ex. D at 9:44-48 ['475 Patent]; Ex. G at 33-34 [Doshi Dep.].

23. Doshi discloses a computer network that is at least a portion of an Internet computer network. Ex. G at 35-36 [Doshi Dep.].

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[2] By referring to the currently ordered claims construction [Document 219] as the necessary basis for this motion, Defendants do not waive their timely filed Objections to certain of those constructions.

24. Doshi was not disclosed to the Patent Office during prosecution of the '373 patent. The Patent Office was not aware of Doshi as it was considering issuance of the '373 patent.

III. The Gordon Patent

25. U.S. Patent No. 5,568,786, entitled "Unified Messaging System and Method" and identifying Gordon as inventor ("Gordon"), was filed February 13, 1995 and issued March 4, 1997 to Alphanet Telecom, Inc. Ex. K, at cover page ['786 Patent].

26. Gordon is prior art to the '373 Patent under 35 U.S.C. § 102(e) & (g).

27. When Gordon was raised during prosecution of the '373 patent, Turock sought to distinguish Gordon solely on the basis that Gordon used two-stage dialing. Ex. L; Ex. M at 4; Ex. N at 8-9; Ex. O at 5.

28. Gordon discloses conversion of voice data from PSTN format to Internet Protocol format. Ex. K at Figure 5, 8:62-9:17 ['786 Patent].

29. Gordon discloses transmission of digital voice packets over the Internet. Ex. K at Figure 5, 8:62-9:17, 10:6-9 ['786 Patent].

IV. Information Available in 1995 to Those Skilled in the Art

30. As demonstrated in *Digital Telephony* by Bellamy, published in 1991, a variety of packet switching technologies were in active use in the mid-1990's, including ATM protocol and Internet protocol networks. Ex. P at 5, 364, 395. This Bellamy publication was incorporated by reference into the '373 patent at column 1, lines 61-65. Ex. A ['373 Patent].

31. Other references from 1995 listed in the '373 patent refer to telephone service over the Internet. Ex. Q [RFC 1789].

V. The Huang Patent and Draft Application

30. U.S. Patent No. 7,336,649, entitled "Hybrid Packet-Switched And Circuit-Switched Telephony System" and identifying Alex Huang as inventor, was filed December 20, 1995 and issued February 26, 2008. Ex. S, at cover page ['649 Patent].

31. On May 26, 1995, Mr. Huang sent to his patent attorney an amended draft patent application that included a single-number dialing embodiment. Ex. R at 954-962; Ex. T at 69-71 [Huang Dep.]

ARGUMENT

I. Anticipation and Obviousness May Be Resolved by Summary Judgment

Every U.S. patent enjoys a statutory presumption of validity. 35 U.S.C. § 282. And the Federal Circuit has interpreted the presumption to require proof of invalidity by clear and convincing evidence. *Liebel-Flarsheim Co. v. Medrad, Inc.*, 481 F.3d 1371, 1381 (Fed. Cir. 2007); *Zenith Electronics Corp. v. PDH Communication Systems, Inc.*, 522 F.3d 1348, 1364 (Fed. Cir. 2008).[3] Nevertheless, summary judgment may be granted on grounds of anticipation or obviousness.

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3 In order to preserve error, Defendants respectfully submit that under the Patent Act, properly construed in accordance with established Supreme Court authority, the appropriate burden of proof for establishing the facts relating to invalidity should be by a preponderance of the evidence. *See, e.g., Grogan v. Garner*, 498 U.S. 279 (1991); *see also Thomas v. Nicholson*, 423 F.3d 1279, 1283-85 (Fed. Cir. 2005) (following *Grogan* and concluding a preponderance of the evidence burden applies to resolve whether the presumption of 38 U.S.C. § 105(a) that a veteran's injury is service-related is overcome); *St. Paul Fire & Marine Ins. Co. v. U. S.*, 6 F.3d 763, 769 (Fed. Cir. 1993) (applying preponderance standard to resolve whether the presumption of correctness for certain U.S. Customs decisions is overcome); *Stratoflex v. Aeroquip*, 713 F.2d 1530, 1535 (Fed. Cir. 1983) (earliest Federal Circuit case on point, holding that presumption of patent validity merely governs the burden of going forward). In addition, the Supreme Court recently questioned the applicability of the presumption of validity when the Patent Office has not considered relevant prior art. *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727, 1745 (2007). In any event, Defendants submit that there is clear and convincing evidence of anticipation and obviousness in this case.

The "ultimate conclusion of obviousness is a question of law." *Agrizap, Inc. v. Woodstream Corp.*, 520 F.3d 1337, 1343 (Fed. Cir. 2008); *see KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1745 (2007). As the Supreme Court's decision in *KSR* demonstrates, therefore, it is entirely proper to grant summary judgment that patent claims are obvious as a matter of law. 127 S. Ct. at 1745-46 (specifically upholding district court's grant of obviousness summary judgment); *see Agrizap*, 520 F.2d at 1342-44 (finding obviousness as a matter of law despite jury finding against obviousness).

Likewise, even though the anticipation defense raises "a question of fact," anticipation too "may be resolved on summary judgment if there is no genuine issue of material fact." *Zenith*, 522 F.3d at 1356-57 (upholding summary judgment of anticipation at 1355-59); *Zenith,* 522 F.3d at 1364; *Liebel-Flarsheim*, 481 F.3d at 1380-83 (upholding summary judgment of anticipation); *see also Finisar Corp. v. DirecTV Group, Inc.*, 523 F.3d 1323, 1334-38 (Fed. Cir. 2008) (reversing denial of motion for judgment as a matter of law on grounds of anticipation).

II. Doshi Anticipates The Asserted Claims Of The '373 Patent.

Under 35 U.S.C. § 102(e)(2), "A person shall be entitled to a patent unless . . . the invention was described in…a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent." Anticipation occurs when such an invention exists that describes the invention in the patent at issue.

A. Invalidity for Anticipation Under U.S.C. § 102(e)

"A determination that a patent is invalid as anticipated under 35 U.S.C. § 102 requires that a prior art reference disclose every limitation of the claimed invention, either explicitly or inherently." *Liebel-Flarsheim Co. v. Medrad, Inc.*, 481 F.3d 1371, 1381 (Fed. Cir. 2007).

B. Doshi Discloses Every Limitation Of Claims 1 and 6 Of The '373 Patent.

In its responses to written discovery, C2 contends that Doshi does not disclose two claim limitations: (1) converting data to or from a PSTN format to an Internet Protocol; and (2) a public computer network that is "at least a portion of an Internet computer network." Ex. J at 3-5. Under the current claims construction, however, the evidence demonstrates beyond dispute that Doshi does in fact disclose these limitations. Thus, the uncontested facts clearly and convincingly establish that Doshi predates the '373 Patent and that it discloses the following limitations of claim 1:

> (a) a method of routing a full duplex telephone call between a first telephone set and a second telephone set using a public computer network as at least part of a communication link connecting said first and second telephone sets,
>
> (b) receiving at a first computer network access port a first telephone call from a central office placed from said first telephone set initiating said full duplex telephone call, said first telephone call specifying a telephone number of said second telephone set, without specifying additional telephone destinations,
>
> (c) establishing a communication link over a computer network between said first computer network access port and a remote second computer network access port,
>
> (d) placing a second telephone call from said second computer network access port to said second telephone set using a PSTN,
>
> (e) converting data received from the computer network from Internet protocol to a PSTN protocol; and
>
> (f) connecting said first telephone call, said communication link and said second telephone call to thereby establish a telephone call between said first telephone set and said second telephone set.

Statement of Undisputed Material Fact ("SOF") ¶¶ 9-23.

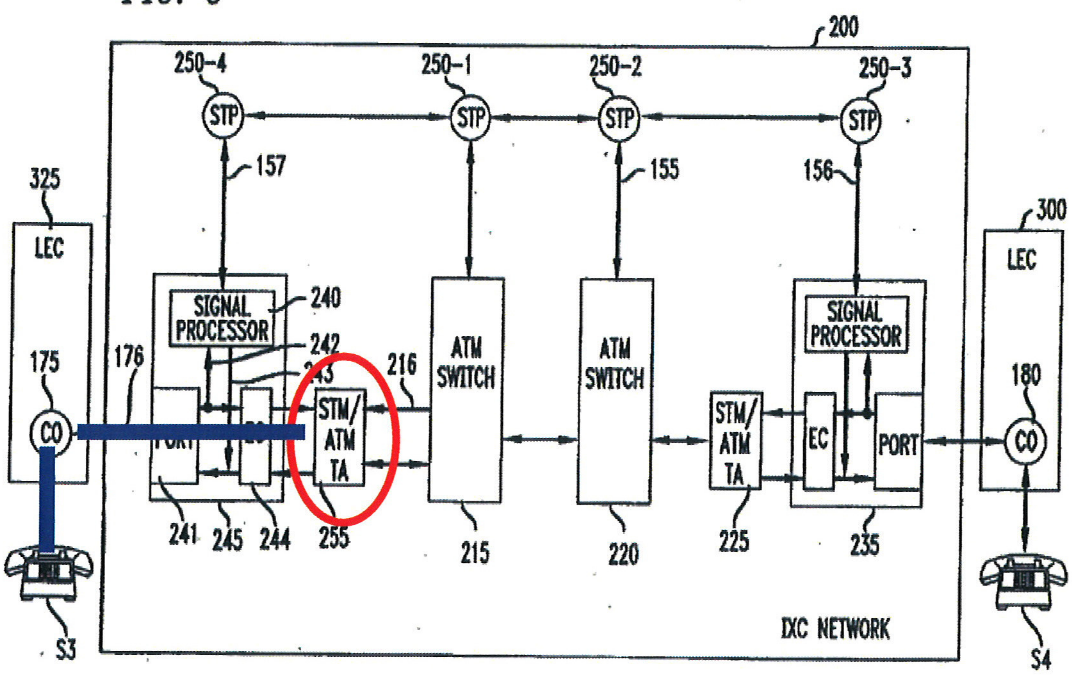
1. Doshi Discloses "Converting Data Received From A Central Office To An Internet Protocol."

As Dr. Doshi himself explained at deposition, there was activity going on in 1994 to determine standards for carrying "Internet Protocol Version 4 at that time, over ATM." Ex. G, at

28-29. Indeed, ATM network[s] . . . have been used as part of the Internet." Ex. G at 38. As additional evidence confirms beyond dispute, the ATM protocol deployed in Doshi is an "Internet protocol" under the Court's claims construction because the ATM protocol is "a communications format capable of transmitting data over the Internet." SOF ¶¶ 11-12.

Doshi then clearly discloses converting a phone call received from a central office in Synchronous Transmission Mode (STM) to the ATM Internet protocol "STM/ATM" using a Terminal Adapter (TA) illustrated in Figures 1 (210) and 6 (255) of Doshi. SOF ¶ 17. Doshi Figure 6 is reproduced below.

FIG. 6



Ex. D ['475 Patent]. Figure 6 clearly shows that the PSTN signal from phone set S3 that has traversed the PSTN through central office 175 is converted at Terminal Adaptor 255 from STM (Synchronous Transfer Mode) to ATM format.

2. Doshi Discloses "A Public Computer Network" That Is At Least A Portion Of The Internet.

The facts are likewise incontestable that Doshi discloses the "public computer network" of the '373 Patent, which the court has construed to be a "computer network that is available for use by the general public," Ex. C, Document 219 at 13. Specifically, Doshi discloses, between the central offices (CO) 25 and 50 in Figures 1 and 6, a graphic representation of the "IXC Network" operated by AT&T to carry voice and data traffic. SOF ¶ 22; Ex. D at Figures 1 & 6 ['475 Patent]. The ATM network described in Doshi is clearly "a computer network available to the general public," i.e., one that consisted of computers used by the public, and carried data as well as voice. SOF ¶¶ 10-12. Dr. Doshi confirmed during his deposition that the ATM Network disclosed in Doshi was available to "public computers."

> A: ...The middle box represents the new technology, the computer data network that we are talking about, and devices that interface the two. So at a high level, that's what the physical architecture is.
> ...
> Q: And, then, in the middle, you have the box that you referred to that's the IXC network?
> A: That is correct, that is interexchange carrier network.
> Q: Okay. And that's a public computer network?
> ...
> THE WITNESS: That is a public—IXC stands for in interexchange carrier network. In this case, it is a public data network and can be used by public computers.

Ex. G at 19-21; *see also* Ex. D at Figure 1, 3:53-4:14 ['475 Patent] (referring to IXC network as a public computer network).

C. Doshi Discloses Every Element Of Claim 2 Of The '373 Patent.

It is undisputed that Doshi also discloses the limitations of dependent claim 2, which merely adds to claim 1 the following limitation: "receiving the first telephone call from a public switched telephone network." SOF ¶¶ 9-23. As reflected in Figure 6, reproduced above, Doshi discloses receiving the first telephone call at the first network access port 241 from a telephone set S3 through a central office (CO) 175 of a LEC or local exchange carrier. Dr. Doshi explained:

> Q: Now, for the next questions, continue to assume that first telephone call means a first demand to set up a telephone call.
> A: Okay.
> Q: All right, now, with that in mind, looking at Figure 6, does it describe or show receiving a first telephone call from a public switched telephone network?
> A: Yes, it does.
> Q: And where is that shown in Figure 6, sir?
> A: You can see that coming on the Link 176 from Central Office 175, which is part of the public switch telephone network, into the port. And part of the data that's coming in will be the signaling message that asks for a call set up.
> Q: And –
> A: And that is the demand that we're talking about.

Ex. G at 34-35 [Doshi Dep.]. Traditional phone set connections to a LEC central office and the lines that connect with central offices clearly constitute the PSTN under the claims construction order. Ex. C, Document 219 at 16.

D. Doshi Discloses the Additional Element of Dependent Claim 6

Dependent claim 6 adds a limitation that the public computer network at least be a portion of the Internet. As Dr. Doshi explained, the public computer network disclosed in his patent is considered to be a portion of the Internet by persons skilled in the art.

> A: The Internet allows various types of subnets or subnetworks, and the part between the two terminal adaptors [the IXC Network of Figures 1 & 6 in Doshi] can be considered part of the Internet.
> Q: Now is that just your understanding or industry understanding?
> A: That was the industry understanding when we were doing this work, yes.

Ex. G at 36. RFC 1577, entitled "Classical IP and ARP over ATM," discusses the use of Internet protocols and confirms that ATM networks like IXC were part of the Internet. Ex. H at Page 1. It "defines an initial application of classical IP and ARP in an Asynchrous Transfer Mode

(ATM) network environment configured as Logical IP Subnetwork (LIS)…" *Id.* RFC 1577 goes on to discuss "the application of ATM as a direct replacement for the "wires" and local LAN segments connecting IP end-stations ("members") and routers operating in the "classical" LAN-based paradigm" *Id.*

E. Conclusion

Because under the uncontested facts, Doshi clearly and convincingly discloses each and every element of claims 1, 2, and 6 of the '373 Patent, Defendants respectfully submit that they are entitled to summary judgment that the asserted claims are invalid as anticipated.

III. The Asserted Claims Of The '373 Patent Are Obvious Under 35 U.S.C. § 103(a)

Even if the Doshi patent does not clearly and convincingly disclose all the elements of the '373 patent, any missing elements would have been obvious to a person skilled in the art at the time of the '373 patent application from either the Gordon patent or other information familiar to those skilled in digital telephony. Huang's invention clearly and convincingly demonstrates that a person skilled in the art would have combined the single-number dialing of Doshi with Internet transmission of voice calls.

A. Invalidity for Obviousness Under Section 103(a)

Even absent anticipation, the Patent Act provides that a "patent may not be obtained . . . if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." 35 U.S.C. § 103(a). The Supreme Court has recently reconfirmed the analysis required under section 103:

> "Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined. Such

> secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented."

KSR Int'l Co. v. Teleflex, Inc., 127 S. Ct. 1727, 1734 (2007), quoting *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17-18 (1966).

"The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727, 1739 (2007). Under *KSR*, when a strong prima facie case of obviousness is established under the primary determinations, any secondary evidence of obviousness becomes immaterial, leaving the effected claims obvious and invalid as a matter of law. 127 S. Ct. at 17 ; *accord, Agrizap, Inc. v. Woodstream Corp.*, 520 F.3d 1337, 1343-44 (Fed. Cir. 2008) (rejecting jury verdict to hold claims obvious); *Leapfrog Enterprises, Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1160-63 (Fed. Cir. 2007).

B. Using the Internet to Accomplish Doshi's One-Stage Dialing Would Have Been Obvious to a Person of Skill in the Art

The uncontestable clear and convincing evidence demonstrates conclusively that using the one-stage dialing method of Doshi to transmit telephone calls in ATM format over the Internet would have been obvious to one skilled in the art. It would have been obvious to combine Doshi with familiar internet telephony art. It would likewise have been obvious to combine Doshi with the internet telephony disclosed in Gordon. These conclusions are clearly and convincingly proved by the draft patent application in May 1995 prepared by Mr. Huang, which plainly described a combination of single-number dialing, ATM transmission, and Internet telephony.

1. Use of the Internet As Telephony Was a Familiar Element in the Art

The industry publication incorporated into the '373 patent, Bellamy's *Digital Telephony*, establishes that a person skilled in the art, like Turock, would have considered ATM and IP transmission technology interchangeable if not identical. SOF 30. More generally, the publications from 1995 found by the examiner and listed as prior art references in the '373 patent demonstrate conclusively that in 1995, a person skilled in the art, like Turock, would have considered a combination of the known single-dialing method of Doshi with the familiar concept of Internet telephony to yield the predictable result of telephone call transmission by means of an Internet-based method to conventional long distance facilities. SOF 11, 12.

2. Gordon Supplies Any Element Missing in Doshi

Copied below is Figure 5 of the Gordon patent

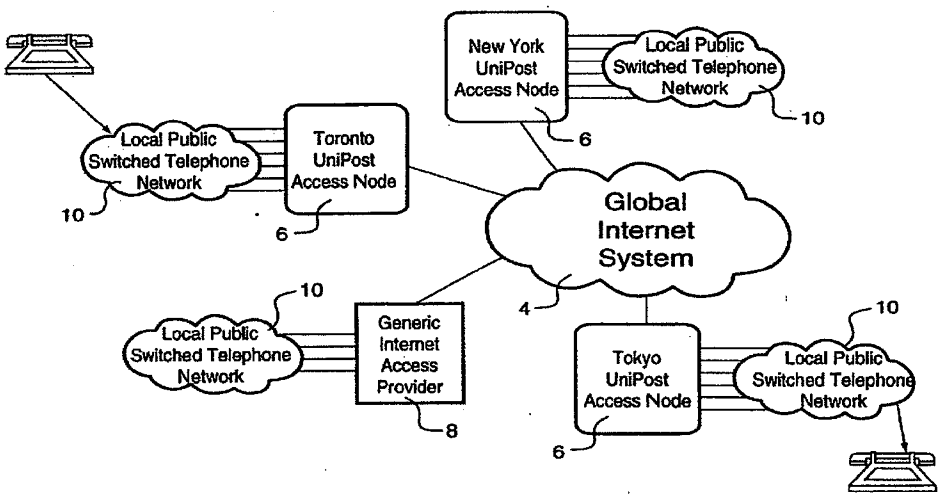


FIG. 5

According to Gordon, this figure "shows how this Unipost system can be used for providing a direct telephone link using the data transmission network involving Internet." Ex. K at 8:62-64. Just as with Doshi and the '373 Patent, figure 5 shows long distance, and even international, telephone calls originating and terminating in the PSTN being transmitted over the Internet. As with the '373 patent, Gordon explains that its method can provide subscribers with a cost advantage for international and long distance calls. Ex. K at 8:67-9:4 ['786 Patent].

Gordon then explains that the phone calls received from the local PSTN are converted into Internet protocols at the Unipost Access Node, each of which must be "able to accept and digitize phone calls." Ex. K at 9:6-7 ['786 Patent]. These conversions by digitization are clearly conversions of data received from a central office under the Court's construction of the PSTN as including "central offices." Ex. C at 16. Further, according to Gordon, this "communication link" over the Internet "utilizes protocols and routing logic which ensures that the digitized voice packets remain in sequence from sender to recipient." Ex. K at 9:7-9 ['786 Patent]. These protocols are clearly within the Court's construction of "Internet Protocol" as a "communications format capable of transmitting data over the Internet." Ex. C at 13. Gordon undeniably discloses the element of converting PSTN data into Internet Protocol.

The Internet, of course, is the quintessential "public computer network" referenced in the asserted claims of the '373 Patent. Gordon therefore undeniably discloses a "public computer network" that is at least a portion of the Internet.

3. Huang Made the Key Combination in May 1995

Before analyzing the Huang material, Defendants want to make clear why Huang is being presented here. Defendants base a separate motion on Huang's prior invention. Prior invention is not material here. Instead, to establish obviousness, Defendants are using the Huang material as evidence that a person skilled in the art actually combined the pertinent elements in 1995 prior to the filing date of the '373 patent.

In that context, it is clear and convincing that the Huang draft application combines the key elements of Doshi and Gordon. Huang discloses calls through a Local Exchange Carrier in the PSTN "from any telephone." Ex. R at Fig. 1a [HS000956]. The application discloses a method for single-stage dialing in this context. Ex. R at Fig. 1b [HS00957]. The application graphically displays routing a call from the LEC through an originating Gateway computer and across a packet-switched network to a terminating Gateway computer. Ex. R at Fig. 2 [HS000958]. In describing the operation of the invention, the application notes "that the emerging Asynchrous Transfer Mode (ATM) networking is treated in this context as a special case of packet-switched networking." Ex. R at [HS000959]. The application then cites "the IP address of the Internet" as an example of its "packet network address." Ex. R at [HS000960]. The application similarly describes the emergence of products "to use Internet, which is a set of interconnected packet-switched networks, for telephony." Ex. R at [HS000962]. The Huang application clearly and convincingly proves that a person of skill in the art would have readily swapped the ATM of Doshi with Internet Protocol networking in order to use one or more constituent packet networks comprising the Internet – and thus the quintessential "public computer network" – as part of a method for routing calls originating in the PSTN.

Accordingly, it is beyond genuine dispute that a person skilled in the art would have found it obvious to combine the one-stage dialing in Doshi with the Internet based method of Gordon in order to yield a predictable result. Both Doshi and Gordon, like Huang, are directed to the same problem of conveniently and advantageously combining existing communications channels – specifically PSTNs – with packet-based computer networks. *See* Ex. K at Abstract ['786 Patent]; Ex. D at 2:26-50 ['475 Patent].

C. Conclusion

The prima facie case of obviousness under the primary *Graham/KSR* considerations is therefore at least as strong as the prima facie cases in *KSR*, *Agrizap* and *Leapfrog*. Defendants respectfully submit that, as in *KSR*, the uncontested facts of this case warrant entry summary judgment of invalidity for obviousness.

CONCLUSION

For the foregoing reasons, Defendants respectfully request that the Court enter summary judgment that the asserted claims of the '373 Patent are invalid as anticipated by Doshi or obvious either from Doshi and familiar methods or a combination of Doshi with Gordon.

Respectfully submitted,

By: ______________________

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CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing document was served in compliance with the Federal Rules of Civil Procedure via electronic mail on all counsel of record on the 3rd day of July, 2008.

B.D. Daniel

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

C2 Communications Technologies, Inc.

Plaintiff,

v.

AT&T, Inc. et al.

Defendants.

Civil No. 2:06-CV-241 (TJW)

[PROPOSED] ORDER

ORDER GRANTING
DEFENDANTS' MOTION FOR SUMMARY JUDGMENT THAT THE
ASSERTED CLAIMS ARE INVALIDATED BY THE DOSHI PATENT

On this date came for consideration Defendants Global Crossing Telecommunications, Inc., Level 3 Communications, LLC and Qwest Communications Corporation ("Defendants") Motion for Summary Judgment That the Asserted Claims are Invalidated by the Doshi Patent. The Court being of the opinion that same should be GRANTED, it is therefore,

ORDERED that Defendants' Motion for Summary Judgment That the Asserted Claims are Invalidated by the Doshi Patent be and hereby is GRANTED.

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

C2 COMMUNICATIONS TECHNOLOGIES, INC.	§ §	
	§	CIVIL NO. 2:06-CV-241(TJW)
V.	§ §	
AT&T, INC., ET AL.	§	

DECLARATION OF B.D. DANIEL

I, B.D. Daniel, pursuant to the provisions of 28 U.S.C. § 1746, declare as follows:

1. I am Of Counsel in the firm of Beck, Redden & Secrest LLP in Houston, Texas, attorneys for Defendants Level 3 Communications, LLC, Qwest Communications Corporation and Global Crossing Telecommunications, Inc. ("Defendants") in the above-captioned case. I submit this declaration in support of Defendants' Motion for Summary Judgment That the Asserted Claims are Invalidated by the Doshi Patent.

2. Attached hereto behind Tab A is a true and correct copy of the U.S. Patent No. 6,243,373.

3. Attached hereto behind Tab B is a true and correct copy of Appendices A-C from Plaintiff's Second Supplemental Objections and Responses to Defendants' First Set of Common Interrogatories (Nos. 3-6).

4. Attached hereto behind Tab C is a true and correct copy of Document 219, Memorandum Opinion and Order dated June 13, 2008 in this cause of action.

5. Attached hereto behind Tab D is a true and correct copy of the U.S. Patent No. 5,568,475.

6. Attached hereto behind Tab E are true and correct copies of excerpts from Sprint Communications Co., L.P.'s Preliminary Invalidity Contentions dated May 18, 2007 in this cause of action.

7. Attached hereto behind Tab F is a true and correct copy of excerpts from Invalidity Contentions of Defendants AT&T Corp., Bell Atlantic Communications, Inc., GTE Southwest, Inc., Verizon North, Inc., MCI Communications Services, Inc., Verizon Global Networks, Inc., MCIMetro Access Transmission Services, LLC, Verizon Select Services, Inc., Teleconnect Long Distance Services and Systems Co., Qwest Communications Corp., Bellsouth Telecommunications, Inc., Global Crossing Telecommunications, Inc., and Level 3 Communications LLC.

8. Attached hereto behind Tab G is a true and correct copy of excerpts from the deposition transcript of Bharat Doshi taken in this cause of action on May 23, 2008.

9. Attached hereto behind Tab H is a true and correct copy of Request for Comments: 1577, which was produced in this cause of action.

10. Attached hereto behind Tab I is a true and correct copy of Request for Comments: 1755, which was produced in this cause of action.

11. Attached hereto behind Tab J is a true and correct copy of excerpts from Defendants' First Set of Common Requests for Admissions (Nos. 1-54) & Plaintiff's Responses and Objections Thereto dated May 23, 2008 in this cause of action.

12. Attached hereto behind Tab K is a true and correct copy of U.S. Patent No. 5,608,786.

13. Attached hereto behind Tab L is a true and correct copy of an Interview Summary dated August 12, 1999, that was produced in this cause of action.

14. Attached hereto behind Tab M is a true and correct copy of an Amendment dated August 17, 1999, that was produced in this cause of action.

15. Attached hereto behind Tab N is a true and correct copy of excerpts from an Appeal Brief dated May 15, 2000, that was produced in this cause of action.

16. Attached hereto behind Tab O is a true and correct copy of excerpts from an Amendment dated January 3, 2001, that was produced in this cause of action.

17. Attached hereto behind Tab P is a true and correct copy of excerpts from the publication entitled "Digital Telephony; Second Edition" by John Bellamy referenced in this '373 Patent.

18. Attached hereto behind Tab Q is a true and correct copy of Request for Comments: 1789, referenced in this '373 Patent.

19. Attached hereto behind Tab R is a true and correct copy of the email dated May 26, 1995 from Alex Huang to Denise Nappi, Re: RIC-095-042, that was included as part of Exhibit M to the Doshi deposition in this cause of action.

20. Attached hereto behind Tab S is a true and correct copy of the U.S. Patent No. 7,336,649.

21. Attached hereto behind Tab T is a true and correct copy of excerpts from the deposition transcript of Alex Lisheng Huang taken on December 20, 2007 in this cause of action.

Executed this 3rd day of July, 2008, in Houston, Texas.

[signature]

B.D. Daniel

APPENDIX 7

C2 COMMUNICATIONS TECHS, INC.,	UNITED STATES
Plaintiff	DISTRICT COURT
vs.	FOR THE EASTERN
AT&T INC., et al.,	DISTRICT OF TEXAS
Defendants	CIVIL NO. 2:06-CV-241

______________________________/

The Videotaped Deposition of BHARAT DOSHI, Ph.D., was held on Friday, May 23, 2008, commencing at 10:00 a.m., at the Holiday Inn Laurel West, 15101 Sweitzer Lane, Laurel, Maryland, before Kenneth Norris, a Notary Public.

REPORTED BY: KENNETH NORRIS

EXHIBIT G

people who were developing the products and the people who were providing services.

And this question that I asked, namely, how do you take this new technology and put it in the middle of standard technology, was asked by our services people. Tom Guiffrida, Kathleen Meier-Helstern, Steven Katz, Arik Kashper, and Rajw Kapoor and Norm Farber are the representative from the services side. Now, they are technical people, but they represent services. And their role was also to understand how the voice telephony worked at that time.

And when we started creating architecture, that's me and Harshavardhana, we were the architect of this new technology, and we first defined all oral architecture for how does that fit into the standard voice telephony. They were the ones who provided the expertise that is coming from standard voice telephony. And, collectively, we also defined the economics of doing so.

So their role was much more the traditional telephony, bringing that to bear on what we were trying to do and eventually to find the economics.

Myself was the chief architect, Harshavardhana was more detailed, when we started to

find architecture it required more details.

Q. So you mentioned you were the chief architect of this?

A. Yeah, of this whole architecture, right.

Q. Okay. Now, if we can look at Figure 1 of your patent.

A. Yes.

MR. OCZEK: If you can show it in the camera just for a few seconds?

(Whereupon, there was a pause in the proceedings.)

BY MR. OCZEK:

Q. Okay. Thanks.

Can you help us understand, sort of at a high level, what this diagram is trying to show?

A. Okay. In this diagram, the two boxes in the left and right are the local exchange carrier, but in general, they represent the traditional telephone network.

S1 and S2 are two end-station sets for the usual telephones.

The middle box represents the new technology, the computer data network that we are talking about, and devices that interface the two.

So at a high level, that's what the physical

architecture is.

Logically, the voice samples, when we talk, are transmitted during this middle part in the central box and the messages that we are getting from one switch to another are transmitted over the top part in the figure.

Q. Okay.

A. Now, there are two logical things they could be, one physical entity or separate physical entity.

Q. Okay.

Let me just ask about some of the particular items in here.

A. Okay.

Q. Looking at the left-hand side, you mentioned the local exchange carrier. That's the LEC?

A. That is the LEC.

Q. Designated by 100 on the left.

A. That is correct.

Q. And then 300 on the right?

A. That is correct.

Q. And, both, again, on the left and the right, there's a circle with CO in it with the numbers 25 and 50. That's the central office?

A. That is the central office.

Q. And on the S1 and S2, you'd mentioned

before, that's the telephone sets on each side of the call.

A. Those are the telephone sets.

Q. And, then, in the middle, you have the box that you referred to that's the IXC network?

A. That is correct, that is interexchange carrier network.

Q. Okay. And that's a public computer network?

MR. BORN: Objection, form.

THE WITNESS: That is a public -- IXC stands for in interexchange carrier network. In this case, it is a public data network and can be used by public computers.

BY MR. OCZEK:

Q. And, then, in sort of the middle of the box, you have a bigger box, if you will, and then a smaller one. But they're essentially the same thing, I believe, but you can tell me.

There are two ATM switches designated by 215 and 220?

A. Those two are the same kind of switches, right. One of them is just expanded to show the details.

Q. Okay.

And also within the box there is, if you can

see, 210 and 225. Within the box it says "STM/ATM TA." These are terminal adaptors, correct?
A. That is correct.
Q. I would like you to take a look at Figure 6 of your patent.
(Whereupon, there was a pause in the proceedings.)
THE WITNESS: For this?
MR. OCZEK: Yes, if you can show it to the camera first.
(Whereupon, there was a pause in the proceedings.)
BY MR. OCZEK:
Q. Now, just as I did with Figure 1, I'm going to ask you if you can help us understand what this diagram is trying to show.
A. This diagram is very similar to the Diagram 1 of Figure 1. The basic difference is that the signaling between the local exchange carrier and the interexchange carrier is done through in-band signaling with this out-of-band signaling. So if you see the line between CO and port, that carries both the voice samples as well as the signaling messages.
Q. All right.
A. And, typically, they are done through either

MF signaling or what they call multi-tone frequency or by robbing bits in the regular stream of data.
Q. Okay.
A. Other than that, those two do very similar things.
Q. Okay. Again, I'll just briefly go over some of the items in this figure as I did with Figure 1.
A. Okay.
Q. Just to have you confirm that.
Looking at the Figure 6, on the left- and right-hand sides, there's the LEC again, designated by 325 and 300. That's the local exchange carrier?
A. That is correct.
Q. And then you have, again, in circles on both the left and right, 175 and 180. That's the central office?
A. That is correct.
Q. Then you have telephone sets S3 and S4 on both the left and right?
A. That is correct.
Q. And, then, in the middle, again, you have a larger box, the IXC network, interexchange carrier network?
A. That is correct.
Q. And, again, that's a public computer

network?
MR. BORN: Objection, form.
THE WITNESS: That is a public computer network.
BY MR. OCZEK:
Q. Within that box, that box two -- the larger box, 200, you have two ATM switches, ATM switch 215 and ATM switch 220, correct?
A. That is correct.
Q. Then, again, you have the STM/ATM TA boxes designated by 255 and 225. These are terminal adaptors?
A. That is correct.
Q. And, then, as you had mentioned a little bit -- a few mention ago, you have a Port 241 on the left and Port 2 -- actually, I'm not sure. There's a number there, but you have a port on the right-hand side as well?
A. That is correct.
Q. Okay. Now, I would like you -- we're going to focus a little bit more on Figure 6, and I will ask you a series of questions --
A. Okay.
Q. -- based on your understanding as the inventor of this patent on Figure 6.

A. Okay.
Q. Okay.
Does Figure 6 show or describe a way of doing, of routing telephone calls between two telephone sets?
A. Yes.
Q. And this would be a full-duplex telephone call.
MR. BORN: Objection, form.
THE WITNESS: This would be a full-duplex telephone call.
BY MR. OCZEK:
Q. Now, for the next question, I'd like you to assume that the term "public computer network" means a computer network available to the public. Okay?
A. Okay.
Q. With that definition in mind, does Figure 6 show the use of a public computer network as part of a communication link between two telephone sets?
MR. BORN: Objection, form.
THE WITNESS: It does.
BY MR. OCZEK:
Q. Now, for the next question, I would like you to assume two definitions, if you will. First, assume that the term "first telephone call" means a first

demand to set up a telephone connection.
A. Okay.
Q. And second, assume that central office means a switching system that terminates a common carrier's customer lines.
A. Okay.
Q. Now, with those two definitions in mind, does Figure 6 of your patent show receiving at a computer network access port, a first telephone call from a central office?
A. Yes.
Q. And what numbers on Figure 6, for the record, show receiving at a first computer network access port, a first telephone call from a central office?
A. That will be coming on Line 176.
Q. From the central office?
A. From the central office to the public computer network.
Q. With those definitions I just told you still in mind, does Figure 6, to your knowledge, show that first telephone set, S3, initiating a full-duplex telephone call?
MR. BORN: Objection to form.
THE WITNESS: Yes, it does.

BY MR. OCZEK:
Q. In your system, would you have done anything other than a full-duplex telephone call for a call itself?
A. In our system, no.
Q. Now, still with those definitions in mind -- and I would be happy to read them back to you -- does Figure 6 of your patent, or your patent in general, describe a first telephone call specifying a telephone number of that second telephone, S4, without specifying additional telephone destinations?
MR. BORN: Objection, form.
THE WITNESS: Yes, it does.
BY MR. OCZEK:
Q. So in other words, in your system, you wouldn't dial -- for S3 to reach telephone set S4, you would have dialed one number in your system?
A. You would dial one number, and -- yes, I think that you would dial only one number.
Q. And that would be the number of telephone set S4?
A. That is correct.
Q. I'd like you to keep that definition of central office still in mind, which was a switching system that terminates a common carrier's customer

line.
A. Okay.
Q. And I would like you to assume, as another definition, Internet protocol means a communications format used to transmit data over the Internet. Or I'm sorry, data on the Internet.
A. Okay.
Q. Now, with those definitions in mind, does your patent describe converting data received from a central office to an Internet protocol?
MR. BORN: Objection, form.
THE WITNESS: Yes, it does.
BY MR. OCZEK:
Q. And why is that?
A. ATM has been using Internet to carry data and video and voice, and I would consider ATM as part of the Internet protocols.
BY MR. OCZEK:
Q. In 1994 when you filed for your patent, was using ATM networks to carry IP, was that known at the time in the industry?
A. Yes.
Q. And how do you know that?
A. There were activity going on in the standards to carry -- how do you carry IP or ATM, or

Internet Protocol Version 4 at that time, over ATM. And there was such activity started earlier by about 1994 or so, I think, they started serious standard activity around that.
Q. And what sort of organization -- when you say "standards activity," what are you referring to?
A. So there are -- at that time, it was called CCITT, but now I think it's called ITU, it's international standards body. And, then, Internet Engineering Task Force, or IETF, is coming more from the international protocol. So those standards activities were already starting at that time.
Q. Okay.
And sort of for the layman, what does standard organizations do?
A. So they create ways of doing things that can get standardized so that when different vendors implement that, they can all talk to each other. So you can buy equipment from multiple different vendors, put a network together, and they would work because they all follow the same standards.
Q. Sort of like when you go to a different hardware store, you can get the same sized screw?
A. Absolutely, or you can take a power plug and plug it in anywhere.

Q. Again, referring to Figure 6 in your patent.
A. Okay.
Q. Does your patent teach how to establish a communication link over a public computer network between a first-network access point and a second-network access point?
MR. BORN: Objection, form.
THE WITNESS: Yes, it does.
BY MR. OCZEK:
Q. And that's shown in Figure 6 of your patent?
A. That is correct.
Q. And what numbers -- if you can, refer to the figure -- show a communication link between over a computer network between a first-network access port and a second computer network access port?
A. In this case, one access port will be what is designated here as 241, and the other one will be merely a measure on the right-hand side within the 235 box.
Q. Now, for the next question, I would like you to assume another definition. And this is a longer phrase. Let me tell you what it is. So for the phrase, placing a second telephone call from a second computer network access port to the second telephone set, assume that means placing a second demand to set

up a telephone connection from the second computer network access port to a second telephone set. Okay?
A. Yes. Okay.
Q. With that definition in mind, does Figure 6 of your patent show or demonstrate placing a second telephone call from a second computer network access port to a second telephone set?
MR. BORN: Objection, form.
THE WITNESS: Yes, it does.
BY MR. OCZEK:
Q. If you could point out the numbers?
A. Okay.
Q. Of where that's shown?
A. Okay. Two elements are involved in placing the call. The port is, once again, the port within 235, and the signal processor within that box does the messaging part to place the call. And that message goes to CO 180 and sets up the call.
Q. CO is the central office?
A. CO is the central office, and that will then dial or connect to the Station S4.
Q. Now, is that second call, using the definition we just talked about, is that second call placed using a public switch telephone network or PSTN?

A. Yes, it does.
Q. Would your answer to my last question change at all if the definition for PSTN was a telephone network in which connections are established as, and when required, and that is supplied, operated and controlled by one or more telecommunications operating companies to provide telephone service that is available to the public?
A. The answer remains the same.
Q. Now, earlier, we talked about a definition for Internet protocol. I'll read that back again.
A. Okay.
Q. Assume this definition, again, for Internet protocol, which is, a communications format used to transmit data on the Internet.
A. Okay.
Q. Does Figure 6 of your patent show converting data received from a computer network -- sorry -- show converting data received from the computer -- public computer network from an Internet protocol to a PSTN protocol?
MR. BORN: Objection, form.
THE WITNESS: Yes, it does.
BY MR. OCZEK:
Q. And would that conversion be done at the

terminal adaptor?
MR. BORN: Objection, form.
BY MR. OCZEK:
Q. Or tell me, sir, where the conversion would be done.
A. The conversion will be at the terminal adaptor.
Q. In this case, it would be --
A. 225.
Q. 225.
Okay.
A. And 255.
Q. Now, for the next question, I have several definitions. Bear with me.
A. Okay.
Q. I will be happy to read anything back to you, so let me know.
A. Okay.
Q. The first one is, assume that the phrase "communications link" means a physical or logical connection between two communicating entities.
A. Okay.
Q. Also assume, when I say "to establish a telephone call" means to establish an arrangement for providing for the telephonic exchange of information.

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A. Okay.
Q. And as we talked about before, assume first and second telephone call mean a first and second demand to set up a telephone connection, respectively.
A. Okay.
Q. With those definitions in mind, does your patent, Figure 6, describe or show connecting the first telephone call, the communication link, and the second telephone call to establish a telephone call between the first telephone set and the second telephone set?
MR. BORN: Objection, form.
THE WITNESS: Yes, it does.
BY MR. OCZEK:
Q. Now, for the next question, continue to assume that first telephone call means a first demand to set up a telephone call.
A. Okay.
Q. All right, now, with that in mind, looking at Figure 6, does it describe or show receiving a first telephone call from a public switched telephone network?
A. Yes, it does.
Q. And where is that shown in Figure 6, sir?
A. You can see that coming on the Link 176 from

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Central Office 175, which is part of the public switch telephone network, into the port. And part of the data that's coming in will be the signaling message that asks for a call set up.
Q. And --
A. And that is the demand that we're talking about.
Q. Now, for purposes of this next question, assume that "Internet computer networking" means the Internet.
A. You might define that more carefully.
Q. Okay.
Define internet more carefully, or define --
A. Okay. Let's finish the question.
Q. Sure.
A. Okay.
Q. Okay. So for the term "Internet computer network" --
A. Okay.
Q. -- assume that that means the Internet.
A. Okay.
Q. With that definition in mind, does Figure 6, your patent, describe or show a computer network being at least a portion of an Internet computer network?
MR. BORN: Objection, form.

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THE WITNESS: Yes, it does.
BY MR. OCZEK:
Q. And why is that?
A. Internet allows various types of subnets or subnetworks, and the part between the two terminal adaptors can be considered a part of the Internet.
Q. Now, is that just your understanding or industry understanding?
MR. BORN: Objection, form.
THE WITNESS: That was the industry understanding when we were doing this work, yes.
BY MR. OCZEK:
Q. Okay. I'm going to -- we're going to continue to talk about Figure 6.
A. Okay.
Q. I'm going to go back and give you a new set of definitions.
A. Okay.
Q. Unless otherwise stated, assume that the new definitions apply.
A. Okay.
Q. Okay.
Now, I want you to assume that "telephone call" means a telephone connection over which two-way voice communication takes place.

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A. Okay.
Q. Does Figure 6 of your patent show or describe or teach how to do a method of routing a telephone call between a first telephone set and a second telephone set?
A. Yes, it does.
Q. And, again, this would be a full-duplex telephone call?
A. That is correct.
Q. Now, for the next question, I'd like you to assume public computer network means the ARPANET or Internet. So public computer network means the ARPANET or the Internet.
A. Yes.
Q. Now, with that definition in mind, Dr. Doshi, does Figure 6 of your patent show the use of a computer -- public computer network that's part of a communication link connecting two telephone sets?
MR. BORN: Objection, form.
THE WITNESS: Yes, it does.
BY MR. OCZEK:
Q. And why is that?
A. The network between two terminal adaptors is a part of a public computer network.
Q. And is that also because ATM networks are

part of the Internet?
A. ATM network has been -- have been used as part of the Internet.
Q. For the next question, I have a series of definitions, so bear with me.
A. Okay.
Q. So we're going to be talking about a telephone call, central office, and network access port.
A. Okay.
Q. Okay. Now, assume a first telephone call means a telephone call separate from a second telephone call which is established before a second telephone call is placed.
A. Okay.
Q. Second, assume central office means a local switching system in which a telephone company building at -- which connects individual subscriber wires to trunks into other individual subscriber wires.
A. Okay.
Q. Now, assume the network access port is directly connected to a central office in which all calls originating from a first telephone set are routed to a central office and then directly to the first computer network access port.

A. Okay.
Q. With those three definitions I just gave you in mind, does Figure 6 of your patent show, describe, or teach receiving at a first computer network access port, a first telephone call from a central office?
MR. BORN: Objection, form.
THE WITNESS: Can you repeat the definition of the first and the second call?
MR. OCZEK: Sure.
BY MR. OCZEK:
Q. Assume a first telephone call means a telephone call separate from a second telephone call which is established before a second telephone call is placed.
A. In that case, this figure does not represent that scenario.
Q. And why is that?
A. The disclosure here reports to the case where the first call carries the information about the second call, and both of them are established together.
Q. What would you need to do to connect two telephone calls, two separate telephone calls?
MR. BORN: Objection, form.
THE WITNESS: If there is a device in the

middle that terminates the first call and then dials the number for the second call and then splices them together, that will be two separate calls where a second call is placed after establishing the first one. And this particular figure does not talk about that.
BY MR. OCZEK:
Q. But was that concept that you just described known at the time, 1994, when you filed your patent application?
A. Yes.
And we do that -- we did that with special announcement. We did that with special announcement, if you wanted to terminate the subscriber call, give them announcement, then let them dial some more digits and then forward the call. So those scenarios, we would terminate the call.
Q. And you had done that at the time you filed your patent application?
A. Before that, yes.
Q. At Bell Labs?
A. At Bell Labs.
Q. Now, with those definitions in mind I talked about, telephone call and -- just telephone call, Figure 6 of your patent describe, show or teach a

first telephone call specifying a telephone number of the second telephone set without specifying additional telephone destinations?
MR. BORN: Objection, form.
THE WITNESS: Yes, it does.
BY MR. OCZEK:
Q. And, again, this is one number that telephone S3 would dial to get S4?
A. That is correct.
Q. I think we need to switch the tape.
A. Okay.
VIDEOGRAPHER: This ends Tape 1 of the deposition of Dr. Bharat Doshi. We're going off the record at 11:28.
(Whereupon, there was a pause in the proceedings.)
VIDEOGRAPHER: This begins Tape 2 of the deposition of Bharat Doshi, M -- PhD. We're back on the record at 11:42.
BY MR. OCZEK:
Q. Dr. Doshi, I would like to continue where we left off, which is looking at Figure 6.
A. Okay.
Q. And continuing to talk about some definitions for phrases and words and asking some

questions associated with that.
A. Okay.
Q. And I would like you to keep the definition of central office in mind, which is a local switching system in a telephone company building which connects individual subscriber wires to trunks into other individual subscriber lines.
And I'd also like you to assume that Internet protocol means Internet protocol Versions 1 through 9.
(Whereupon, there was a pause in the proceedings.)
BY MR. OCZEK:
Q. With those definitions in mind, does your patent describe, teach, or show converting data received from the central office to an Internet protocol?
MR. BORN: Objection, form.
THE WITNESS: No.
BY MR. OCZEK:
Q. Your patent talks about ATM?
A. That is correct.
Q. But as you testified before, ATM networks can certainly transport IP?
MR. BORN: Objection, form.

THE WITNESS: That is correct.
(Whereupon, there was a pause in the proceedings.)
BY MR. OCZEK:
Q. Would -- if I use the phrase of "one with skill in the arts," do you know what that means?
A. Sort of a title, I know, yes.
Q. Okay. So let's use the definition of your colleagues at Bell Labs, the skill set of your coworkers at Bell Labs.
A. Okay.
Q. At the time of your invention in 1994, would one of skill in this field, telecommunications field, know how to convert data in IP format and carry it over an ATM network to a PSTN protocol?
MR. BORN: Objection to form.
THE WITNESS: Yes, they would.
BY MR. OCZEK:
Q. And why do you say that?
A. Because converting the pitch from one format to another one is a well-known technique, and before IP or ATM, it was done for IP over frame relay and frame relay over ATM. So this is just another way of doing it.
Q. All well-known techniques at the time?

A. All well-known techniques at that time.
Q. This was sort of the heart of Bell Labs technology at the time?
A. Yes.
MR. BORN: Objection to form.
THE WITNESS: The mapping between two types of format is common in the telecommunications as well as voice and data and multimedia communications.
BY MR. OCZEK:
Q. If you can look at Column 4 of your patent, Dr. Doshi.
A. Okay.
Q. And if you can -- I will refer you to Lines 31 through 57, that paragraph, starting with "more particularly"?
A. Um-um.
Q. And, then, it ends with "initial address message, IAM."
A. Okay.
Q. If you could read that to yourself.
(Whereupon, there was a pause in the proceedings.)
THE WITNESS: Okay.
BY MR. OCZEK:
Q. In that paragraph, it talks about a call

setup message. And at the end of the paragraph, the last sentence says, "The transmitted call set up message will also be referred to herein as an initial address message, IAM."
A. Correct, um-um.
Q. Can you describe what an IAM is?
A. So that's a message that is sent from one switch to another switch, telling that a caller has asked me to set up a call, and I'm communicating all the details to you so you can take over and process it. That's the initial address message. Mainly, because it carries the address of the calling -- the calling party, it's called initial address message.
Q. Is that a demand to set up a call?
A. It is a demand to set up the call.
Q. You can set that Exhibit 1 aside.
A. Okay.
(Whereupon, there was a pause in the proceedings.)
(Doshi Deposition Exhibit Number 2 was marked for identification.)
BY MR. OCZEK:
Q. Dr. Doshi, I'm handing you what's been marked as Exhibit 2, which is a copy of a U.S. Patent No. 6243373.

APPENDIX 8

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

C2 COMMUNICATIONS TECHNOLOGIES, INC.,	§	
	§	
Plaintiff,	§	**Civil Action No. 2:06CV-241 TJW**
	§	
vs.	§	**JURY TRIAL REQUESTED**
	§	
AT&T, CORP., *et al.*,	§	
	§	
Defendants.	§	

PLAINTIFF'S RESPONSE TO MOTION FOR SUMMARY JUDGMENT THAT THE ASSERTED CLAIMS ARE INVALIDATED BY THE DOSHI PATENT

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STATUTES

SUMMARY OF RESPONSE

The Defendants' argument that U.S. Pat. No. 5,568,475 to Doshi anticipates the Patent-in-Suit, U.S. Pat. No. 6,243,373 to Turock, is premised entirely on the fallacious claim that ATM is an Internet protocol under the Court's claim construction of "Internet protocol." ATM, which stands for "Asynchronous Transfer Mode," is a lower level protocol, as explained in detail below, that can encapsulate many different types of data, including data formatted according to the Internet protocol, for transmission between ATM nodes in a communications system. In this sense, ATM acts as a carrier for Internet protocol, analogous to a mail truck that picks up several bags of mail from the airport and carries them to the local post office. But the ability of ATM to encapsulate and transport Internet protocol data does not thereby transform ATM into an Internet protocol any more than does a mail truck carrying a bag of mail somehow turn the truck into a mail bag. Indeed, the ATM protocol was developed completely separately from, and exists totally independent of, any of the Internet protocols. Defendants' position is akin to saying that because Internet data has traveled over the wires of the PSTN, the PSTN is the Internet.

The Court construed Internet protocol to mean "a communications format capable of transmitting data *over* the Internet." The Defendants allege that because "there was activity" going on in 1994 to "determine standards to *carry* Internet Protocol Version 4 at that time, *over* ATM", ATM is an "Internet protocol". This interpretation turns the Court's claim construction on its head. Subsumed within the Court's construction is the assumption that, whatever communications format is being used, it is one that can transmit data *over* the Internet. ATM, however, does not transport anything *over* the Internet because ATM lies beneath the Internet protocols in the hierarchy of protocols that are used to transport data from a source to a destination. In other words, the Internet protocol may be carried *over* ATM, but ATM itself is not a protocol for transmitting data *over* the Internet as required by the Court's claim construction. In effect, the Defendants have rewritten the Court's construction to mean "a communications format capable of transmitting data *under* the Internet." Defendants' entire case for anticipation, therefore, relies on a linguistic slight of hand inconsistent with the Turock Patent and the Court's construction of "Internet protocol."

Moreover, the Doshi Patent's use of ATM protocol rather than an Internet protocol has significant technical consequences for setting up telephone calls. Doshi must set up a dedicated call path for each telephone call, which he refers to as a virtual circuit, similar to the creation of dedicated call circuits used in setting up a voice path on the traditional PSTN. Doshi's telephone network, therefore, replicates the basic idea of dedicated call circuits left over from the PSTN. Indeed, Doshi viewed the ATM network as the next iteration of the traditional telephone network and does not even describe the use of a computer network as required by the claims-in-suit. Turock's claimed method, by contrast, relies on Internet protocols to route calls through a computer network dynamically, without the use of dedicated (virtual) circuits. In short, Turock's call routing method is "connectionless" while Doshi's is "connection-oriented." Thus, the differences between Turock and Doshi are fundamental rather than merely cosmetic, as the Defendants would have the Court believe.

The Defendants understand that they cannot meet their burden of clear and convincing evidence of anticipation because, inter alia, Doshi does not disclose converting from a PSTN protocol to an Internet protocol or vice versa. Accordingly, they attempt to reconstruct the Turock patent from the general knowledge of those of skill in the art and the disclosures of U.S. Pat. No. 5,608,786 to Gordon ("the Gordon Patent") and the Doshi Patent. These efforts fail because there is no explanation of how (or why) one would graft the IP based system of the Gordon Patent onto the ATM based system of the Doshi Patent. Indeed, the Doshi Patent expressly teaches away from utilizing an Internet routing scheme to route calls and instead describes the use of the ATM protocol's complex virtual circuit scheme for setting up a call path, creating a virtual circuit for each telephone call. The Gordon Patent, in turn, is dedicated primarily to "a unified messaging system" for conveniently retrieving voice mail, email, and FAX transmissions. Moreover, Doshi utilizes an ATM network rather than utilizing a computer network as in Gordon. Given the disparate notion of the problems solved by each respective reference, it is clear that the Defendants are merely trying to piece together the Turock invention from radically different references. For these and additional reasons, laid out in detail below, the Defendants have failed to prove by clear and convincing evidence that Doshi, alone or in any combination with additional art, invalidate the Turock patent.

ARGUMENT

I. Anticipation Requires Identical Disclosure of All Claim Elements

"A patent shall be presumed valid." 35 U.S.C. § 282 (2000). To overcome this presumption of validity, the party challenging a patent must prove facts supporting a determination of invalidity by clear and convincing evidence. *Apotex USA, Inc. v. Merck & Co.*, 254 F.3d 1031, 1036 (Fed. Cir. 2001), *cert. denied*, 534 U.S. 1172 (2002) (citing *Am. Hoist & Derrick Co. v. Sowa & Sons, Inc.*, 725 F.2d 1350, 1360 (Fed. Cir. 1984)). On summary judgment, all justifiable inferences are made in favor of the nonmovant. *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 255 (1986) ("The evidence of the nonmovant is to be believed, and all justifiable inferences are to be drawn in his favor.").

Whether a patent is anticipated under 35 U.S.C. § 102 is a question of fact. *Apple Computer, Inc. v. Articulate Sys., Inc.*, 234 F.3d 14, 20 (Fed. Cir. 2000). Anticipation requires the disclosure in a single piece of prior art of each and every limitation of a claimed invention. *Id.* at 20 (*citing Electro Med. Sys. S.A. v. Cooper Life Scis.*, 34 F.3d 1048, 1052 (Fed. Cir. 1994)). Where, as here, the moving party relies on the testimony of a witness to substitute for actual disclosure in the allegedly anticipatory reference, that testimony must be testimony from one skilled in the art and must identify each claim element, state the witnesses' interpretation of the claim element, and explain in detail how each claim element is disclosed in the prior art reference. *Schumer v. Lab. Computer Sys.*, 308 F.3d 1304, 1315 (Fed. Cir. 2002).

II. Doshi Does Not Disclose or Suggest Converting Data to or from a PSTN Protocol and an Internet Protocol

The fundamental protocol of the Internet is the Internet Protocol. Any other protocol must operate over and in combination with the Internet Protocol in order to be "capable of transmitting data over the Internet." (Exhibit A, Forys Dec. at ¶50). Defendants cannot and do not contend that the Doshi Patent discloses or suggests the use of the Internet Protocol itself:

> Q. And I would like you to keep the definition of central office in mind, which is a local switching system in a telephone company building which connects individual subscriber wires to trunks into other individual subscriber lines.
>
> And I'd also like you to assume that Internet protocol means Internet protocol Versions 1 through 9.
>
> . . .
>
> Q. With those definitions in mind, does your patent describe, teach, or show converting data received from the central office to an Internet protocol?
>
> . . .
>
> THE WITNESS: No.

(*See* Defendants' Exhibit D ("Doshi Patent")[1]; Exhibit B at 42:3-19 (Doshi Deposition) (objections omitted); Exhibit A, Forys Dec. at ¶¶59-63). This admission alone is fatal to Defendants' claim of anticipation. All that Doshi discloses is a communications system, having nothing to do with the Internet or its protocols, that converts telephone calls from a PSTN format to an ATM format. (Doshi Patent at 2:61-3:19). Defendants raise two simplistic arguments in their attempt to get around this inconvenient fact: 1) that IP traffic could be sent over ATM networks at the time of the filing date of the Turock Patent; and 2), that ATM is an Internet protocol "because packets in ATM format are capable of transmitting data over the Internet" (*See* Defendants' Statement of Facts ¶¶11-12). The first argument is simply irrelevant to anticipation under the Court's construction: regardless of whether ATM was capable of sending Internet data, the Doshi Patent does not disclose or suggest actually doing it. (Doshi Patent at 1:1-14:47; Exhibit B at 42:3-19 (Doshi Deposition); Exhibit A, Forys Dec. at ¶¶59-63). The second

[1] Throughout this response, Plaintiff shall cite to U.S. Pat. No. 5,568,475 to Doshi as simply "Doshi Patent at ___."

argument turns the Court's construction of "Internet protocol" on its head, asserting that "a communications format capable of transmitting data *over* the Internet" is the same as "a communications format *over which* Internet data can be transmitted.

More than just the rules of the English Language prohibit this inversion. The reasons that ATM is not and cannot be an "Internet protocol" are rooted in the fundamental architecture of modern data networking called the "OSI Model." Understanding the roles played by ATM and the protocols of the Internet in turn reveals fundamental architectural differences between the Doshi and Turock systems. These differences reveal the Doshi system as an incremental extension of the old circuit-switched telephone network, and contrast the paradigm shift represented by Turock's bridge between the legacy PSTN and the packet-switched, circuit-less world of the Internet. (Exhibit A, Forys Dec. at ¶¶55-57).

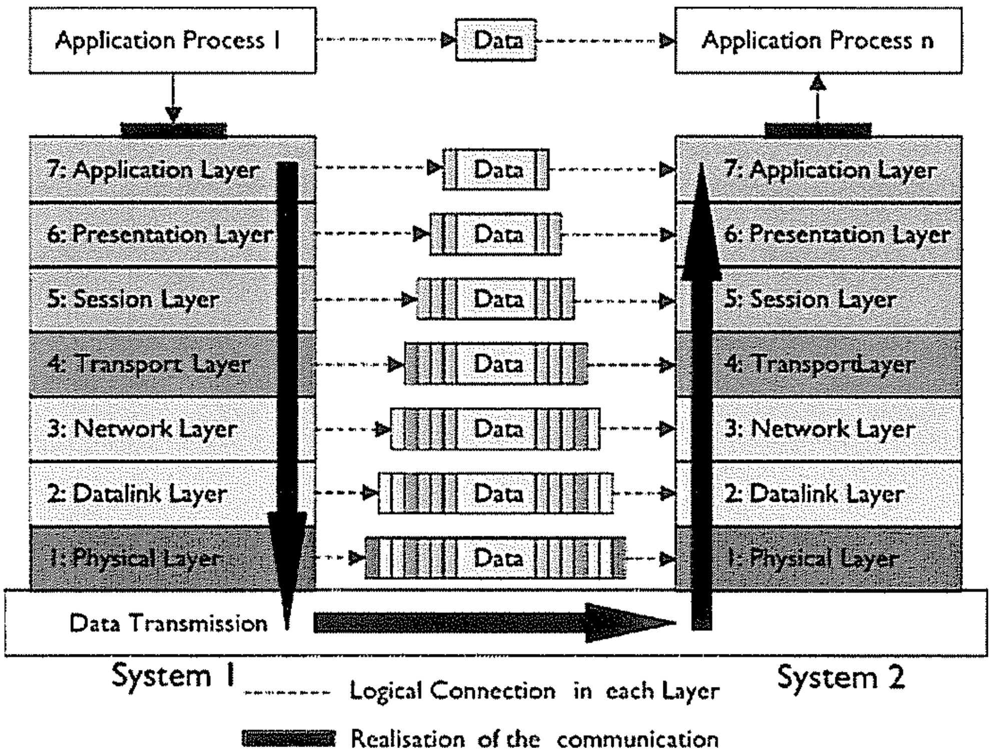
a. The ATM Protocol Lies Beneath the Internet Protocols in the OSI Protocol Stack

The ATM protocol and the Internet protocol[2] lie at different layers of what is known to those of skill in the art as "the OSI model." (*Id.* at 36; Exhibit B at 59:21-60:10 (Doshi Deposition)). Their classification in different layers highlights the fact that they play fundamentally different roles and provide different functionality in the transmission of data. (Exhibit A, Forys Dec. at ¶¶37-44).

Beginning in 1977, the Open Systems Interconnection ("OSI") model was developed by the International Organization for Standardization (ISO) to, among other things, facilitate the inter-working of different data networks. (*Id.* at ¶36). The basic strategy of the OSI Model was to group the various functions that have to be performed in transporting data into 7

[2] *See* Exhibit C, A protocol is a "convention or standard that controls or enables the connection, communication, and data transfer between two computing endpoints. In its simplest form, a protocol can be defined as the rules governing the syntax, semantics, and synchronization of communication."

groups, called "Layers," where each respective lower layer provides its services to the layer above. (*Id.* at ¶¶37-38). These layers are, from top to bottom, the Application, Presentation, Session, Transport, Network, Data-Link, and Physical Layers, as shown graphically in the diagram below.[3] (*Id.* at ¶¶39, 41-44). This grouping allows one to, among other things, implement technical changes in one layer without having to change other layers. (*Id.* at ¶37).



The distinction between ATM and an Internet protocol primarily implicates Layers 2 through 4, although an explanation of Layer 1 clarifies the differences between layers. The Physical Layer, Layer 1, is concerned with the physical connectivity between two points, including, for example, how one sends data bits and the voltages or frequencies (in the case of a radio channel) required for data transmission. (*Id.* at ¶39). This includes the layout of pins, voltages, cable specifications, etc. *Id.* It is largely irrelevant, as far as higher level layers are

[3] *See* Exhibit D.

concerned, what makes up the physical layer. (*Id.* at ¶40). One could, in theory, send an IP packet with a carrier pigeon. *Id.* Similarly, one could transmit Internet data over the PSTN, which would not transform the protocols of the PSTN into a protocols that transmit data over the Internet. (*Id.* at ¶¶40, 51; *cf.* Ex E, B. Doshi, S. Dravida, D. Jeske, K. Merti, and B. Samadi, *Performance Analysis of Switch Access Systems*, Bell Labs Technical Journal, April-June 1999 at 197 ("Since the public switched telephone network (PSTN) is the most universal way of accessing the Internet and corporate intranets from home, the 'new' data traffic is being carried through the traditional circuit switch and trunking network.")).

Layer 2 is concerned with the logical transmission of data between two adjacent points in a network. (Exhibit A, Forys Dec. at ¶¶41). Examples of Layer 2 protocols include Ethernet and the ATM protocol. (*Id.*; Exhibit B at 59:21-60:9). Layer 3, or the Network Layer, by contrast, is concerned with *routing* from one point to another in the network, which typically encompasses many points in the network rather than just adjacent points. (Exhibit A, Forys Dec. at ¶42). "Routing" is the process of selecting paths in a network along which to send network traffic. *Id.* In the context of packet networks, this encompasses the transit of logically addressed packets from their source toward their ultimate destination through intermediate nodes. *Id.* Internet routers operate at this layer—directing data throughout extended networks and making the Internet possible. *Id.*

Finally, Layer 4 is called the "Transport Layer" and provides for data transfer between end users, as opposed to just endpoints. Two famous examples of Layer 4 protocols include TCP and UDP, both of which are used predominately with the Internet protocol: TCP/IP and UDP/IP. (*Id.* at ¶43). Thus, there are many different ways that a transmission could be sent in the OSI model. For example, with a dial up connection to an Internet Service Provider, a common configuration would be to use a T1 trunk from the central office as Layer 1, PPP as Layer 2, IP as Layer 3, and TCP as Layer 4. (*Id.* at ¶47).

The analogy of mailing a letter is helpful in understanding how the various layers operate and interact. A mail room in a New York corporation decides that a letter, which must arrive the next day, should be sent by overnight courier to its destination in Seattle (Layer 4 – Transport). The courier company receives an envelope containing the letter, reads the address from the envelop, and determines that to get the letter to Seattle it must route the package through an intermediate destination, its Denver hub. It then places the letter in a courier package labeled "Denver" (a Layer 3 Network function, namely, looking at the address on the letter, determining a route from New York to Seattle via intermediate stops based on the address, and placing the letter in a courier package to assist the intermediate carrier). The courier then hands the courier package to workers for an airline flying between New York and Denver, who take the courier package and load it on the airplane (a Layer 2 Data Link function, namely sending the package to Layer 1 for transportation between adjacent stops). The plane flies from New York to Denver (a Layer 1, Physical layer function). (*Id.* at ¶45).

In Denver, the courier package is checked to see if the envelop is in good shape and then given to a person who handles routing for the courier company in Denver (a Layer 2 Data Link function, where the Layer 2 protocol performs error detection and correction and hands the package up to Layer 3 to determine routing). The routing person opens the courier package and determines from the address on the envelope that it needs to be sent to Seattle. He then puts the letter in a new courier package with a tag for Seattle and hands the package to workers for an airline flying from Denver to Seattle (a Layer 3 routing function, as above). The package is loaded on the plane (a Layer 2 function). Finally, the package is flown to Seattle (a

Layer 1 function). In Seattle, the courier package is checked to make sure it is in good shape, and then given to the Seattle routing office (a Layer 2 function). The Seattle branch of the courier company removes the envelope from the courier package, sees that the destination is Seattle and delivers it, according to the address on the envelope, to the mail room of the destination corporation (a Layer 3 routing function). The mail room removes the letter from the courier package and sends it to the secretary of the recipient (a Layer 4, transport function) who then performs subsequent upper layer tasks in formatting and presenting the letter to the ultimate recipient. *Id.*

In the case of mail delivery, it is irrelevant who actually provides the transport from New York to Denver and then from Denver to Seattle as far as the Layer 3 routing function and Layer 4 transport function are concerned – the router could have chosen any number of airlines, trains, cars, etc. for transport between adjacent stops in the route between source and destination. In the same way, data formatted according to an Internet protocol could be transported by any Layer 2 protocol, including ATM or the more prevalent Ethernet protocol. (*Id.* at ¶47). This highlights the error of Defendants' interpretation of the Court's claim construction: it is the Layer 3 protocol that is carried over the Layer 2 protocol, not vice versa as Defendants argue.

The situation is further illustrated by an article written by Doshi article entitled *Protocols, Performance, and Controls for Voice over Wide Area Packet Networks*, Bell Labs Technical Journal, October-December 1998 at 313, where Doshi shows ATM as a lower layer protocol below the Internet protocol stack:

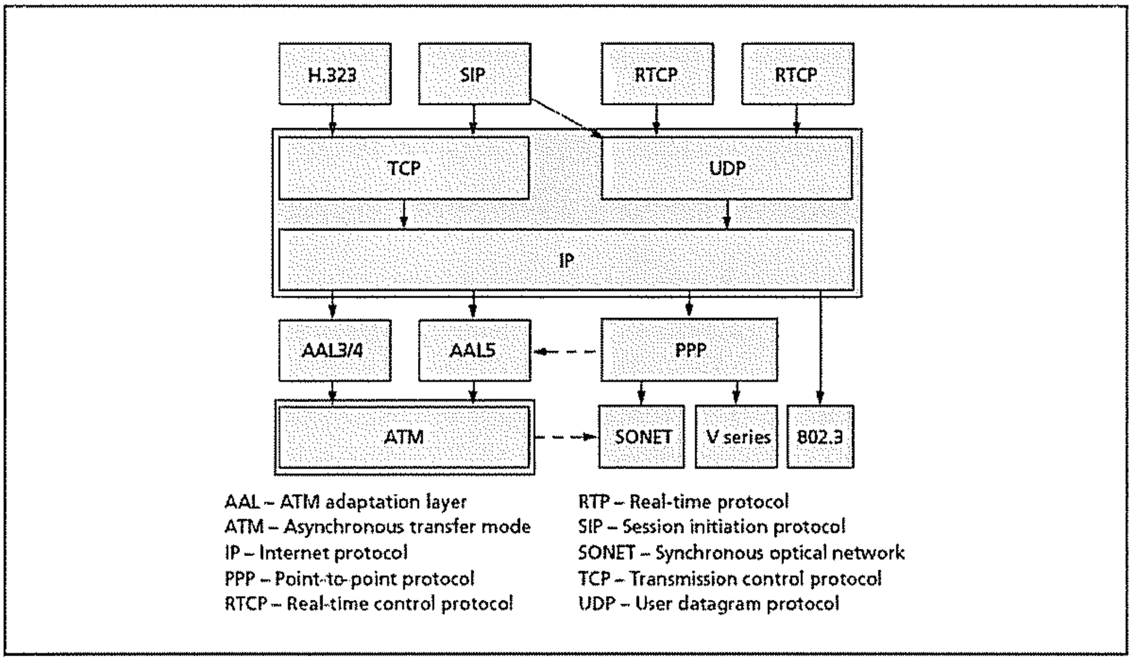


Figure 6.
A typical protocol stack for Internet telephony.

(Exhibit F at 313). Thus, placed within the context of the OSI model, the impropriety of Defendants' position becomes clear: ATM lies beneath the Internet protocol in the OSI protocol stack and does not carry anything "over" the Internet. (Exhibit A, Forys Dec. at ¶¶47-48; Exhibit B at 59:21-60:9 (Doshi Deposition)).

b. Defendants' Position that ATM is an Internet Protocol is Inconsistent with the Court's Claim Construction, the Claim Construction Positions Taken by the Parties in this Case, and the '373 Patent Specification

Seen against the backdrop of the OSI model, it is clear that ATM and IP play different roles in the context of data transfer, ATM being a Layer 2 protocol concerned with connecting adjacent points in a network and the Internet Protocol being a Layer 3 protocol providing for routing packets through an Internet network using, inter alia, Internet routers, with higher level Layer 4 protocols used to transmit data above the Internet layer. No party in this case has heretofore ever proposed a construction of "an Internet protocol" that was below Layer 3 in the OSI model. The Defendants originally proposed the construction "Internet Protocol, versions 1 through 9" and Plaintiffs originally proposed "A communications format used to transmit data on the Internet (e.g., TCP/IP and/or UDP/IP)", in essence a Layer 4 protocol for transmitting data over a network already utilizing the Internet Protocol. (September 7, 2007 Joint Claim Construction and Prehearing Statement at 4-5). The Court's construction, "a communications format capable of transmitting data *over* the Internet" presupposes the existence of the Internet at a lower level, and suggests a Layer 4 protocol. (Exhibit A, Forys Dec. at ¶¶49-50). In the vernacular of those in the art, the Courts construction means XXX/IP, where XXX reflects a protocol that transmits data over an IP network. (*Id.* at ¶48).

The Turock Patent is explicit in its description of the protocols used in the invention:

> Both the TCP and UDP protocols are built on top of a lower layer protocol known as the IP (Internet Protocol). IP is used to format and route TCP and UDP messages. TCP/IP and UDP/IP have become worldwide de facto standards for interprocess communication and provide the underlying transport mechanism in use on the Internet.

(*See* Defendants' Exhibit A ("Turock Patent")[4] at 3:62-67; *see also* 3:53 – 4:4; 6:44-65; 9:18-22). Nowhere does the specification mention underlying protocols such as ATM or equate them with an Internet protocol. (Turock Patent 1:1-18:59).

Moreover, Turock's method for call routing provides advantages over Doshi's ATM scheme that clarify the fundamental differences between the two inventions. In particular, Doshi sets up a virtual circuit for each call, whereas Turock relies upon the routing methods provided by the Internet protocol, as discussed in detail immediately following.

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[4] Throughout this response, Plaintiff shall cite to the patent-in-suit as simply "Turock Patent at ___."

c. Doshi's ATM Voice Scheme Requires a Complex Call Routing Scheme While Turock's IP Method Relies on the Routing Mechanism Provided by the Internet Protocol

The Doshi Patent discloses a method for routing telephone calls using an ATM cell header containing a Virtual Path Identifier and a Virtual Channel Identifier. (Doshi Patent at 1:23-27; (Exhibit A, Forys Dec. at ¶¶55-56). Each call set-up request comes into the ATM switch from the central office with a particular trunk and trunk subgroup identifier that is mapped on a one-to-one basis with a Virtual Path Identifier and a particular Virtual Circuit Identifier, as shown in Fig. 3:

INCOMING TRUNK	INCOMING TRUNK SUBGROUP	INCOMING PORT	VCI	VPI
T_k	TSG_i	P_m	VCI_k	VPI_i
⋮	⋮	⋮	⋮	⋮
1	27	27	1	27
⋮	⋮	⋮	⋮	⋮
T_{n-1}	TSG_{n-1}	P_{n-1}	VCI_{n-1}	VPI_{n-1}
T_n	TSG_n	P_n	VCI_n	VPI_n

(Doshi Patent at Fig. 3 (Figure numbers omitted); (Exhibit A, Forys Dec. at ¶56)). Since the Doshi system only specifies a Layer 2 ATM protocol, the determination of a route from one point to another through the network must be set in advance (at the time of network configuration) and stored at each node. (Exhibit A, Forys Dec. at ¶¶55-56). Each node would have a prespecified table that would assign an outgoing path and VPI/VCI pair based on the incoming VPI/VCI pair. (Doshi Patent at 1:23-45; 2:61-3:15; 6:13-65; 7:24-63; Forys Dec. at ¶¶55-56). The series of ATM nodes, together with the mappings between the trunks from the central office and the VCI and VPI, form a dedicated call path that has to be set up for each telephone call. (Exhibit A, Forys Dec. at ¶56). Thus, for each call Doshi creates a virtual circuit in a way similar to the creation of dedicated call circuit for a voice path on the traditional PSTN. (*Id.* at 56). Doshi's telephone network, therefore, replicates the basic idea of dedicated circuits left over from the PSTN. *Id.*

Turock, however, saw that you could eliminate this complexity by relying on the routing capabilities provided by the Layer 3 Internet protocol. (Turock Patent at 3:37-4:4; Exhibit A, Forys Dec. at ¶57). By converting from PSTN to Internet protocol, a call can progress over the network solely by utilizing the IP address of the computer network access port in the vicinity of the called party. (Exhibit A, Forys Dec. at ¶57). The individual IP packets containing voice data may take any number of paths through numerous IP routers, none of which have to be identified ahead of time as do the ATM nodes of Doshi. *Id.*

d. Doshi's Testimony is Premised on the Same Erroneous Interpretation of the Court's Claim Construction as the Defendants

The Defendants rely entirely on Doshi's testimony for the proposition that his patent discloses the use of an Internet protocol for the simple reason that the patent never mentions the Internet, the Internet protocol, or any of the protocols used to carry data over the Internet Protocol. (Doshi Patent; Exhibit A, Forys Dec. at ¶¶59-60). Doshi, however, based his statements on the same erroneous interpretation of the Court's claim constructions as the Defendants:

> Q. What exactly is your definition of Internet protocol?
>
> A. If I just define Internet protocol as something that is used in Internet, that's Internet protocol.
>
> Q. If I just define Internet as something that's used --
>
> A. A protocol that is used in Internet.

> Q. So under that definition, Internet is -- so *any protocol that had carried Internet traffic*, under your definition, would be an Internet protocol?
>
> A. Yes.
>
> Q. And that's the assumption that you're making in saying ATM is an Internet protocol?
>
> A. Yes.

(Exhibit B at 72:21-73:10 (Doshi Deposition) (Emphasis added)). Thus, Doshi is clear about why he considers ATM to be an Internet protocol – any protocol lying *beneath* the Internet protocol that had ever carried Internet traffic is an Internet protocol in his view. This interpretation is, however, squarely at odds with any parties' proposed claim construction of "Internet protocol" or with the construction adopted by the Court in this case.

e. Doshi Does Not Disclose a "Computer Network" as Required by the Claims

Doshi envisioned his ATM network purely as a replacement for the existing Interexachange Network of the traditional PSTN: "Presently, the designers of telecommunications networks are seriously considering replacing the STM switching and associated transport facilities with Broadband ISDN (B-ISDN) based on ATM as the underlying technology. What this means is that the circuit switched structure, associated signaling systems, databases, operations systems, etc., will be replaced using ATM based transport, signaling and messaging." (Doshi Patent at 2:27-34; Exhibit A, Forys Dec. at ¶56). Each figure in the patent that depicts the network, Fig.'s 1, 6, and 7, shows the network being access with traditional telephone sets, so that the only data being carried on the network is voice data. (Doshi Patent at Fig.'s, 1, 6, and 7; Exhibit A, Forys Dec. at ¶61).

Defendants misstate C2's position in their brief regarding the absence of a "public computer network" in the Doshi Patent. C2 does not content that Doshi's ATM network is not public: it is clearly made available to the public under the Court's construction of "public computer network". Doshi does not, however, disclose any transmission of data other than voice between the ATM nodes. (Exhibit A, Forys Dec. at ¶66). Because of this, the Defendants rely on Doshi's testimony to supplement the disclosure, but his after-the-fact testimony cannot cure this deficiency as the law requires that the allegedly anticipatory reference identically disclose all elements of the claim, which Doshi clearly does not. *Apple Computer, Inc.*, 234 F.3d at 20.

f. Doshi Fails to Disclose Dependant Claim 6, "wherein said computer network is at least a portion of an Internet Computer Network

Defendants further allege that the ATM telephone network disclosed in the Doshi Patent is at least a portion of the Internet because the Internet "allows various types of subnets or subnetworks, and the part between the two terminal adaptors [the IXC Network of Figures 1 & 6 in Doshi] can be considered part of the Internet." *See* Defendants' Motion at 12. In reality, there is no connection shown between the IXC network and the Internet in any of the Figures of the Doshi patent. (Exhibit A, Forys Dec. at ¶¶64-72). Nor is there any mention whatsoever of the Internet in the Doshi patent. (*Id.* at ¶65). In order for a node, e.g. ATM switch or any other element of a network, to be part of the Internet, it must be connected to the rest of the Internet. (*Id.* at ¶66). That is inherent in the very notion of a network which requires that elements are interconnected. *Id.*

All connections shown to the Doshi network are from the standard voice network, which even the Defendants cannot allege is the Internet. *Id.* In addition, there is not even a mention of an IP address for the ATM switches in Doshi's patent and therefore there is no way for any Internet users outside of Doshi's network to even access it. *Id.* Defendants' reliance on RFC 1577 is simply irrelevant. It merely highlights, in essence, that ATM networks can be configured to carry IP traffic, which cannot cure the deficiencies of Doshi's lack of disclosure of any connection to the Internet in his patent. (*Id.* at ¶67).

III. Defendants Have Failed to Prove By Clear and Convincing Evidence That Turock's Single Number Dialing Embodiment is Obvious

a. The Defendants Failure to Provide Evidence of the Level of Skill in the Art Requires Denial of their Motion as a Matter of Law

Obviousness depends on an objective analysis by the fact-finder of (1) the scope and content of the prior art; (2) the differences between the claimed invention and the prior art; (3) the level of ordinary skill in the art; and (4) any relevant secondary considerations that give light to the circumstances surrounding the origin of the subject matter sought to be patented. *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17-18 (1966). Relevant secondary considerations are such things as commercial success, long felt but unsolved needs, failure of others, and the presence or lack of some motivation to combine, or avoid combining prior art teachings. *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1734-35 (2007).

Here the Defendants have failed to provide any evidence of the level of ordinary skill in the art or of any relevant secondary considerations surrounding the Turock Patent. Given this failure to meet the required elements of an obviousness defense, courts have refused to grant a defendant summary judgment:

> In their summary judgment papers, defendants have failed to submit any evidence from which the court could assess, as a matter of law, the relevant level of skill possessed by one in the art, much less evidence sufficient to establish the assertion that, if faced with the relevant prior art, Dr. Fordtran's invention would be obvious to one skilled in the art. Additionally, defendants have failed to address the final factor necessary to a complete obviousness analysis, namely, the existence of "secondary considerations," if any are implicated under the facts and circumstances of this case. Thus, in the absence of such evidence, or a stipulation that none exists or that the facts relevant to the Graham factors are undisputed, the court declines to rule, as a matter of law, on the issue of obviousness.

Braintree Lab's, Inc. v. Nephro-Tech, inc., 58 F.Supp.2d 1293, 1302 (D. Kan. 1999). Given the Defendants complete dearth of evidence on this element their motion for invalidity based on obviousness must be denied as a matter of law.

b. The Mere Knowledge That One Could Use the Internet for Telephony Cannot Render The Turock Patent Obvious

Pointing to Bellamy's *Digital Telephony*, which was cited in the Turock Patent, the Defendants allege, with no support, that a person of skill in the art "would have considered ATM and IP transmission technology interchangeable if not identical." *See* Defendants' Motion at 15. They go on in similarly conclusory fashion to state that, given publications found by the Examiner and listed as prior art references, "one would have considered the single number-dialing method of Doshi with the familiar concept of Internet telephony to yield the predictable result of telephone call transmission by means of an Internet-based method to conventional long distance facilities." *Id.* These assertions are devoid of technical support.

As discussed above, ATM and IP are fundamentally different protocols that impart totally different requirements in routing traffic. At the time of the Turock Patent, these differences included:

- the ATM protocol was considered a layer 2 protocol whereas IP was a layer 3 protocol (and TCP/IP or UDP/IP were considered a layer 4 protocol).
- ATM has a prescribed path (a virtual circuit) which all cells from a telephone call must follow. In the IP protocol, no prescribed path is followed.
- ATM has small, 53 byte fixed length packets, called cells. IP packets can be of variable length and are significantly larger.
- ATM had service classes (constant bit rate, variable bit rate ...), IP networks were "best effort."

- ATM had a Call Admission Control (CAC) strategy to control load entering the system in order to guarantee service levels, IP networks did not.

- ATM forwarded calls using labels much like zip codes, IP networks used IP addresses.

(Exhibit A, Forys Dec. at ¶74). Each of these differences is directly relevant to providing telephone service, but Defendants provide no mention or explanation of how these differences could be resolved in attempting to marry Doshi's virtual circuit based ATM telephony system with the nebulous "knowledge of those in the art" proffered by Defendants to achieve the single number dialing, Internet-based telephony system of the Turock Patent. To the contrary, Doshi's ATM based patent directly teaches away from the call routing method of Turock by replicating the circuit-based method of the PSTN rather than the circuit-less method of Turock. (*Id.* at ¶¶56-57). In this context, the Defendants have supplied no basis for altering the Doshi patent to encompass a fundamentally different technology for call routing. Accordingly, the Defendants have provided far less than clear and convincing evidence that Turock's method is obvious in view of Doshi and the general knowledge of those in the art.

c. The Turock Patent is not Obvious in View of Doshi Combined with Gordon

The Defendants allege that Gordon "supplies any missing element in Doshi". *See* Defendants' Motion at 15. Gordon was cited during prosecution and discloses a two-number dialing system whereby the caller calls a "UniPost Access Node" using the standard PSTN, receives a prompt from the Node, and enters the number of the called party. (Turock Patent; *See* Defendants' Exhibit K (the "Gordon Patent")[5] at 9:10-16). The patent is primarily directed to a unified messaging system that allows a user to access voicemail, email, and facsimiles with a single telephone number. (Gordon Patent at Abstract, 1:5-14, 1:66-2:24, 3:31-35). The

[5] Throughout this response, Plaintiff shall cite to U.S. Pat. No. 5,608,786 as the "Gordon Patent at ___."

Defendants have supplied no explanation for how Gordon could "supply any missing element in Doshi", particularly given that Doshi explicitly provides for call routing utilizing his complex ATM virtual circuit scheme, as explained above rather than any Internet protocol, and no where mentions or suggests that an Internet protocol could be utilized instead of ATM. (Exhibit A, Forys Dec. at ¶76). It is unclear, technically, how the two patents could even be combined. (*Id.* at ¶¶76-77). While KSR "counsels against applying the [TSM test] as a rigid and mandatory formula... it remains necessary to show 'some articulated reasoning with some rational underpinning to support the legal conclusion on obviousness." *Aventis Pharma v. Lupin*, 499 F.3d 1293, 1301 (Fed. Cir. 2007)(emphasis added). Accordingly, the Defendants have failed to show by clear and convincing evidence that the claim 1 of the Turock patent is obvious in view of Doshi and Gordon.

d. Huang's Invention of Single Number Dialing in an Internet Environment After Turock's Invention Date is Irrelevant to Obviousness

The Defendants make the curious argument that because Huang provided an ATM based and an Internet protocol based, single-number dialing telephony system in May of 1995 that that is somehow evidence that Huang combined Doshi and Gordon. *See* Defendants' Motion at 16-17. This argument fails for the simple reason that the Defendants have provided no evidence of the level of ordinary skill in the art that frames an obviousness analysis. *Braintree Lab's, Inc.*, 58 F.Supp.2d at 1302. In addition, the Defendants cite no legal authority for the proposition that a later filed application can provide evidence that a person skilled in the art can combine two other references, neither of which are cited in the application and which are directed to fundamentally different network schemes. *Id.* Moreover, their argument is irrelevant because Doshi's virtual circuit based ATM patent employs a fundamentally different call routing scheme than that provided by an Internet based system, as discussed above. The mere fact that another inventor, who may have had much greater than average skill in the art, was able to develop a system that could use either type of protocol is irrelevant. The Defendants make repeated assertions that one could simply swap one network for another, but they provide no citation to expert testimony for this proposition, instead relying solely on attorney argument. (*See* Defendants' Motion at 16-17; Exhibit A, Forys Dec. at ¶¶76-77). Accordingly, Huang's subsequent development of an ATM or IP-based, single-number dialing system is irrelevant to the facts at hand.

e. *Miniauction, Inc. v Thomson Corp.* is Inapplicable to the Facts of this Case

Miniacution, Inc. v. Thomson Corp. cannot cure the deficiencies of Defendants' obviousness case. 2008 U.S. App. LEXIS 14858 (Fed. Cir. 2008). *Miniauction* does not sanction the failure of the Defendants to prove the level of ordinary skill in the art, it does not alleviate the Defendants' problem of combining references addressing completely different problems, and it does not supply the Defendants with a basis for treating ATM and IP as interchangeable technologies in the context of Turock's invention. As such, *Miniacution* is simply inapposite to the facts at hand.

CONCLUSION

Because the asserted claims are valid in view of either Doshi, Doshi in combination with the general knowledge of those of skill in the art, or Doshi in combination with Gordon, the Defendants' motion for summary judgment of invalidity should be denied.

DATED: July 29, 2008.

Respectfully submitted,

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CERTIFICATE OF ELECTRONIC SERVICE

This is to certify that all counsel of record who are deemed to have consented to electronic service are being served with a copy of this document via the Court's CM/ECF system per LOCAL RULE CV-5(a)(3) today June 29, 2008. All other counsel of record will be served by postage paid, certified first class mail, return receipt requested.

/s/ Mark W. Born
Mark W. Born

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

C2 COMMUNICATIONS TECHNOLOGIES, INC.,	§	
	§	
Plaintiff,	§	**Civil Action No. 2:06CV-241 TJW**
	§	
vs.	§	**JURY TRIAL REQUESTED**
	§	
AT&T, CORP., *et al.*,	§	
	§	
Defendants.	§	

DECLARATION OF MARK BORN

I Mark Born, pursuant to the provisions of 28 U.S.C. §1746, declare as follows:

1. My name is Mark Born. I am over the age of 18, of sound mind, and otherwise competent to make this declaration.

2. I am an attorney with The Ware Firm in Dallas, Texas. I am one of the attorneys representing Plaintiff C2 Technologies, Inc. ("C2") in the above captioned case.

3. The following Exhibits to Plaintiff's Response to Motion for Summary Judgment That the Asserted Claims Are Invalidated by the Doshi Patent are true and correct copies of the following:

   a. Attached hereto is Exhibit A a true and correct copy of the Declaration of Leonard J. Forys and attachments thereto.

   b. Attached hereto is Exhibit B a true and correct copy of excerpts from the videotaped deposition of Bharat Doshi, Ph.D., held on Friday, May 23, 2008.

c. Attached hereto is Exhibit C a true and correct copy of the Wikipedia definition of Protocol.

d. Attached hereto is Exhibit D a true and correct copy of Ethernetindustrialnetworking.com technical article: *Looking Behind the Automation Protocols*.

e. Attached hereto is Exhibit E a true and correct copy of *Performance Analysis of Switch Access Systems*, Bell Labs Technical Journal, April-June 1999.

f. Attached hereto is Exhibit F a true and correct copy of *Protocols, Performance, and Controls for Voice Over Wide Area Packet Networks*, Bell Labs Technical Journal, October-December 1998.

4. I declare under penalty of perjury that the foregoing is true and correct.

Executed on July 29, 200

Mark Born

APPENDIX 9

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

C2 Communications Technologies, Inc. Plaintiff, v. AT&T, Inc. et al. Defendants.	Civil No. 2:06-CV-241 (TJW)

DEFENDANTS' REPLY BRIEF ADDRESSING PLAINTIFF'S RESPONSE TO MOTION FOR SUMMARY JUDGMENT THAT THE ASSERTED CLAIMS ARE INVALIDATED BY THE DOSHI PATENT

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CASES

STATUTES AND REGULATIONS

Defendants Global Crossing Telecommunications, Inc., Level 3 Communications, LLC and Qwest Communications Corporation ("Defendants") respectfully submit this reply brief (1) to address issues raised in Plaintiff's Response to Motion for Summary Judgment that the Asserted Claims Are Invalidated by the Doshi Patent ("C2 Anticipation/Obviousness Response") (Document 243), and thereby (2) to demonstrate why Defendants are entitled to the summary judgment requested in their anticipation/obviousness invalidity motion, based primarily on the Doshi patent ("Defendants' Anticipation/Obviousness Motion") (Document 229).

SUMMARY OF REPLY

Summary Judgment is Appropriate

The C2 Anticipation/Obviousness Response contains no challenge to the Statement of Material Facts submitted in Defendants' Anticipation/Obviousness Motion.

The Turock Patent is Anticipated by Doshi

Under the Court's construction of "Internet protocol" and "public computer network," C2's expert affidavit essentially concedes that the ATM voice messages described in U.S. Patent No. 5,568,475 ("Doshi" or "Doshi patent") are transmitted over the Internet, proving Defendants' point that ATM messages are an "Internet protocol." Similarly, Defendants' uncontested evidence proves that the ATM network described in Doshi was a "public computer network."

In other words, C2's expert *affirmatively* confirms that the patent in suit, U.S. Patent No. 6,243,373 (the "Turock patent"), is anticipated by Doshi.

The only way C2 can avoid this result is to seek to revisit the Court's construction of "Internet protocol" and "public computer network." This untimely and improper attempt to reargue claims construction must fail.

The clear, convincing, and uncontested evidence entitles Defendants to summary judgment that the Turock patent is invalid under 35 U.S.C. § 102 as anticipated by Doshi.

The Turock Patent is a Predictable Combination of Prior Art Elements

C2's expert affidavit states that the "concept of one-step dialing was well known to persons of even limited skill in the art since equal access using presubscription for long distance companies was established for nearly a decade before the Turock patent." This undisputed statement of material fact by C2's expert is confirmed by the Huang patent and patent application, which in 1995 combined one-number dialing through preset numbers with Internet long distance transmission between points on the PSTN. Under the applicable standards recently established by the Supreme Court and Federal Circuit, this uncontested material fact that one-step dialing through presubscription was well-known in the art by 1995 proves that the asserted claims of Turock patent would have been obvious to a person skilled in the art.

ARGUMENT

I. The Response Raises No Genuine Issue of Material Fact

In full compliance with Local Rule CV-56(a), Defendants' Anticipation/Obviousness Motion includes a Statement of Undisputed Material Facts with comprehensive citations to proper summary judgment evidence. (Document 229, pp. 2-6).

Local Rule CV-56(b) provides that "[a]ny response to a motion for summary judgment ***must*** include: . . . (2) any response to the 'Statement of Undisputed Material Facts.'" (Emphasis added). The C2 Anticipation/Obviousness Response, however, contains no such response. In addition, C2 has not timely objected to any of the supporting evidence attached by Defendants in support of the Statement of Undisputed Material Facts. To the contrary, however, almost all of the evidence attached to the C2 Anticipation/Obviousness Response is inadmissible and therefore could not raise a genuine fact issue. (*See* Defendants' Motion to Strike Inadmissible Material Attached to the Summary Judgment Responses of Plaintiff C2 (Document 253).

In these circumstances, it is proper under Federal Rules 56(c) and (e) to grant summary judgment based on Defendants' Anticipation/Obviousness Motion.

II. C2's Evidence Independently Confirms That Doshi Anticipates Turock

C2 focuses on two elements of the Turock patent in trying to rebut that the Doshi patent anticipates all the elements of the Turock patent (Document 229, pp. 8-13). C2 argues that Doshi does not disclose either "an Internet protocol" or a "public computer network." (Document 243, pp. 4-16).

This Court construed each of these two terms. (Document 219). An "Internet protocol" is "a communications format capable of transmitting data over the Internet." (*Id.*, p. 13). The Court construed "public computer network" as "a computer network available to the general public." (*Id.*)

C2 does not challenge Defendants' Undisputed Material Fact # 11 that "an ATM protocol is an 'Internet protocol' because packets in ATM format are capable of transmitting data over the Internet." (Document 229, p. 4). Undisputed Material Fact # 12, based in part on C2's admission in response to Defendants' Request for Admission, establishes that "it was well-known in the art that Internet Protocol ("IP") traffic could be sent over ATM networks." (Document 229, p. 4). And, C2's technical expert states that he "does not dispute the fact that ATM networks may be used as part of the Internet." (Document 243-3 ¶ 72, at p. 26; *accord*, *id.* ¶ 60, at p. 21 (Forys Affidavit)). That same expert describes ATM networks as samples of "data networks" and refers to "data technologies including ATM." (*Id.* ¶ 13, p. 3, ¶ 19, p. 5). The Doshi patent itself explains that the ATM methodology creates data packets. (Document 230-4, col. 1, ll. 14-22).

Under the uncontested facts, the ATM protocol for creating data packets disclosed in the Doshi patent constitutes an "Internet protocol" because, under the Court's claims construction, an ATM protocol is "***capable*** of transmitting data over the Internet."

C2 also does not challenge Defendants' Undisputed Material Fact # 21 that the Doshi patent "discloses a public computer network." (Document 229, p. 5). Similarly, C2 does not challenge Defendants' Undisputed Material Fact # 23 that the Doshi patent "discloses a computer network that is at least a portion of an Internet computer network." (*Id.*). C2 nowhere argues that the IXC network disclosed in Doshi was not "available to the general public." And C2's expert confirms that the prior art disclosed "deployment of ATM switches within 'classical IP' networks." (Document 243-3, ¶ 67, at p. 24).

III. C2's Anticipation Response Impermissibly Attempts to Reargue Claim Construction

After Dr. Doshi was deposed in this case on May 23, 2008, C2 apparently concluded that his patent would anticipate the Turock patent under the construction of "Internet protocol" that C2 had previously advocated. (*See* Document 172, p. 5). On June 9, 2008, C2 sought to "withdraw" its construction in favor of a narrower construction. (*See* Document 217).

The Court rejected C2's attempted "withdrawal." (Document 219, p. 13). C2 now "interprets" (i.e., disregards) the Court's construction of "Internet protocol," arguing for a narrow construction virtually identical to the narrow construction once rejected by the Court. (Document 243, pp. 6-14). Similarly, C2 hinges its anticipation response on a new "interpretation" of "public computer network." (*Id.* at 15-17).

Under Federal Rule 72(a), C2 had the opportunity to object to the Magistrate's claims constructions within 10 days of service of the Magistrate's *Markman* ruling. C2 did not take this opportunity. Under Rule 72, therefore, C2 "may not assign as error [any] defect" in the

Markman ruling. In other words, C2 is irretrievably bound by the Court's current *Markman* ruling. No further interpretation of these claim terms is permissible as a matter of Rule 72(a) – and certainly not under the guise of an expert's "interpretation." And in any event, C2 should not be permitted to advance claims constructions that are inconsistent with such a ruling that is binding on C2.[1] *See Saffran v. Boston Scientific Corp.*, No. 05-547, 2008 U.S. Dist. LEXIS 52563, *4 (E.D. Tex. Jul. 9, 2008) (discussing consequence of expert testimony contradicting the court's *Markman* order). Accordingly, C2's entire argument on anticipation necessarily fails as a matter of law under Rule 72.

IV. <u>C2's Expert's Declaration Makes Clear That the Turock Patent is Obvious</u>

U.S. Patent No. 5,608,786 (the "Gordon patent") is prior art. (Document 229, p. 6) (Defendants' Undisputed Material Fact # 26). "When [the] Gordon [patent] was raised during prosecution of the '373 patent, Turock sought to distinguish Gordon solely on the basis that Gordon used two-stage dialing." (Document 229, p. 6) (Defendants' Undisputed Material Fact # 27). It is clear that the text of the Gordon patent discloses all of the elements of the Turock patent other than one-step dialing. (*See* Document 229, pp. 6, 15-16).

C2's expert states that the "concept of one-step dialing was well known to persons of even limited skill in the art since equal access using presubscription for long distance companies was established for nearly a decade before the Turock patent." (Document 243-3 ¶ 94, p. 33) This is an undisputed material fact. Moreover, this fact is fully confirmed by the Huang patent in late 1995 and Huang's draft patent application in May of 1995. (Documents 232-4, 232-5). Huang explicitly used preset numbers to accomplish one-step dialing in the context of a system

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[1] Defendants reserve the right to move for reconsideration of the claim construction if it becomes apparent after C2 serves its invalidity rebuttal report that C2's expert intends to argue his "interpretation," and thus claim construction issues to the jury.

for transmitting long distance calls originating and terminating in the PSTN over a "packet network," citing the Internet as an example of a "packet network." (Document 232-5, at Figs. 6, 7; Document 232-4, at HS 000956-57).

A person with skill in the art would have known how to accomplish one-step dialing through presubscription and to combine one-step dialing with the other elements disclosed in the Gordon patent to yield the predictable result of Internet transmission of long distance phone calls from one part of the PSTN to another. This qualifies as a quintessential ground for an obviousness summary judgment under recent and controlling Supreme Court and Federal Circuit authority. *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727, 1739 (2007); *Leapfrog Enterprises, Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1160-63 (Fed. Cir. 2007).

V. C2's Obviousness Response Otherwise Fails as a Matter of Law

Defendants demonstrated how publications from 1995 would have caused a person skilled in the art to combine one-step dialing with internet telephony, or to substitute Internet transmission for Doshi's ATM network, and thereby accomplish all the elements of the Turock patent. (Document 229, p. 15). C2 nowhere attempts to challenge the facts supporting this analysis or to refute this legal argument. (Document 229, pp. 3-4) (Defendants' Undisputed Material Facts ## 10-12).

Defendants likewise demonstrated how the Gordon patent supplied the elements that C2 claims to be missing in the Doshi patent. (Document 229, pp. 15-16). The facts supporting this analysis were stated in Defendants' Anticipation/Obviousness Motion and now also stand wholly uncontested. (Document 229, p. 6) (Undisputed Material Facts ## 28 and 29).

C2 purports to address this argument based on a combination of Doshi and Gordon. (Document 243, pp. 19-20). But, this section of C2's Anticipation/Obviousness Response really just attacks straw men and nowhere refutes Defendants' argument.

For example, C2 argues that Doshi does not suggest replacement of ATM with Internet protocol. (*Id.* p. 20). This argument is an evasion which turns on the now-rejected rigid application of the Teaching/Suggestion/Motivation test. Viewing Doshi in isolation from other prior art is improper; the Gordon patent itself explicitly suggests and teaches use of the Internet for long distance telephony between phones on the PSTN. (Document 231-4, at Fig. 5, col. 8, l. 62 – col. 9, l. 17). Both the Huang and Turock patents (Doc. 175, Exhibit D) describe the strong economic motivations for use of the Internet in long distance telephony. (Document 232-5, at col. 2, ll. 35-51; Document 230-1, at col. 2, ll. 49-67). The combination of the Gordon and Doshi patents satisfies any acceptably flexible evaluation of obviousness.

Misapplying the pertinent analysis, C2 points to the supposed technical difficulty in combining the two patents. (Document 243, p. 20). As the Federal Circuit explained just this past month, however, the "central principle in" the obviousness "inquiry is that 'a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions.'" *Muniauction, Inc. v. Thomson Corp.*, No. 2007-1485, slip op. (Fed. Cir. July 14, 2008) (Document 238-2) (quoting *KSR*, 127 S. Ct. at 1734)). The focus of the proper obviousness analysis is the "use" of particular prior art "***elements***," not a brute-force combination of embodiments of two entire patents. The Turock patent is obvious as a matter of law precisely because it is ***nothing more*** *than* "the predictable use of the prior art ***elements***" of Doshi and Gordon "according to their established functions" within the meaning of *KSR*.

Accordingly, the C2 Anticipation/Obviousness Response fails to provide a valid impediment to summary judgment on obviousness grounds.

VI. Huang's Simultaneous Invention Is Strong Evidence of Ordinary Skill in the Art and Obviousness

C2 purportedly finds Defendants' reliance on Huang's invention to be "curious." (Document 243, p. 20; *see* Document 229, pp. 16-17).

First, it has long been settled that "[t]he fact of near-simultaneous invention, though not determinative of statutory obviousness, is strong evidence of what constitutes the level of ordinary skill in the art." *Ecolochem v. S. Cal. Edison Co.*, 227 F.3d 1361, 1379 (Fed. Cir. 2000) (citing *The Int'l Glass Co. v. U.S.*, 408 F.2d 395, 405 (Ct. Cl. 1967)). The Huang invention in 1995, is at the very least "near-simultaneous" with (and under undisputed facts prior to) the Turock "invention." The Huang invention is strong evidence of the level of ordinary skill in the art, refuting the C2 argument that Defendants have not proved the level of ordinary skill in the art. (Document 243, pp. 17-18, 20).

Furthermore, the Supreme Court has held that the "failure of others" is a valid secondary consideration tending to show non-obviousness. *KSR*, 127 S. Ct. at 1734 (quoting *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966)). The obvious corollary is that evidence of *successful* near-simultaneous invention is strong evidence that a claimed invention was obvious. *Ecolochem*, 227 F.3d at 1379. In *Ecolochem*, the Federal Circuit upheld a district court's reliance on evidence of simultaneous invention as evidence of obviousness. *Id.*; *accord*, *In re Merck & Co.*, 800 F.2d 1091, 1098 (Fed. Cir. 1986).

Inasmuch as C2 offers no evidence of secondary considerations tending to show non-obviousness, the Huang invention provides clear and convincing evidence that Defendants' *prima facie* cases of obviousness warrant summary judgment of invalidity.

VII. *Muniauction* Is Directly on Point

C2 makes no serious attempt to refute Defendants' demonstration that the Federal Circuit's recent decision in *Muniauction* compels summary judgment of obviousness in this case. (*See* Document 238). Instead, C2 argues that *Muniauction* is irrelevant because of Defendants' purported failure to prove the level of skill in the art, the supposed problem of "combining references," and the failure of *Muniauction* to supply a basis for treating ATM and IP as interchangeable. (Document 243, p. 21).

These are clearly unavailing attempts to avoid the import of *Muniauction*. Here, there is evidence of the level of skill in the art, and as in *Muniauction*, there is no dispute about that level of skill. *Muniauction*, citing *KSR*, demonstrates that the relevant combination is of prior art "elements," not entire references. Defendants' Undisputed Material Facts ## 10-12 establish that those of ordinary skill in the art considered ATM and IP systems interchangeable and interconnectable in the long distance telephony context of the Turock patent.

C2 has no meaningful basis to avoid the dispositive impact of *Muniauction*.

CONCLUSION

Accordingly, Defendants respectfully request that the Court enter summary judgment on Defendants' affirmative defenses and counterclaims that the asserted claims of the Turock Patent are invalid because (a) they are anticipated by Doshi alone; or (b) are obvious from Doshi in combination with elements of other prior art and common knowledge in the art at the time.

Dated: August 11, 2008

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing document was served in compliance with the Federal Rules of Civil Procedure via electronic mail on all counsel of record on the 11th day of August, 2008.

/s/ Jacob K. Baron
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