A communication method comprises: processing a first message from the user CPE to select a circuit switch from a plurality of circuit switches, and selecting an identifier and a DS0 to route user communications from the user CPE to the circuit switch; transferring a second message indicating the identifier and the DS0 and transferring an SS7 IAM to the circuit switch; receiving the user communications from the user CPE in a packet format having the identifier in headers, and routing the user communications in the packet format based on the identifier in the headers; and receiving the second message and the user communications in the packet format, and in response, converting the user communications from the packet format into a DS0 format and transferring the user communications in the DS0 format over the DS0 to the one circuit switch.
BROADBAND TELECOMMUNICATIONS SYSTEM

RELATED APPLICATIONS

[0001] This patent application is a continuation of U.S. patent application Ser. No. 10/261,530; filed Oct. 1, 2002; entitled “BROADBAND TELECOMMUNICATIONS SYSTEM,” which is a continuation of U.S. Pat. No. 6,501,759; filed Feb. 4, 2000; entitled “BROADBAND TELECOMMUNICATIONS SYSTEM,” which is a continuation of U.S. Pat. No. 6,115,280; filed on Nov. 22, 1996; entitled “BROADBAND TELECOMMUNICATIONS SYSTEM,” and which is hereby incorporated by reference into this patent application.

FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable

MICROFICHE APPENDIX

[0003] Not applicable

BACKGROUND OF THE INVENTION

[0004] 1. Field of the Invention

[0005] The invention relates to broadband systems, and in particular, to broadband systems that utilize narrowband systems for various capabilities.

[0006] 2. Background of the Prior Art

[0007] Conventional circuit switches provide the backbone for many current telecommunications networks. These switches process call signaling and extend the call connection towards the destination. They have also been developed to include sophisticated capabilities. Examples include caller validation, number screening, routing, connection control, and billing. These switches are also used to deploy various services. Examples include calling cards, “800” calling, voice messaging, and class services.

[0008] At present, Asynchronous Transfer Mode (ATM) technology is being developed to provide broadband switching capability for telecommunications calls, which are requests for telecommunications services. Some ATM systems have used ATM cross-connects to provide virtual connections, but cross-connect devices do not have the capacity to process signaling used by telecommunications networks to set up and tear down calls. Thus, ATM cross-connects cannot make connections on a call-by-call basis. As a result, connections through cross-connect systems must be pre- provisioned which creates a relatively rigid switching fabric. Due to this limitation, ATM cross-connect systems have been primarily to provide dedicated connections, such as permanent virtual circuits (PVCs) and permanent virtual paths (PVPs). But, they do not provide ATM switching on a call by call basis as required to provide switched virtual circuits (SVCs) or switched virtual paths (SVPs). Those skilled in the art are well aware of the efficiencies created by using SVPs and SVCs as opposed to PVCs and PVPs because SVCs and SVPs utilize bandwidth more efficiently.

[0009] ATM switches have also been used to provide PVCs and PVPs. Because PVCs and PVPs are not established on a call-by-call basis, the ATM switch does not need to use its call processing or signaling capacity. ATM switches require both signaling capability and call processing capability to provide SVCs and SVPs. In order to achieve virtual connection switching on a call by call basis, ATM switches are being developed that can process calls in response to signaling to provide virtual connections for each call. These systems cause problems, however, because they must be very sophisticated to support current networks. These ATM switches must process high volumes of calls and transition legacy services from existing networks. An example would be an ATM switch that can handle large numbers of POTS, 800, and VPN calls.

[0010] Currently, ATM multiplexers are capable of interworking traffic of other formats into the ATM format. These are known as ATM interworking multiplexers (muxes). ATM multiplexers are being developed that can interwork traffic into ATM cells and multiplex the cells for transport over an ATM network. These ATM mux are not used to implement virtual connections selected on a call-by-call basis.

[0011] Unfortunately, there is a need for efficient systems that can integrate the capabilities of broadband components with the capabilities of conventional circuit switches. Such a system would provide ATM virtual connections on a call-by-call basis, but support the numerous services currently provided by circuit switches.

SUMMARY

[0012] Examples of the invention include a method of operating a communication system to transfer user communications from user Customer Premises Equipment (CPE) to one of a plurality of circuit switches. The method comprises receiving and processing a first message from the user CPE to select the one circuit switch from the plurality of circuit switches, and selecting an identifier and a DSO to route user communications from the user CPE to the one circuit switch. The method comprises transferring a second message indicating the identifier and the DSO and transferring a Signaling System Seven (SS7) Initial Address Message (IAM) to the one circuit switch indicating the DSO. The method comprises receiving the user communications from the user CPE in a packet format having the identifier in headers, and routing the user communications in the packet format based on the identifier in the headers. The method comprises receiving the second message and the user communications in the packet format, and in response, converting the user communications from the packet format into a DSO format and transferring the user communications in the DSO format over the DSO to the one circuit switch.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1 is a block diagram for a version of the invention.

[0014] FIG. 2 is a logic diagram for a version of the invention.

[0015] FIG. 3 is a block diagram for a version of the invention.

DETAILED DESCRIPTION

[0016] FIG. 1 depicts a version of the invention. The term “connection” refers to the transmission media used to carry user traffic and the term “link” refers to the transmission
media used to carry signaling or control messages. On FIG. 1, connections are shown by solid lines and links are shown by dashed lines. Users 100 and 102 are connected to broadband system 104 by connections 150 and 151 respectively. Users 100 and 102 are linked to broadband system 104 by links 160 and 161 respectively. Users 100 and 102 could be any entity that supplies telecommunications traffic to broadband system 104 or that receives traffic from broadband system 104. Some examples would be a telecommunications switch or customer premises equipment (CPE). Connections 150 and 151 represent any connection that might be used by users 100 and 102 to access broadband system 104. Examples include: DS3, DS1, DS0, ISDN, E3, E1, E0, SDH, SONET, cellular, and PCS connections. Links 160 and 161 represent any signaling link that might be used between users 100 and 102 and broadband system 104. Examples include signaling system #7 (SS7), C7, ISDN, TCP/IP, and UDP/IP.

Broadband system 104 includes ATM interworking multiplexer (mux) 110, mux 112, mux 114, ATM cross-connect 120, narrowband switches 130 and 132, and signaling processor 140. Broadband system 104 also includes connections 152-156 and links 162-166. Cross-connect 120 is connected to mux 110, 112, and 114 by connections 152, 153, and 154 respectively. Mux 112 is connected to switch 132 by connection 155, and mux 114 is connected to switch 130 by connection 156. Mux 112 is connected to user 100 by connection 150, and mux 112 is connected to user 102 by connection 151. Connections 152-154 are ATM connections—preferably carried by SONET. Connections 155 and 156 are narrowband connections similar to connections 150 and 151. Preferably, connections 155 and 156 are DS3 or DS1 connections with embedded DS0s.

Signaling processor 140 is linked to mux 110 by link 162, to mux 112 by link 163, to switch 132 by link 164, to mux 114 by link 165, and to switch 130 by link 166. Signaling processor is linked to users 100 and 102 by links 160 and 161 respectively. One skilled in the art is aware that an STP might be used to exchange signaling instead of direct links. Links 160, 161, 164, and 166 are conventional signaling links with examples being SS7, ISDN, or C7. Links 162, 163, and 165 are any links that carry control messages, with examples being SS7 links, UDP/IP over-etherenet, or a bus arrangement using a conventional bus protocol. Typically the switches and muxes are connected to a network management system that is not shown for purposes of clarity.

ATM cross-connect 120 is a conventional device that provides a plurality of ATM virtual connections between the muxes. Typically, the virtual connection would use DS1, DS3, or SONET for transport. The virtual connections are typically designated by the Virtual Path Identifier/Virtual Channel Identifier (VPI/VCI) in the cell headers. These VPI/VCIs are provisioned from mux 110 to mux 114, but the cross-connect does not need to be controlled on a call-by-call basis. An example of the cross-connect is the NEC model 20. Those skilled in the art are aware that a multiple cross-connects could be used in this fashion, but for purposes of clarity, only a single cross-connect is shown. Either a single cross-connect or multiple cross-connects are referred to as a cross-connect system.

Muxes 110, 112, and 114 are operational to interwork (convert) traffic between ATM and non-ATM formats in response to control messages from signaling processor 140. Typically, this interworking entails interworking individual DS0s with individual VPI/VCIs in accord with messages from by signaling processor 140. A detailed description of the muxes is provided further below.

Narrowband switches 130 and 132 are conventional circuit switches. These switches process and interconnect calls. Typically, they connect an incoming DS0 to an outgoing DS0. Often, they perform numerous tasks including, validation, screening, routing, billing, and echo control. These switches can also be configured to provide special services. Examples of special services are: calling cards, class services, voice activated calling, and voice messaging, virtual private networking, hearing impaired assistance/enhancement, operator services and intelligent network call routing (local number portability, personal/terminal mobility, toll free calling).

Signaling processor 140 is operational to receive and process signaling to select a narrowband switch and connections to the selected switch. This switch selection can be based on various criteria. A few examples are: available access to the switch, current loading on the switch, the service capabilities of the switch, or the area served by the switch. Typically, the connections would be a VPI/VCI and a DS0. Signaling processor 140 is capable of providing control messages to the muxes to implement the connections. Signaling processor 140 is also capable of exchanging signaling with the switches to facilitate call processing. If required signaling processor 140 can also exchange signaling with the users to facilitate the call. A detailed description of signaling processor 140 follows further below.

In this embodiment, the invention operates as follows for a call from user 100 to user 102. In this embodiment, signaling processor 140 is transparent to the users and to the narrowband switches. The users and narrowband switches attempt to interact as they would in a typical network scenario. In the context of the invention, signaling is “intercepted” and processed by signaling processor 140. Connections are “intercepted” and extended by the muxes.

User 100 will seize a call connection on connection 150 to mux 110. Typically, this is a DS0 embedded within a DS3. User 100 will also forward a call set-up message to signaling processor 140. Typically, this is an SS7 Initial Address Message (IAM). Signaling processor 140 will process the IAM in order to select a switch to process the call, it will select the connections to that switch. For example, if switch 130 is selected, an ATM connection pre-provisioned through cross-connect 154 frommux 110 to mux 114 over connections 152 and 154 would be selected. In addition, a connection to switch 130 would be selected within connection 156. For a standard call, a VPI/VCI and a DS0 would be selected by signaling processor 140.

Signaling processor 140 would send an IAM to switch 130 over link 166. The IAM would contain information used to process the call, such as the dialed number and the incoming DS0. Signaling processor would send a control message to mux 110 over link 162. The control message would instruct mux 110 to interwork the DS0 on connection 150 with the selected VPI/VCI on connection 152. Signaling processor would send a control message to mux 114 over link 165. The control message would instruct mux 114 to interwork the selected VPI/VCI on connection
154 with the selected DS0 on connection 156. As a result, a
call path from user 100 to switch 130 would be established
through mux 110, cross-connect 120, and mux 114.

[0026] Switch 130 would process the call and select a
route for the call. The switch would interconnect the
incoming DS0 on connection 156 with another DS0 on connection
156. Switch 130 would also send an IAM indicating the
destination for the call. In this example, the destination
selected by switch 130 would be user 102. The IAM from
switch 130 would be routed to signaling processor 140.
Signaling processor 140 could read the destination point
code in this IAM to determine the destination (user 102)
selected by the switch for the call. Signaling processor 140
would select a VIP/VCI from mux 114 to the mux serving
the destination—mux 112. Signaling processor 140 would
also select a DS0 within connection 151 between mux 112
and user 102.

[0027] Signaling processor 140 would send a control
message to mux 114 over link 165. The control message
would instruct mux 114 to interwork the DS0 on connection
156 with the selected VIP/VCI on connection 154. Signaling
processor 140 would send a control message to mux 112
over link 163. The control message would instruct mux 112
to interwork the selected VIP/VCI on connection 153 with
the selected DS0 on connection 151. Signaling processor
140 might send a signaling message to user 102 to facilitate
call completion.

[0028] As a result, a call path from switch 130 to user 102
would be established through mux 114, cross-connect 120,
and mux 112. Combining the two call paths, a connection
from user 100 to user 102 is established through broadband
system 104. Advantageously, this is accomplished over
broadband ATM connections, but without the need for an
ATM switch or the call-by-call control of the ATM cross-
connect. The muxes and the cross-connect provide ATM
connections selected by the signaling processor on a call-
by-call basis. The signaling processor makes these selec-
tions based on the call processing of the narrowband switch.
The narrowband switch is also able to provide special
features to the call.

[0029] Advantageously, only one narrowband switch was
required within system 104. Because ATM broadband trans-
port is available, the location of this switch is relatively
independent. Any switch in system 104 could be used to
process call. The ATM system provides the connection from
the origination point to the switch, and from the switch to the
destination point. This means narrowband switches can be
selected based on load and availability. A narrowband switch
could also be taken out of service simply by instructing the
signaling processor to quit selecting it.

[0030] The Signaling Processor

[0031] The signaling processor would typically be sepa-
rate from the muxes, but those skilled in the art appreciate
that they could be housed together and coupled in a bus
arrangement instead of being coupled by a data or signaling
link. The signaling processor may support a single mux or a
plurality of muxes. The signaling processor is comprised of
hardware and software. Those skilled in the art are aware of
various hardware components which can support the
requirements of the invention. One example of such hard-
ware is the FT-Sparc provided by Integrated Micro Products
PLC. The FT-Sparc could use the Solaris operating system.
Any data storage requirements could be met with conven-
tional database software systems.

[0032] FIG. 2 illustrates an example of the signaling
processor, but any processor which supports the require-
ments stated for the invention would suffice. As shown in
FIG. 2, signaling processor 240 includes functional blocks
composed of SS7 interface 242, mux interface 244, and
connection processor 246. These functional blocks have
interrelations that are indicated and that are discussed below.
SS7 interface 242 receives and transmits SS7 signaling over
link 261. Mux interface 244 exchanges control messages
with the muxes over link 263. Connection processor 246
exchanges network management information with network
management systems over link 263.

[0033] SS7 interface 242 is operational to receive and
transmit SS7 messages. SS7 interface 242 includes Message
Transfer Part (MTP) functionality for MTP levels 1, 2, and 3.
MTP 1 defines the physical and electrical requirements for
a signaling link. MTP 2 sits on top of MTP 1 and maintains
reliable transport over a signaling link by monitoring status
and performing error checks. Together, MTP 1-2 provide
reliable transport over an individual link. A device would
need MTP 1-2 functionality for each link it uses. MTP 3
sits on top of MTP 2 and provides messages to the proper
signaling link (actually to the MTP 2 for that link). MTP 3
directs messages to applications using MTP 1-2 for access
to the signaling system. MTP 3 also has a management func-
tion which monitors the status of the signaling system and
can take appropriate measures to restore service through the
system. MTP levels 1-3 correspond to layers 1-3 of the open
systems interconnection (OSI) reference model (OSI/RM).

[0034] SS7 interface 242 also includes Integrated Services
Digital Network User Part (ISUP) functionality. This might
include ISUP timers that generate release message or re-
transmit message where appropriate. If B-ISUP signaling is
being used, SS7 interface 242 could also be equipped with
B-ISUP capability. All of these elements are known in the
art. SS7 interface 242 could be constructed using commer-
cially available SS7 software interface tools. An example of
such tools would be SS7 interface software provided by
either Trillium, Inc., or by Dale, Gesek, McWilliams, and
Sheridan, Inc.

[0035] SS7 interface 242 forwards IAM messages from
link 261 to connection processor 246. SS7 interface 242 also
receives IAMs from connection processor 246 and transmits
them over link 261. SS7 interface 242 will receive subse-
cquent SS7 call-related messages from link 261. SS7 inter-
face 242 will alter the routing labels of these subsequent
messages and re-transmit them over link 261. Examples of
these subsequent messages include Address Complete Mes-
sages (ACM), Answer Messages (ANM), Release Messages
(REL), and Release Complete Messages (RLC).

[0036] The routing label contains a Destination Point
Code (DPC), an Originating Point Code (OPC), a Circuit
Identification Code (CIC), and a Signaling Link Selection
(SLS) code. The OPC and DPC identify the origin and
intended destination for the signaling message. For example,
a message sent from point A to point B would have an OPC
of A and a DPC of B. A return message would reverse the
two and have an OPC of B and DPC of A. The CIC identifies
the originating circuit used on the call. The SLS is used to
allow load sharing among the signaling links.
[0037] The following discussion refers to FIG. 1 and its associated embodiment. When subsequent call related messages are received by the SS7 interface of signaling processor 140, the OPC, DPC, and/or CIC may need to be altered. A message from originating user 100 to selected switch 130 would have its DPC and CIC altered to reflect the new DPC and CIC selected for the call by signaling processor 140. This is because switch 130 expects its own DPC and switch 130 also needs to know the actual DSO used by mux 114 on connection 156. A message to originating user 100 from switch 130 would have its OPC altered to reflect the DPC in the original IAM from user 100. This is because user 100 expects response messages for the call from the point where the original IAM was sent. This point code is the DPC of the original IAM. The CIC is also altered to reflect the CIC in the original IAM from user 100. This is because user 100 expects the DSO in the message to be the DSO used in connection 150. Messages between terminating user 102 and selected switch 130 would need the CICs altered to reflect the actual DSOs used by the recipient of the message. The CIC in messages from user 102 to switch 130 would reflect the DSO in connection 156. The CIC in messages from switch 130 to user 102 would reflect the DSO in connection 151.

[0038] Referring back to FIG. 2, connection processor 246 is operational to process incoming IAMs and select connections. On calls into the network, connection processor 246 selects a narrowband switch to process the call and also selects the connections to this narrowband switch. These connections are typically VPI/VCI—DS0 combinations. If the call is extended beyond the selected narrowband switch, connection processor 246 identifies the required call destination in the IAM from the narrowband switch. Connection processor 246 also selects the connections to this destination. These connections are typically VPI/VCI—DS0 combinations.

[0039] As discussed above, the signaling processor can be transparent to the users. As a result, the users will send signaling to the narrowband switch selected by the user. The destination of this SS7 signaling message is identified by the Destination Point Code (DPC). Thus, on calls entering the network, the DPC indicates a narrowband switch selected by the user. Connection processor 246 typically uses this DPC to select a narrowband switch. This may be the same narrowband switch selected by the user or another narrowband switch. Connection processor 246 may then check the current usage of the selected switch. This might include the available trunk access to the switch and/or the processing load of the switch. If the access to the switch is congested or if the switch CPU is heavily loaded, then an alternate switch may be selected. In addition, special network operations may require the use of an alternate switch—for example, if a switch is inactive for maintenance or testing.

[0040] Once the switch is selected, connections to the switch are selected. The DSO in the inbound connection is identified by the Circuit Identification Code (CIC) in the IAM. A VPI/VCI is selected that has been previously provisioned through the cross-connect from the mux connected to the incoming DSO to the mux serving the selected switch. A DSO is selected from the latter mux to the selected switch. Based on the selections, IAM information is provided to SS7 interface 242, and control message information is provided to mux interface 244.

[0041] As discussed above, once the narrowband switch processes the call, it will send an IAM to the destination. Connection processor 246 will receive this IAM and use the DPC to identify the destination and select the appropriate connections to this destination. The CIC in the IAM identifies the DSO from the selected switch to the mux. A VPINC from that mux to a destination mux and a DSO from the destination mux to the destination are selected. The selections are then implemented by the muxes in response to control messages from signaling processor 240. Connection processor 246 also tracks the usage and status of connections and connection groups for the connections under its span of control. It also receives network management information.

[0042] In some embodiments, connection processor 246 uses at least portions of the dialled number to select the narrowband switch. For example, narrowband switch “A” might be assigned to area code “X.” On calls to area code “X,” switch “A” is selected. If switch “A” is unavailable, alternate switch “B” could be used. This could also be carried out using the area code and exchange (NPA-NXX). In some embodiments, the dialled number may correspond to a special service offered by a select group of switches. For example, the number “1-800-NXX-XXXX” might correspond to a calling card service offered from only two switches. “888” and “900” numbers are also used in this fashion. Connection processor 246 could select one of these switches based on the dialed number. In some embodiments, the caller's number (commonly referred to as ANI), may be used in a similar fashion in order to select the switch to provide services to a caller. In some embodiments, the call could be routed to a switch based on the carrier identified in the signaling. This information is found in the carrier identification parameter in the IAM.

[0043] Mux interface 244 accepts information from connection processor 246 indicating the connections that are to be made or disconnected. Mux interface 244 accepts this information and provides corresponding control messages to the appropriate muxes. Mux interface 244 may also receive acknowledgments from the muxes. As a result, signaling processor 240 can provide ATM header information to the muxes for use in configuring the headers of ATM cells so that the cells are routed to the desired destination.

[0044] ATM Interworking Multiplexers

[0045] FIG. 3 shows one embodiment of the mux that is suitable for the present invention, but other muxes that support the requirements of the invention are also applicable. Shown are control interface 300, OC-3 interface 305, DS3 interface 310, DS1 interface 315, DS0 interface 320, ATM adaption Layer (AAL) 330, and OC-3 interface 335. Control interface 300 exchanges control messages with the signaling processor. Typically, these messages include DS0—VPI/VCI interworking assignments that are to be implemented by AAL 330. As such, this information is provided to AAL 330.

[0046] OC-3 interface 305 accepts the OC-3 format and makes the conversion to DS3. DS3 interface 310 accepts the DS3 format and makes the conversion to DS1. DS3 interface 310 can accept DS3s from OC-3 interface 305 or from an external connection. DS1 interface 315 accepts the DS1 format and makes the conversion to DS0. DS interface 315 can accept DS Is from DS3 interface 310 or from an external connection. DS0 interface 320 accepts the DS0 format and
provides an interface to AAL 330. OC-3 interface 335 is operational to accept ATM cells from AAL 330 and transmit them to the cross-connect.

[0047] AAL 330 comprises both a convergence sublayer and a segmentation and reassembly (SAR) layer. AAL 330 is operational to accept the user information in DS0 format from DS0 interface 320 and convert the information into ATM cells. AALs are known in the art and information about AALs is provided by International Telecommunications Union (ITU) document 1.363. An AAL for voice is also described in patent application Ser. No. 08/395,745 filed on Feb. 28, 1995, entitled “Cell Processing for Voice Transmission,” and hereby incorporated by reference into this application. AAL 330 obtains the virtual path identifier (VPI) and virtual channel identifier (VCI) for each call from control interface 300. AAL 330 also obtains the identity of the DS0 for each call (or the DS0s for an N×64 call). AAL 330 then converts user information between the identified DS0 and the identified ATM virtual connection. Acknowledgments that the assignments have been implemented may be sent back to the signaling processor if desired. Calls with a bit rate that are a multiple of 64 kbit/second are known as N×64 calls. If desired, AAL 330 can be capable of accepting control messages through control interface 300 for N×64 calls.

[0048] As discussed above, the mux also handles calls in the opposite direction—from OC-3 interface 335 to DS0 interface 320. This traffic would have been converted to ATM by another mux and routed to OC-3 335 by the cross-connect over the selected VPI/VCI. Control interface 300 will provide AAL 330 with the assignment of the selected VPI/VCI to the selected outbound DS0. The mux will convert the ATM cells with the selected VPI/VCI in the cell headers into the DS0 format and provide it to the selected outbound DS0 connection. A technique for processing VPINCIs is disclosed in patent application Ser. No. 08/653,852, filed on May 28, 1996, entitled “Telecommunications System with a Connection Processing System,” and hereby incorporated by reference into this application.

[0049] DS0 connections are bi-directional and ATM connections are typically uni-directional. As a result, two virtual connections in opposing directions will typically be required for each DS0. As discussed, this can be accomplished by provisioning the cross-connect with companion VPI/VCIs in the opposite direction as the original VPI/VCIs. On each call, the muxes would be configured to automatically invoke the particular companion VPI/VCI to provide a bi-directional virtual connection to match the bi-directional DS0 on the call.

[0050] With an understanding of the preferred embodiment, those skilled in the art will appreciate that the present invention allows the integration of high speed broadband transport with systems configured for narrowband process and control. By performing call handling functions in narrowband switches, the broadband transport capability is transparent to the users and to other existing network components configured to interact with narrowband switches. Moreover, the broadband transport is accomplished economically and efficiently without the need for broadband switches.

[0051] Those skilled in the art will appreciate that variations from the specific embodiments disclosed above are contemplated by the invention. The invention should not be restricted to the above embodiments, but should be measured by the following claims.

1. A method of operating a communication system to transfer user communications from user Customer Premises Equipment (CPE) to one of a plurality of circuit switches, the method comprising:

   receiving and processing a first message from the user CPE to select the one circuit switch from the plurality of circuit switches, and selecting an identifier and a DS0 to route user communications from the user CPE to the one circuit switch;

   transferring a second message indicating the identifier and the DS0 and transferring a Signaling System Seven (SS7) Initial Address Message (IAM) to the one circuit switch indicating the DS0;

   receiving the user communications from the user CPE in a packet format having the identifier in headers, and routing the user communication in the packet format based on the identifier in the headers; and

   receiving the second message and the user communications in the packet format, and in response, converting the user communications from the packet format into a DS0 format and transferring the user communications in the DS0 format over the DS0 to the one circuit switch.

2. The method of claim 1 wherein selecting the one circuit switch from the plurality of circuit switches comprises selecting the one circuit switch based on available access to the one circuit switch.

3. The method of claim 1 wherein selecting the one circuit switch from the plurality of circuit switches comprises selecting the one circuit switch based on service capabilities of the one circuit switch.

4. The method of claim 1 wherein selecting the one circuit switch from the plurality of circuit switches comprises selecting the one circuit switch based on an area served by the one circuit switch.

5. The method of claim 1 wherein the one circuit switch is assigned to an NPA, wherein the first message from the user CPE indicates a called number, and wherein selecting the one circuit switch from the plurality of circuit switches comprises selecting the one circuit switch based on the called number having the NPA.

6. The method of claim 1 wherein the one circuit switch is assigned to an NPA-NXX, wherein the first message from the user CPE indicates a called number, and wherein selecting the one circuit switch from the plurality of circuit switches comprises selecting the one circuit switch based on the called number having the NPA-NXX.

7. The method of claim 1 wherein the one circuit switch provides a service that corresponds to a called number, wherein the first message from the user CPE indicates the called number, and wherein selecting the one circuit switch from the plurality of circuit switches comprises selecting the one circuit switch based on the called number corresponding to the service provided by the one circuit switch.

8. The method of claim 1 wherein the one circuit switch provides a calling card service that corresponds to a called number, wherein the first message from the user CPE indicates the called number, and wherein selecting the one circuit switch from the plurality of circuit switches com-
prizes selecting the one circuit switch based the called number corresponding to the calling card service provided by the one circuit switch.

9. The method of claim 1 wherein selecting the one circuit switch from the plurality of circuit switches comprises selecting the one circuit switch based on a caller number.

10. The method of claim 1 wherein selecting the one circuit switch from the plurality of circuit switches comprises selecting the one circuit switch based on a carrier identification.

11. The method of claim 1 wherein selecting the one circuit switch from the plurality of circuit switches comprises selecting the one circuit switch based on network maintenance conditions.

12. The method of claim 1 wherein the first message comprises an Internet Protocol (IP) message.

13. The method of claim 1 wherein the second message comprises an Internet Protocol (IP) message.

14. The method of claim 1 wherein receiving the user communications from the user CPE comprises receiving the user communications over a wireless connection.

15. The method of claim 1 wherein the packet format comprises asynchronous transfer mode and the identifier comprises a virtual path identifier.

16. The method of claim 1 wherein the packet format comprises asynchronous transfer mode and the identifier comprises a virtual circuit identifier.

17. The method of claim 1 further comprising routing the user communications from the circuit switch to a called party.

18. The method of claim 1 further comprising processing the user communications to provide a calling card service.

19. The method of claim 1 further comprising processing the user communications to provide a voice messaging service.

20. The method of claim 1 further comprising processing the user communications to provide a user terminal mobility service.

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