APPARATUS AND METHODS FOR MULTIMODE INTERNETWORKING CONNECTIVITY

FIELD OF THE INVENTION

The invention herein relates to the field of digital network and communication transmission system, more particularly, it relates to an apparatus able to provide multimode internetworking connectivity over a plurality of disparate network systems, service providers, and internetworking environments, concurrently and a method thereof.

BACKGROUND OF THE INVENTION

The advent of digital technology had led to the convergence of computing, networking, and high-bandwidth communication technologies to provide network connectivity for a multiplicity of integrated and interactive multimedia applications. Due to the development and demand of said multimedia applications, it is inevitable that network systems and infrastructures have to evolve from a myriad of discrete network systems into integration as well as hybridization of network systems and infrastructures, giving rise to network systems such as Multi-Protocol Label Switching (MPLS) enabled IP system.

In the internetworking environment, the Internet is presently the only global internetworking environment. The Internet is built upon Internet Protocol (IP) suites of network protocol stacks. Using IP-based routers and MPLS switches systems, data is routed from source to destination endpoints.

Currently, end-user would subscribe for Internet services from a single Internet Service Provider (ISP) by having interconnection between the Subscriber Network Equipment (SNE) and the ISP network gateway equipment. To provide for connectivity, the ISPs utilize existing circuit-based telephony switches and/or cable television (TV) infrastructures through copper wire, optic fibre, and/or wireless means to provide transmission medium services for network connectivity.

As known by those who are well-versed in the field, said Subscriber Network Equipment (SNE) has an operating system serving as network access controller for said SNE. Said network access controller has relevant network protocol stacks to support connectionless network systems, such as Internet Protocol (IP) as well as, to support

Signaling System No. 7 (SS-7) network signaling ~~and~~ for point-to-point connection, such as Point-To-Point Protocol (PPP).

Said SNE either works as a stand-alone or as a multiplexer able to provide network connectivity to a plurality of network-enabled User Premise Devices (UPD). Said SNE not only provides Local Area Network (LAN) based connectivity services for multi-connections and sessions of said plurality of User Datagram Protocols (UDP) at their premises, but also provides external network connectivity and access to the Internet.

With SNE, such as Digital Subscriber Line (xDSL), Asynchronous Transfer Mode (ATM), and the likes, its network controller utilizes call establishment and PPP protocols to establish connectivity from the subscriber premise to the Internet Service Provider (ISP) network gateway switches using telephony network infrastructure. The Asynchronous Transfer Mode/Long-Term Evolution (ATM/LTE) network systems provide connectivity on the telephony section of the network while the MPLS-enabled IP network interfaces, supporting several Permanent Virtual Circuits (PVC), provides connectivity among a plurality of MPLS-enabled IP network switches on the Internet network section.

For data communication over copper telephony lines, frequencies not used for analog voice services are utilized for data transmission through the use of multi-carrier band modem, such as xDSL. Said multi-carrier band modems utilized Frequency-Division Multiplexing (FDM) means and Discrete Multi-Tone (DMT) line code technology, to enable greater data service capacity by dividing the useful bandwidth into discrete and smaller frequency channels.

This multi-carrier band methodology is also utilized in wireless data communication from the carrier bandwidth spectrum. In addition, said multi-carrier band methodology had also evolved to incorporate not only the use of frequency and code-division multiplexing but also time-division multiplexing technology, as well.

With DMT implementation, all available data bandwidth for data transmission is allocated to two transmission channels, one for upload and the other for download. Said upload and download channels provide for connectivity between the SNE and the ISP network gateway. It is a common practice for most xDSL and wireless modems to allocate a pre-defined discrete range of frequencies for download channel while another pre-defined

range of frequencies for upload channel. With adaptive rate-based DSL modem said allocation of predefined discrete range of frequencies had been eliminated and replaced with dynamic allocation of bandwidth frequencies.

During initialization of xDSL modems, the controller of the modem would test each of the carrier bands, known as “bin”, to establish the signal-to-noise ratio (SNR) for each multi-carrier band frequency. The controller will then make a plan on how to exploit each of the bins through what was termed "bits per bin" allocation. Those bins that have a good SNR will be chosen to transmit signals with a greater number of possible encoded values in each main clock cycle. If the SNR of the bins changes, the DSL modem can alter the bits-per-bin allocations.

It should be noted that although prior art provide for the classification of Quality of Service (QoS), based upon SNR factor, for each carrier band, it did not have the ability to prioritize and differing QoS data service for a plurality network connectivity based upon said QoS classification. As known by those well-versed in the field, none of the prior art documents, including those which use adaptive allocation of bandwidth technology, teaches means to dynamically portion bandwidth of differing QoS classification to support multi-mode connectivity sessions to multiple service providers or internetworking environments.

It should also be noted that data network devices disclosed in prior art documents only provide the means for multiple UPD connectivity for uploading and downloading channels, from the subscribers to a single ISP network gateway source, for a single-mode internetworking service. None of the prior art documents teach the means to support multi-mode connectivity sessions having the ability to subscribe to multiple ISPs. In addition, said network connectivity from existing ISPs provides only to a shared-media and connectionless IP-based internetworking environment. Thus prior art documents are only able to provide a single-mode internetworking environment.

With the increase usage and knowledge gain about the Internet network technology, the inherent weakness of shared-media and connectionless internetworking environment, which is its security vulnerability at the network level, had became well-known. Concern regarding the Internet inherent security vulnerability would inevitably leads to the need to develop a more secure internetworking environment, from a network level perspective.

From historic perspective, should one view the evolution of the telephony environment, one could gain insight to the possible evolution of the future multimedia internetworking environment. The first iteration of telephony environment is a party-line environment where there is no network switching capability. Calls were broadcast through the phone line to a collection of interconnected telephone sets, similarly to first iteration of shared-media data LAN network systems.

As usage for telecommunication increases along with the number of user sets, switching capability was implemented at the exchange level, initially using manual means which then advance to mechanical means. This gave rise to the second iteration of telephony network systems. Said second telephony comprises of a hybrid of switched and non-switched network topology, which in a sense, resemble the present MPLS-enabled IP based network system.

Privacy issue and requirement from end-users, as well as, advent of electronic means eventually led to the third iteration of telephony systems and environment, end-to-end connected-oriented and dedicated-media communication thorough initially circuit-based and later to virtual circuit-switching methods.

As known by those well-versed in the art, hybrid MPLS-enabled IP network system enables circuit-switching for IP technology. Whereas technologist are aware the network environment is more secure at the MPLS network system section due to the use of circuit-switching method, they also understood that the network security vulnerability could be exploited at the IP section of network and router.

This is due to the ability for malicious users to exploit IP connectionless/stateless and share-media scheme of communication for anonymous intrusive eavesdropping, and more importantly, the ability to insert malicious instructions or programs at the network-level. Thus, there is a need to elimination said area of vulnerability in order to enhance security in the network-level of the environment.

In short, there is a need for another internetworking system and environment which does not, in anyway, uses connectionless and shared-media network topology and methodology. Method for creating such internetworking environment was shown in

Malaysia Patent No. MY-129914-A by C T Lee, coined as Virtual Dedicated-Media Internetworking (VDMI) environment.

International Application Number WO 00/31929 describes a method and apparatus to provide reserved bandwidth and QOS/COS virtual circuit connections in a network using both conventional and novel reservation protocols and frame formats. An apparatus is disclosed which includes an enterprise control point that communicates with switches via a reserved signalling channel.

As known by those skilled in the art, prior art neither have the ability subscribe to nor concurrently support more than one ISP not to mention the ability to provide subscribers to subscribe to disparate internetworking environments. Basically, present network devices are not able to concurrently support dedicated-media and connection-oriented internetworking environment, such as VDMI, along with the present shared-media Internet environment. In short, prior art documents are engineered in a way where they are neither able to concurrently support multiple ISPs nor multi-mode internetworking environment, at the subscriber level.

The present invention is design to able subscribers to subscribe for multimode connectivity to multiple ISP and Application Service Provider (ASP) for disparate internetworking environments. The present invention provides for a novel controller for network devices, having means to subscribe and allocate resources for connectivity to multiple ISP and ASP in a multimode internetworking environment, concurrently.

SUMMARY OF THE INVENTION

The first principal objective of the present invention is to provide a system having the ability to concurrently subscribe for network connectivity sessions to disparate shared-media and dedicated-media internetworking environments for Internet, MPLS-enabled VPN, and Virtual Dedicated-Media Internetworking services.

The second principal objective of the present invention is to provide the methods for the ability to portion bandwidth allocated for said communication channels, for connections to a plurality of disparate network systems and environments, concurrently, from a network transceiver, using either multi-carrier bands or Virtual Connection Circuit (VCC) method.

The third principal objective of the present invention is to provide said transceiver's controller with network protocol stacks and access control procedures for the establishment of communication sessions not only for IP-based application services but also for VDMI-based applications services.

International Application Number WO 00/31929 describes a method and apparatus to provide reserved bandwidth and QOS/COS virtual circuit connections in a network using both conventional and novel reservation protocols and frame formats. An apparatus according to the invention includes an enterprise control point that communicates with switches via a reserved signalling channel.

The fourth principal objective of the present invention is to provide the method for dynamic allocation of carrier bands of spectrum and frequency based medium, as well as, for bandwidth allocation for VCC systems, to enable said transceiver to concurrently support connectivity sessions to plurality of network and application service providers in a plurality of internetworking environment.

The fifth principal objective of the present invention is to provide call establishment capability for the transceiver controller to communicate to public VCC network central controller and with the destination network gateway transceiver for the subscription and establishment for communication channels from said transceiver to said network gateways.

The sixth principal objective of the present invention is to provide end-users with concurrent connectivity to public and shared-media Internet services, MPLS-enabled IP Virtual Private Network (VPN) services, entirely connection-oriented sessions using end-to-end circuit-switching for VDMI-enabled internetworking services for discrete and hybrid types of application services, among disparate connection-oriented and connectionless network systems and environments for a myriad of applications.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 illustrates prior art network topology of a plurality of network system and infrastructures supporting single-source Service Provider and single-mode internetworking connectivity.

FIG. 2 depicts present invention network topology of a plurality of network system and infrastructures supporting multi-mode internetworking environment connectivity to a plurality of Service Providers.

FIG. 3 depicts types of present embodiment internetworking environment connectivity.

FIG. 4 depicts the key type of internetworking environment supported by prior art transceivers.

FIG. 5 depicts types of prior art internetworking environment and networking systems.

FIG. 6 is a block diagram illustrating the components of present embodiment network transceivers and switches for multimode internetworking system.

FIG. 7 depicts the network protocol components and the types of connectivity state-machines of present shared-media based internetworking environment supported by prior art embodiment.

FIG. 8 depicts the network protocol components and the types of connectivity state-machines for both shared-media and virtual dedicated-media internetworking environments supported by present embodiment.

Fig. 9 is a flowchart for setting up prior art embodiment of single-mode connectivity to a single ISP service provider network gateway for shared-media IP environment using xDSL network devices.

Fig. 10 flowchart depicts present embodiment process for setting up call/connection listening ports and multi-mode connectivity connections to a plurality of shared-media, hybrid network systems and dedicated-media service gateways, using multi-carrier bands or spectrums.

Fig. 11 flowchart depicts the method for the subscription and establishment of Internet services.

Fig. 12 depicts the xDSL algorithm flowchart for enabling the transceiver to change the allocated bandwidth resources of a connection.

Fig. 13 flowchart depicts the method for the subscription and establishment of IP-based associative addressing-enabled VPN connectivity services.

Fig. 14 flowchart depicts the method for the subscription and establishment of hybrid network system connectivity sessions among disparate connection-oriented and connectionless network system topology.

Fig. 15 flowchart depicts the method for the subscription and establishment of end-to-end, connection-oriented and circuit-switching connectivity for VDMI-based application services.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 illustrates the present global shared-media internetworking environment, the Internet, operating over a plurality of interconnected digital network systems topology. For fast Internet services, said global Internet backbone network system (11) utilizes MPLS-based circuit-switching capability for interconnecting a plurality of regional Internet Service Provider (ISPs) Internet systems (41), Multi-Protocol Label Switching (MPLS) based Virtual Private Networks (VPN) (40) and mobile networks (36).

As shown, the Subscriber Network Equipment (SNE) transceiver (44, 44a) functions either as a standalone or multiplexer, able to provide connectivity for a plurality of sub-net of User Premise Device (UPD) transceivers (18), through wired or wireless means. As illustrated, said SNE is only able to support a single connection to a single ISP (45) to provide connectivity for Internet (34) services.

Fig. 2 illustrated the ability of the present embodiment SNE transceivers (12, 12a) to subscribe, support, and manage multiple communication session in order to provide concurrent connectivity of public and shared-media Internet services (34), IP (Internet Protocol) based and associative addressing switching-enabled VPN services (35), hybrid

network system connection sessions among disparate connection-oriented and connectionless network systems services (33), and end-to-end, connection-oriented, and circuit-switching connection sessions for Virtual Dedicated-Media Internetworking (VDMI) - based application services (32).

As shown, the SNE transceiver (12, 12a) could functions either as a standalone or a multiplexer, able to provide connectivity for a plurality of sub-net transceivers (18), through wired or wireless means, and is able to connect to a plurality of service provider networks and internetworking services.

As depicted, those wireless transceivers (12a) are connected to mobile network (39) having associative addressing means, for routing and address resolution, while the Digital Subscriber Line (xDSL) transceivers (12) are connected to Digital Subscriber Line Access Multiplexer (DSLAM) (13) having Virtual Circuit Connection (VCC) multiplexing means and is subsequently connected to associative addressing switching-enabled shared-media network system (40) and/or VCC connection-oriented circuit-switching network system (30). Said xDSL and wireless transceivers (12, 12a) utilized a plurality of carrier bands for signal transmissions.

Fig. 2 and 3 illustrated the types of internetworking environment connectivity which present embodiment transceivers are able to support for further clarification. As shown, the connectivity topology type 34 is for subscription to shared-media internetworking environment, and the connectivity topology type 32 is for virtual dedicated-media internetworking environment (38). Also noted is the present embodiment ability to subscribe and support concurrent shared-media and virtual dedicate-media internetworking environment (38) which is the used of both types of topologies 34 and 32 or its equivalents.

Unlike the present embodiment, prior art transceivers and network switches are able to support and subscribe only to share-media internetworking environment (41), as illustrated in Fig. 4. Fig. 5 depicts the types of existing prior art internetworking environments, encompassed within a shared-media internetworking environment (41), which are IP router-based Internet (49), MPLS-enabled Internet (11), and IP-based MPLS-enabled VPN (40) environments.

As illustrated in Fig. 6, the key components of SNE transceiver (12, 12a) are a programmable network data-link control means (21) and a programmable network access control means (20). Said network access control (20) is able to establish a plurality of transmission channels, through said data-link control (21), for receiving and transmitting of digital signal. Said network access control (20) is to manage the allocation of communication bandwidth or carrier bands to enable concurrent connectivity of a plurality of communication channels and sessions to a plurality of disparate internetworking systems and environment.

As shown, said network access control (20) comprises of a network connection protocol stack and signaling database module (22), and network connection management module (23). Said network connection management module (23) further comprises of a bandwidth resource database (27), a user network connection profile database (26) and a network connection database (28) component.

Said network connection signaling database module (22) containing a library of multiple network signaling and/or network access management procedural protocols (24). Said network access control (20) is able to subscribe for communication channel and session of connectionless and shared-media internetworking environment, and/or connection-oriented and VDMI environment by using the appropriate signaling protocols from said network connection signaling database (22).

Said network connection management module (23) further comprises of a LAN connectivity sub-module (25) and a Wide Area Network (WAN) connectivity sub-module (29). LAN connectivity sub-module (25) only manages communication sessions among a plurality of sub-nets, while said WAN connectivity sub-module (29) manages external communication connections and sessions among a plurality of Internet Service Providers (ISP) and Application Service Providers (ASP).

FIG. 7 illustrated the types of network protocol components and the connectivity states of prior arts, supported by network routers, switches, and transceivers for enabling present shared-media internetworking environments as depicted in Fig. 5. As illustrated, application-layer programs, such as File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP) and the likes, communicate in a finite-state machine or connection-oriented manner, as indicated by solid line (32). For media-based application, said application may

subscribe to compression programs, such as Moving Picture Experts Group (MPEG), MPEG-1 or MPEG-2 Audio Layer III (MP3), and the likes. Said applications also utilize signaling protocol, such as Media Gateway Control Protocol (Megaco), Session Description Protocol/ Session Initiation Protocol (SDP/SIP), Real Time Streaming Protocol (RTSP) and the likes, for signaling, as well as for user transmission protocol means, such as Real-Time Transport Control Protocol (RTCP) and Real-Time Transport Protocol (RTP).

The latter protocols would then subscribe to transport-layer protocol such as Transmission Control Protocol (TCP), User Datagram Protocol (UDP) and Stream Control Transmission Protocol (SCTP). Whereas TCP and SCTP communication session are stately (connection-oriented), UDP is not. Presently all those transport-layer protocols are engineered to be hot-wired to IP. Since IP network-layer protocol operates in a stateless communication session, thus the communication session after IP is connectionless, as indicated by the dotted lines (34).

To enable faster routing of IP packets, Multiple Protocol Label Switching (MPLS) was developed to enable IP switching through network switches instead of router. With MPLS, Permanent Virtual Circuits (PVCs) are programmed to enable circuit-switching of IP packets, creating a hybrid transmission media of packet-switching and circuit-switching communication means, as indicated by the dashed and dotted lines (33/35). Said IP packets, through IP routers or MPLS-enabled IP switches, are then routed through transmission medium supporting Data Link-layer network protocols such as gigabit-Ethernet, Asynchronous Transfer Mode Adaptation Layer 5 (AAL5/ATM), Synchronous Optical Network (SONET), and the likes.

From the SNE perspective, it should be noted that whereas SNE end-node switch, whether it utilizes optical or electro-magnetic means for land-lines, is able to support multi-service provider communication channels, present xDSL devices are not able to do so. More importantly, as illustrated in Fig. 7, said communication channels and sessions only support a single internetworking environment, a shared-media internetworking, which is IP.

It should be noted that the backbone network system for the back office of all present VCC network central controller systems (31) operates using shared-media internetworking VPN, such as IP-enabled VPN. Thus, the vulnerable of VCC network central controller system (31) originated from the use of said IP system.

FIG. 8 depicts the types of network protocol components and the connectivity states of the present embodiment, supported by network routers, switches, and transceivers to enable a multimode internetworking environment, as illustrated in Fig. 3. As depicted, prior discussed communication sessions and channels associated with prior arts are still applicable.

What is unique and different about the communication sessions and channels from prior art is the use of Media Adaptation Layer (MAL) higher-layer network protocol (80). Unlike prior transport-layer protocols which are hot-wired to IP network protocol, MAL (80) is not. Instead, MAL (80) has a switching capability to subscribe to any transmission media or medium, depending upon what type of communication session been requested by the application-layer programs. This enables novel Internet-like application capability to operate natively on circuit-switching network systems.

For better understanding, let's view the differences from the perspective of secure transaction applications. Presently, using encryption and tunneling technology, secure transactions are conducted using firewall but still operates over packet-switching IP network environment. With MAL technology, it is possible to conduct secure transaction, using encryption and tunneling technology, over end-to-end connection-oriented and circuit-switching network topology, without having to traverse over any packet-switching networks at all, inclusive IP networks.

MAL higher-layer network protocol (80) has User Plane, Control Plane and Management Plane components. MAL's User Plane component enabled application-layer programs to interface and interconnect with it and subsequently to the subscribed lower-layer network protocol. MAL's Control Plane component control the interconnection and signaling with subscribed lower-layer network protocols while its Management Plane component governs and manages the types of interconnects be it with solely to connection-oriented and circuit-switched based transmission medium network protocols for VDMI environment, MPLS-enabled circuit-switching transmission medium with connectionless packet-switching IP transmission media environment, or a combination of both, concurrently.

As illustrated, MAL (80) has stately communication with application-layer programs, signaling protocols, and user transmission protocol means, as depicted by the bold solid

lines (32). As shown, MAL (80) is able to support stateless communication session with ICMP and IP, as illustrated by the bold dotted lines (34), to IP transmission media. However, through PPP and Media Transfer Protocol (MTP), MAL is able to interface with stately transmission media systems such as Universal Mobile Telecommunications System/ Long-Term Evolution (UMTS/LTE), AAL5/ATM, and etc. In this situation, MAL (80) is able to still maintain stately communication sessions to the underlying transmission mediums, as illustrated by the bold solid lines (32).

Also illustrated, with MAL network protocol (80), it is possible for said VCC network central controller system (31) internetworking capability to be entirely established using circuit-switching backbone network system topology, inclusive its back office. This eliminates the network security vulnerability arising from IP system topology, due to the absent of shared-media internetworking implementation. Said VCC network central controller system (31) and its back office system are now able to operate entirely under end-to-end, connection-oriented and circuit-switching communication channels using PVC scheme.

For internetworking data communication, most present prior arts Subscriber Network Equipment or Customer Equipment (CE) were engineered in “client-mode design” rather than in “server-mode design” for WAN connectivity. This is due to the lack of call establishment listening port mechanism for WAN Connectivity sub-module. With client-mode design prior art equipment were engineered with a specific source connectivity function since there is only one internetworking environment, and from a single service provider whom provides said connectivity to said Internet environment. The exception is been the narrow Integrated Services Digital Network (ISDN’s) CE equipment which could enable the establishment of client-mode connectivity to the most two service providers. For better understanding, below shall be described a prior art xDSL embodiment, using client-mode model for establishing connectivity for Internet.

Fig. 9 flowchart depicts the setting up procedures of prior art embodiment for single-mode connectivity to a single ISP service provider network gateway for shared-media IP environment using xDSL transceiver. On activation of prior art transceiver (44), step 101, the program boot up the operating system for said xDSL in step (102) to serve as a network access controller (NAC), and load the appropriate network protocols and handshake/signaling protocols in step (103). Upon complete, transceiver (44) could now be

able to proceed to establishing a connection listening port in process (104) and broadcast its availability for providing interconnection and internetworking to its sub-nets.

Transceiver (44) would then activate step (105) which is the process for testing each carrier/channel bands to determine the Signal Noise Ratio (SNR) for each carrier band, and periodically thereafter. Said NAC records the result of its test within NAC's along with the allocated "bits per bin" for each channel band within its Bandwidth Resource database. Prior art Bandwidth Resource database usually contains fields for carrier band identification, SNR reading and "bit per bin" information only.

The transceiver (44) would then automatically proceed to step 106, and dial-up to DSLAM device call establishment listing port using Point-to-Point Protocol (PPP) to procure a connection for data transmission from transceiver to said DSLAM and subsequently to its subscribe ISP's Internet or VPN gateway through step (108). Upon success of said procurement of connection to said DSLAM, transceiver (44) would then allocate all its carrier/channel bands for said allocated connection with said DSLAM to procure Internet service from said ISP and request and obtained an IP address for its usage. Upon completion, transceiver (44) could now proceed to step (109), which is the process to start accepting and process sub-nets Internet connection requests for connectivity to the Internet or MPLS-enabled IP-based VPN.

Fig. 10 flowchart depicts present embodiment process for setting up call and connection establishment listening ports for multi-mode connectivity connections to a plurality of shared-media and dedicated-media service gateways, using multi-carrier bands or spectrums. On activation of present embodiment transceiver (12a) in step 110, the program started boot-up transceiver's operating system in step 111 which serves as Network Access Control (NAC) means (20), and load the appropriate network protocols and handshake/signaling protocols in step 112.

Said transceiver (12a) utilizes said NAC (20) and its Data-Link Control (D-LC) (21) components, for the establishment of connections among its sub-net devices and/or to any external connected network devices. Upon complete, transceiver (12a) could now be able to proceed to establish a connection listening port process in step 113 and broadcast its availability for providing interconnection and internetworking to its sub-nets.

Transceiver (12a) would then activate step 114 process which tests each carrier/channel bands to determine the Signal Noise Ratio (SNR) for each carrier band, as well as periodically thereafter. Said NAC (20) records the result of its SNR test along with its allocated “bits per bin” for each channel band within its Bandwidth Resource database. Unlike prior art, present embodiment’s Bandwidth Resource database (27) contains fields for carrier band identification, SNR reading, allocated “bits per bin” value, SNR rating, and a field to identified whether or not said carrier band had been in use.

Upon completion of step 115, said transceiver (12a) would dial-up to its interconnected DSLAM device’s call establishment listening port and registered its call establishment listening port with said DSLAM (13). Upon successful completion of step 115, said transceiver’s NAC (20) is now ready to start accepting and processing its sub-nets internetworking connection requests, as well as, requirements through step 116. Said transceiver (12a) NAC (20) then enquired its User Network Connection Profile database (26) to determine the type of interconnection and internetworking its allowed to support.

In the initial activation process 110 till completion of step 116, and without any constraint of interconnection and internetworking, said NAC proceed to step 117 which determine whether or not there is a need for establishing VDMI connectivity. If yes, the process then proceeds to step 118, otherwise it proceeds to step 119. In step 119, said NAC (20) determine whether or not there is a need for establishing hybrid network connectivity. If yes, the process then proceeds to step 120, otherwise it proceeds to step 121. In step 121, said NAC (20) determine whether or not there is a need for establishing MPLS-enabled VPN connectivity. If yes, the process then proceeds to step 122, otherwise it proceeds to step 123. In step 123, said NAC (20) determine whether or not there is a need for establishing connectivity to the Internet. If yes, the process then proceeds to step 124, otherwise it proceeds to step 125 whereby said NAC (20) is in a waiting-mode state to receive connection and call establishment requests for internetworking from its sub-nets or from external caller party.

Fig. 11 flowchart depicts the method for the subscription and establishment of Internet services. Either from step 123 of transceiver (12a) activation process or a request from a sub-net device for Shared-Media Internet (SMI) Internet connectivity services, said NAC (20) proceed to step 124 which is to establish SMI connectivity from said transceiver (12a) through said DSLAM (13) to its subscribed ISP gateway. Upon receipt for step 124

process, said NAC retrieve Internet network connection information from its User Network Connection Profile database (26) in step 400 and proceed to step 401.

In step 401, said transceiver (12a) signal its interconnected DSLAM (13) call establishment listening port for connection establishment to the requested ISP gateway for a communication channel. Upon success of said procurement for connection to said DSLAM (13), transceiver (44) would then allocate the prescribe amount of either sequential range of carrier bands or carrier bands having low QoS classification for connectivity to said public Internet service via DSLAM and said ISP gateway to procure ISP for Internet services, and record said allocated channel band identification within its Network Connection database (28) in step 402. Said NAC (20) also request to obtain an IP address from ISP gateway for its usage in step 403. Upon success of step 403, NAC is now able to implement step 404, which is the ability to receive and send IP packets from its sub-net to its connected ISP gateway.

Another unique feature the present embodiment had over prior art is the ability to increase and decrease the bandwidth allocated for the communication channels. Fig. 12 depicts the xDSL algorithm flowchart for enabling the transceiver to change the allocated bandwidth resource of a connection. Upon receipt of instruction for the need to increase or decrease the amount of bandwidth, said NAC (21) activated process (128).

When step 128 invocation/procedural call had been issued, step 301 evoked the process for processing the request to increase or decrease the allocated bandwidth for upstream and downstream channel bands. For increasing of bandwidth procedure, said NAC (20), with reference to bandwidth resource database (27), determine whether or not there is any available channel band to be allocated for the requested amount. If no, it informs the requester there is no available resources. If yes, it proceeds to step 302.

In step 302, said NAC (20) through said D-LC (21) signal to its interconnected DSLAM's call establishment listening port to request for change of Quality of Service (QoS) for said allocated transmission connection. On receipt of approval to change the bandwidth from said DSLAM (13), said transceiver (12a) invoke step 303, and supply the channel band IDs to be added or dropped for said connection. Upon obtaining conformation from said DSLAM (13) that said requested had been executed, said NAC (20) registered said changes in channel bands allocation by flagging or unflagging the "In-Use" data field for said channel

band IDs in said Bandwidth Resource database (27) and registered said changed in allocated channel bands in its Network Connection database (28).

Upon completion of step 304, NAC (20) proceed to step 305, which implements the process to termination connection with said DSLAM (13) network control/signaling port for the undertaking of this process.

Fig. 13 flowchart depicts the method for the subscription and establishment of IP-based associative addressing-enabled VPN connectivity services. Either from step 121 of transceiver (12a) activation process or upon a request from a sub-net device for MPLS-enabled VPN connectivity service, said NAC (20) proceed to step 122 which is to establish connectivity from said transceiver (12a) through said DSLAM (13) to its subscribed VPN gateway. Upon receipt of step 122's procedural call, said NAC (20) retrieves said MPLS-enabled VPN's network connection information from its User Network Connection Profile database (26) in step 500 and proceed to step 501.

In step 501, said transceiver (12a) signal its interconnected DSLAM's call establishment listening port to request for connection to the requested ISP gateway for a communication channel. Upon success of said procurement of connection to said DSLAM (13), transceiver (12a) would then allocate the prescribe amount of either sequential range of carrier bands or carrier bands having low to moderate QoS classification for said transmission channel connectivity via DSLAM to said MPLS-enabled VPN gateway to procure for secure Internet service from said VPN ISP, and record said allocated channel band identifications within its Network Connection database (28) in step 502. Said NAC (21) then registered its IP address with said MPLS-enabled VPN gateway for its usage in step 503.

At the MPLS-enabled VPN gateway, through used of tunneling methodology, said gateway associated said transceiver's IP address to its label or associative addressing and record said addressing information within its user/endpoint session translation database. The MPLS-enabled VPN gateway uses said user/endpoint session translation table for both address resolution, routing when inserting or removing said MPLS shim header for said transceiver IP packets. Said MPLS-enable VPN gateway, then encrypted and encapsulated said IP packets within another IP packet having MPLS associative addressing and route, through destination forwarding, through its label-swapping and circuit-switching based

network. Upon success of step 503, NAC is now able to implement step 504, which is the ability to receive and send IP packets from its sub-net to its connected MPLS-enabled VPN gateway.

Its is normal, that a call establishment may originated from a circuit-switching network system, but the network system could either be end-to-end circuit-switching topology or an combination of circuit-switching and packet-switching network topology, such as 3G and 4G systems. If the interconnect comprises of a hybrid of packet and circuit switching systems then end-to-end, connection-oriented and circuit-switch internetworking environment does not exists. The below procedural flowcharts describe the process for determining and processing hybrid network and VDMI connectivity establishment.

Present embodiment transceiver (12, 12a), operating in server-mode, have a registered call establishment listening port from it to the DSLAM and vise-verse. Step 200 to step 205, as illustrated in Fig 14 and Fig.15, are the process to implement such capability. Request for connect would originated from subscriber through invocation for connection to a called party in step 200, or from external through call establishment request from DSLAM through transceiver (12, 12a) call establishment listening port from a caller party in step 203.

Should the connection establishment origin from process 200, transceiver NAC (20) retrieve the requesting user/sub-net connection information from User Network Connection Profile database (27) and, if required, from Virtual Access Control Configuration Protocol ,VACCP, database said requesting user/sub-net connection information. NAC (20) process said user/sub-net connection information to determine whether or not said user/sub-net is allow for connection to said called party, or whether or not the connection will utilizes for VDMI-based application. In step 202, should NAC determine the connection is for VDMI application, its route the process to step 118, otherwise the connection process is routed to 120.

Fig. 14 flowchart depicts the method for the subscription and establishment of hybrid network system connectivity sessions among disparate connection-oriented and connectionless network system topology. When the call establishment process is routed to step 120, NAC (20) through DL-C (21) signaled its connected DSLAM call establishment listening port to negotiate for connection to called party/endpoint, or, if caller party does not have access authority, said NAC (20) deny and terminate said call establishment in process

606. Should said connect was approved, NAC (20) activated process 607 to establish connection.

Upon success of said procurement of connection to said DSLAM, transceiver (12a) would then allocate the prescribe amount of either sequential range of carrier bands or carrier bands having moderate to high QoS classification to said called or caller party connection via DSLAM and said hybrid network systems, and record the allocated channel band identifications within its Network Connection database (28) in step 607. Said DSLAM through said VCC gateway would obtained and registered a Virtual Path Identifier/Virtual Circuit Identifier (VPI/VCI) address from said VCC network central controller or MPLS-enabled circuit-switching controller during process 608.
Upon completion of step 608, the user/end-point is now able to send and receive information packets through said VCC channel/MPLS label-swapping circuit until terminated.

Fig. 15 flowchart depicts the method for the subscription and establishment of end-to-end, connection-oriented and circuit-switching connectivity for VDMI-based application services. When the call establishment process is routed to step 118, NAC (20) through DL-C (21) signaled its connected DSLAM call establishment listening port to negotiate for connection to said called party/endpoint, or, if caller party does not have access authority, said NAC (20) deny and terminate said call establishment in process 206. Should said connect was approved, NAC (20) activated process 207 to establish connection.

Upon success of said procurement of connection to said DSLAM, transceiver (12a) would then allocate the prescribe amount of either sequential range of carrier bands or carrier bands having high QoS transmission classification for connectivity to said called or caller party via DSLAM to an entirely end-to-end circuit-switching network system topology, and record the allocated channel band identifications within its Network Connection database (28) in step 207. Said DSLAM through said VCC gateway would obtained and registered a VPI/VCI address from said VCC network central controller during process 208.
Upon completion of step 208, the user/end-point is now able to send and receive information packets through said VCC channel until terminate.

INDUSTRIAL APPLICABILITY

The invention finds utility in packet and circuit-switching network infrastructure for multimedia computing and communication connectivity to enable concurrent interaction among a plurality of service providers gateways and disparate internetworking environments and of for online applications and the likes.

Inasmuch as numerous derivative network system and infrastructure can be made using the preferred embodiment, such derivative network system may not depart from the spirit and scope of the industrial applicability. Whereas the present embodiment had been discussed herein as Subscriber Network Equipment (SNE), it finds equal usage as Provider Equipments (PE), such as network switches and the likes. In addition, herein describe the Network Access Controller's Network Control Management Module maintains discrete Network Connection, Bandwidth Resource and User Network Connection Profile database, this does not means there could not be an integration of those databases in part or whole. There is no intention to limit the applications of the invention to this exact disclosure of industrial applicability discussed herein. Most particularly, it is contemplated that this invention can be used with any communication and network system for electronic information connectivity and transmission whether it is wired and/or wireless medium-based network topologies.

CLAIMS

1. A system comprising of a plurality of interconnected digital network system and equipment having transceiver means (12), either as standalone or as multiplexer, for providing networking capability to a plurality of subnet transceivers (18) and is able to supports a plurality of Virtual Circuit Connections, (VCC), said transceivers (12) interface with public circuit-switching network system's (31) Digital Subscriber Line Access Multiplexer, (DSLAM) ,(13) and/or mobile network (39) having VCC network multiplexing means and/or associative addressing enabled routing and multiplexing means, such as Multiprotocol Label Switching, (MPLS)-enabled switches, for interfacing with Internet Protocol, (IP) network system (41), and is characterized by:

said system provide connectivity to a plurality of Internet Service Providers, (ISPs) network gateways (43a) for providing Shared-Media Internet (SMI) services, and to at least a Application Service Provider, (ASP), VCC-enabled network gateways (33) for providing Virtual Dedicated-Media Internet, (VDMI) services via their respective digital network interfaces (42, 32);

said transceiver (12) support a plurality of network protocol stacks, having a programmable network data-link control means (21) for establishing data-link connections, and a programmable network access control means (20) having a network connection signaling database module (22), containing library of multiple network signaling and/or network access control procedures (24), and a network connection management module (23) to enable said transceiver (12) to subscribe for and managed a plurality of connectivity to connectionless SMI environment, and/or to end-to-end and connection-oriented VDMI environment;

said network connection management module (23) having a user network connection profile database (26), a bandwidth resource database (27), and a network connection database (28);

said transceiver (12) is able to establish a plurality of transmission channels for receiving and transmitting digital signal, and said transceiver (12) network access control means (20) have means to manage the allocation of VCC sessions and bandwidth, enabling concurrent connectivity for a plurality of communication sessions of disparate

internetworking systems, environment, and applications, and record said VCC identifier and bandwidth within said network connection database (28);

said transceiver (12) provides its subnet transceivers (18) to concurrently subscribe for connectivity among a plurality of Service Providers, (SP) network gateways (43, 33) for SMI and/or VDMI based internetworking environments via IP-based routers, associative addressing enabled network switching system, and/or VCC network system for a plurality for application services;

at least a VCC channel connection is allocated for network signaling purposes; and

said network access control (20) having means to establish entirely end-to-end and connection-oriented communication session channels for a plurality of VDMI enabled application services.

2. The system claimed in claim 1, wherein said network access control (20) create a listening port for establishing connections among its sub-net devices and broadcast its presence, and is further characterized by:

said network access control (20) is able to signal to and subscribe from said data-link control means (21) for the establishment of both switched/dynamic and non-switched/static transmission channels and record said types channels within said network connection database(28);

said data-link control (21) is able to dynamically allocates communication channels and bandwidth allocation for downstream and upstream information traffics, to a plurality of disparate SMI systems and environment and record said channels and allocated bandwidth within said network connection (28) and bandwidth resource (27) databases, respectively;

said data-link control (21) is able to dynamically allocates connection channels and bandwidth allocation, for downstream and upstream information traffic within a channel or through separate channels, for a plurality of VCC-enabled sessions for VDMI enabled applications and record said channels and allocated bandwidth within said network connection (28) and bandwidth resource (27) databases, respectively;

said transceiver (12) is connected through a DSLAM switch (13) coupled to a associative addressing-enabled network systems ~~(40a)~~ and/or a VCC network system (30), and is subsequently connected to a plurality of network or application gateway means (43, 33) to provide connectivity to SMI environment of public Internet, associative addressing-enabled Virtual Private Network (VPN) services, and/or VDMI environment, for network-based peer-to-peer and/or client-server applications;

said data-link control (21) of said transceiver (12) is able to communicate to said DSLAM (13), VCC network system (30), and VCC-enabled application network gateway (33) through VCC network central controller means (31), or to IP-based and associative addressing switching-enabled network system (40) of said SMI network gateways (43), for the subscription and establishment of communication channels and sessions wherein:

at least a communication channel allocated as listening port from said transceiver means (12) to said network central controller (31) for the used of network signaling by said network access control means (20) to communicate with said network central controller means (31); and

said channel is used for call establishment in the setting up of static and/or dynamic and switch-based data-link connections and communication channels for application end-points via their respective gateway.

3. The system claimed in claim 2, and is further characterized by:

said network access control means (20) having a user network connection profile database (26), containing records of user and network service profile information for the establishment of multiple and differing communication channels of static and dynamic connections, said network access control (20) having processing logic operable to extract, receive and send said user and network management information as subscribed by application, containing user and end-node identification information, called party information and connection bandwidth requirements for the required VCC access channel from said sub-net transceivers (18);

based upon the user and network service profile record from said user network connection profile database (26), said network access control (20) access parameter setting

logic determine the type of static and/or dynamic connection requirement applicable to said requested VCC access channel and set the requested access requirement parameters for said VCC access channel and its corresponding access channel identifiers and record said access parameters within said network connection (28) and bandwidth resource (27) databases; and

having means to analyze the static and/or dynamic connection information based on the internetworking requirement to determine the user/caller identity, end-node location, end-device identity information, and user session information for dynamic allocation of static and/or dynamic connection configuration based on said requested user session service information, and to provide the network, the user session information, for the configuration of said user/caller connectivity session for the requested internetworking environment and record said connection session information within said network connection (28) and bandwidth resource (27) databases.

4. The system claimed in claim 3, and is further characterized by:

said transceiver (12) is able to dynamically increase or decrease the bandwidth allocation amount for application data services, of said VCC system (30), wherein said transceiver (12) network access control means (20) is able to communicate with said VCC network central controller (38) to dynamically negotiate and subscribe for the required bandwidth allocation for said internetworking application and record said changes within said bandwidth resource database (27).

5. The system claimed in claim 4, wherein said Data- Link Control, (D-LC), means (21) having network signaling procedures for the establishment of application end-point's data-link connection for a plurality of lower-layer network protocol system which uses connectionless and packet-routing scheme, and is further characterized by:

said data-link control means (21) having network signaling procedures for the establishment of application end-point's data-link connections, by using said lower-layer connectionless network's handshake protocol procedures and schemes, concurrently to different service provider's gateways.

6. The system claimed in claim 5, whereby said transceiver (12) network access control means (20) creates a listening port and broadcast to shared-media enabled subnet devices of its availability, and is further characterized by:

said network access control (20) having means to created a call establishment listening port for dedicated-media enabled sub-nets, supporting Media Adaptation Layer (MAL) network protocol (80) or any other higher-layer network protocol stack able to subscribes for the establishment of connection-oriented VCC, as well as, for access authentication;

said network access control (20) having means to created a call establishment listening port using a Permanent Virtual Circuit, ~~(~~PVC~~)~~ or Switch Virtual Circuit, ~~(~~SVC~~)~~, through said VCC-enabled DSLAM switch and VCC network system (30) to said VCC network central controller (31) for connectivity and communication with said VCC central controller (31);

said call establishment listening port is allocated for the used of network signaling capability;

during call establishment, said network access control (20) allocated the appropriate signaling protocol to said data-link control (21) for the establishment of point-to-point connections for upstream and downstream communication channels from said transceiver (12) to the requested network gateway, said network access control (20) is able to allocate the appropriate handshake protocol of network control protocols and/or end-point signaling protocols/network programming interface primitives to said data-link control (21) for the establishment SMI, associative addressing-enabled VPN, hybrid network system, and/or VDMI communication sessions among its sub-nets, which utilizes said SMI, associative addressing-enabled VPN, hybrid network system, and/or VDMI network protocol, respectively, supported by said SMI, associative addressing-enabled VPN, and VDMI network gateways in order for said data-link control (21) to establish the required communication links among those devices;

said network access control (20) uses the user and network service profile information from said user network connection profile database (26), said network access

control (20) govern the approval for connectivity of its plurality of sub-nets and/or end-users to the subscribed internetworking environment, and visa-versa; and

said network access control (20) is able to manage a plurality of VCC and to allocate a portion of bandwidth for each VCC channel in order to provide concurrent connectivity for:

public Internet session (34) services;

IP-based and associative addressing switching-enabled VPN session (35) services;

a hybrid network system connection session (33) services among disparate connection-oriented and connectionless network systems; and

end-to-end, connection-oriented, and circuit-switching connection sessions (32) for VDMI-based application services.

7. A method for subscription and establishment of Internet services, wherein the method includes:

network access control (20) able to manage a plurality of Virtual Connection Circuit (VCC) and allocate a portion of bandwidth for each VCC channel in order to provide concurrent connectivity for:

public Internet session (34) services;

Internet Protocol (IP)-based and associative addressing switching-enabled VPN session (35) services;

a hybrid network system connection session (33) services among disparate connection-oriented and connectionless network systems;

end-to-end, connection-oriented, and circuit-switching connection sessions (32) for VDMI-based application services;

network access control (20), through call establishment listening port, communicated with Virtual Connection Circuit, (VCC) network central controller (31) for establishing of upstream and downstream connection channels from transceiver (12) to an interface connected to a Internet Service Provider, (ISP) network gateway (42) for subscription of public Internet services;

upon receipt of approval and acceptance for connectivity, said network access control (20) allocates a portion amount of bandwidth resources for VCC connectivity channels to said ISP gateway and record within its databases device addressing identifiers and the associated VCC addressing identifiers of public circuit-switching networks and bandwidth rate allocated for upstream and downstream connectivity channels, and utilized information from network connection (28) and bandwidth resource (27) databases for transmission services of communication session usage; and

said network access control (20) has the ability to dynamically changes amount of pre-defined bandwidth allocated for said Internet service by using data-link control (21) to increase and decrease allocated amount of bandwidth associated with upstream and downstream communication channels and records changes within said network connection database (28).

8. The method claimed in claim 7, wherein the method for the subscription and establishment of IP-based and associative addressing-enabled virtual private network (VPN) connectivity services is:

upon receipt of connectivity request from shared-media enabled sub-nets for VPN services, said network access control (20), through said call establishment listening port, communicated with said VCC network central controller (31) for the establishment of connectivity to subscribed IP-based and associative addressing switching-enabled network gateway (43) for the subscription of IP-based and associative addressing switching-enabled VPN service;

upon receipt of approval and acceptance for connectivity, said network access control (20) allocates a portion of the amount of bandwidth to said VCC channel for connectivity to said VPN services and record within its databases said device addressing identifiers and the associated VCC addressing identifier of the public circuit switching

network and the bandwidth rate allocated for said upstream and downstream connectivity channels, and utilized said information from said network connection (28) and bandwidth resource (27) databases for transmission services of said communication session usage; and

said network access control (20) has the ability to dynamically changes the amount of pre-defined of bandwidth allocated for said VPN service by using said data-link control (21) to increase and decrease the allocated amount of bandwidth, associated with said upstream and downstream communication channels allocated for said VPN service and records said changes within its network connection database (28).

9. The method claimed in claim 7, wherein the method for the subscription and establishment of hybrid network system connectivity sessions among disparate connection-oriented and connectionless network systems is:

upon receipt of connectivity request from dedicated-media sub-nets for connectivity services without request for end-to-end dedicated media connectivity, said network access control (20), through said call establishment listening port, communicated with said VCC network switch central controller (38) for the establishment of connectivity to the subscribed Network Service Provider's (NSP) having associative addressing-enabled hybrid network gateway for the subscription of IP-based and associative addressing switching and address resolution enabled hybrid network connectivity services;

upon receipt of approval and acceptance for connectivity, said network access control (20) allocates the prescribed amount of bandwidth for said hybrid network system connectivity session among the disparate connection-oriented and connectionless network systems and record within its network connection (28) and bandwidth resource (27) databases, said device addressing identifiers and the associated VCC addressing identifier of said public circuit-switching networks and the bandwidth rate allocated for said upstream and downstream communication channels, and utilized said information from said network connection database (28) for transmission services of said communication session.

10. The method claimed in claim 7, wherein the method for the subscription and establishment of end-to-end, connection-oriented and circuit-switching connectivity for Virtual Dedicated-Media Internetworking, {VDMI}, -based application services is:

said network access control (20) is able to utilize Media Adaptation Layer's (MAL's) associative addressing capability for routing, multiplexing, and address resolution services;

said network access control (20) allocated appropriate signaling protocols to Data-Link Control, (D-LC), means (21) for the establishment of VCC communication channels from transceiver (31) to VDMI Application Service Provider's, (ASP's), VCC gateway and/or end-point devices, for establishment of VDMI communication sessions among its sub-nets, which utilizes said MAL network protocol, and said ASP's MAL-enabled network gateway, which also implemented said MAL's associative addressing scheme for destination forwarding, multiplexing, and address resolution capabilities;

upon receipt of connectivity request from VDMI enabled sub-nets for end-to-end and dedicated media connectivity, said network access control (20) through said call establishment listening port, communicated with said VCC network switch central controller (33) for the establishment of end-to-end VCC connectivity to the subscribed ASP network gateway or to said called end-point device, supporting MAL network protocol or any other higher-layer network protocol stack having the ability subscribe for end-to-end, connection-oriented and dedicated-media network communication session services;

said network access control (20) allocates prescribed amount of bandwidth for end-to-end connection-oriented and dedicated-media communication session among a plurality of VCC network devices;

and upon receipt of approval and acceptance for said VDMI connectivity, said network access control (20) record within its network connection database (28) said device addressing identifiers and the associated VCC addressing identifier of said public circuit-switching networks and the bandwidth rate allocated for said upstream and downstream communication channels, and utilized said information from said network connection database (28) for transmission services for and during said communication session; and

said network access control (20) has the ability to dynamically changes the amount of pre-defined of bandwidth allocated for said VDMI service by using said data-link control (21) to increase and decrease the allocated amount of bandwidth, associated with said communication channels allocated for said VDMI service and records said changes within its network connection database (28).

11. A system comprising of a plurality of interconnected digital network systems, having at least a Subscriber Network Equipment, (SNE), transceiver (12a) functions either as standalone or as multiplexer providing connectivity for a plurality of its sub-net transceivers (18), through wired or wireless means, said transceiver (12a) is connected to a mobile network and/or Digital Subscriber Line Access Multiplexer, (DSLAM), (13) using associative addressing means for routing and address resolution, and/or Virtual Connection Circuit (VCC) multiplexing means (32) which is subsequently connected to associative addressing switching-enabled shared-media network system (40), and/or VCC circuit-switching network system (30), respectively;

said transceiver (12a) support a plurality of carrier bands/spectrum for digital signal transmissions, said transceiver (12a) having means, upon activation and periodically thereafter, polls the plurality of digital signal carrier bands to determine the quality of the transmission capability of each carrier band and record the resultant information of the quality of transmission capability for each carrier band in its bandwidth resource database (27), said digital carrier bands are able to support a plurality of transmission channels of half-duplex and/or full duplex communication sessions, said transceiver (12a) having multiplexing/de-multiplexing means for the transmission of multimedia information, said transceiver (12a) having a programmable network data-link control means (21), and is characterized by:

said network data-link control means (21) is able to establish connection-oriented and/or connectionless internetworking data-link connections;

said transceiver (12a) having a programmable network access control means (20) able to establish a plurality of transmission channels, through said data-link control means (21), for receiving and transmitting digital signal and to manage the allocation of the digital carrier bands to enable concurrent connectivity for a plurality of communication channels and sessions to a plurality of disparate internetworking systems and environment by providing connectivity to IP-based and associative addressing switch-enabled network gateways (14) to more than one Internet Service Providers (ISPs), and/or to a plurality of VDMI-enabled Application Service Providers, (ASPs), gateway (35), via digital interfaces (15, 34);

at least a digital carrier band allocated for network signaling function;

said network access control means (20) have a network connection signaling database module (22) containing library of multiple network signaling and/or network control and management procedural protocols (24), and a network connection management module (23) having a user network connection profile database (26), a bandwidth resource database (27), and a network connection database (28);

said network access control means (20) utilizes said network connection signaling database module (22) and network connection management module (23) to subscribe to and manage a plurality of communication channel and session of connectionless, shared-media internetworking environment, and/or connection-oriented and Virtual Dedicated-Media Internetworking, (VDMI) environment.

12. The system claimed in claim 11, wherein said NAC (20) create a listening port for establishing connections among its sub-net devices and broadcast its presence, and is further characterized by:

said network access control means (20) is able to signal to and subscribe from said data-link control means (21) for the establishment of both switched/dynamic and non-switched/static transmission channels and record said types channels within said network connection database(28);

said data-link control means (21) is able to dynamically allocates half-duplex or full-duplex communication channels, for downstream and upstream information traffics, to a plurality of disparate SMI networking systems and environments, and/or a plurality of VCC-enabled sessions for VDMI enabled applications environment and record said channels and allocated bandwidth within said network connection (28) and bandwidth resource (27) databases, respectively;

said transceiver (12) is connected through a DSLAM (13) which is coupled to an associative addressing switching-enabled network emulation gateway means (40a) and/or to VCC network system (30), and is subsequently connected to a plurality of network or application gateway means (43, 33) to provide connectivity for either shared-media internetworking environment for public Internet services (34) using IP routers, Virtual Private Network (VPN) services (35) using associative addressing switching-enabled IP switches,

and/or to a plurality of VCC circuit-switching application gateways (32) to provide for peer-to-peer and/or client/server applications in a VDMI environment;

said network access control means (20) through said data-link control means (21) is able to communicate and negotiate with said VCC network switch central controller and said MPLS-enabled network gateway and system, through said DSLAM (13), for the subscription and establishment of communication channels and sessions wherein:

at least a communication channel allocated as listening port is established from said transceiver (12) to said network central controllers of said VCC circuit-switching and MPLS-enabled network systems for the used of network signaling by said network access control means (20) to communicate with said VCC and MPLS network central controller; and

said listening port channel is used for call establishment in the setting up of static and/or dynamic and switch-based data-link connections and communication channels via their respective gateways.

13. The system claimed in claim 12, and is further characterized by:

said network access control means (20) have a user network connection profile database (26) containing records of user and network service profile information for the establishment of multiple and differing communication channels of static and dynamic connections, said network access control means (20) having processing logic operable to extract, receive and send user and network management information, as subscribed by application, containing user and end-node identification information, called party information and connection service requirements for the required access channel from said UPD transceivers (18); wherein

based upon the user and network service profile record from said user network connection profile database (26), said network access control means access parameter setting logic determine the type of static and/or dynamic connection requirements applicable for said requested connection and set the requested access requirement parameters for the allocated transmission carrier bands and record said connection identifiers, types access parameters

and said transmission carrier band identifiers within said network connection database (28); and

having means to analyze the static or dynamic connection information based on the internetworking requirement to determine the user/caller identity, end-node location, end-device identity information, and user session information for dynamic allocation of static and/or dynamic connection configuration based on said requested user session service information, and to provide the network, the user session information, for the configuration of said user/caller connectivity session for the requested internetworking environment and record said connectivity information within said network connection (28) and bandwidth resource (27) databases.

14. The system as claimed in claim 13, and is further characterized by:

said network access control means (20), through said data-link control means (21), is able to dynamically increase and decrease the numbers of carrier bands allocated for the used of internetworking applications and record said changes within said network connection (28) and bandwidth resource (27) databases.

15. The system claimed in claim 14, wherein said data-link control means (21) having network signaling procedures to enable the establishment of application end-point's data-link connection for a plurality of lower-layer network protocol system which uses connectionless and packet-based routing scheme, and is further characterized by:

said data-link control means (21) having network signaling procedures to enable the establishment of application end-point's data-link connections, by using said lower-layer connectionless network's handshake protocol procedures and scheme, concurrently to different service provider's gateways.

16. The system claimed in claim 15, whereby in activation of said transceiver (12), said network access control means (20) creates a listening port and broadcast to shared-media enabled sub-net devices of its availability, and is further characterized by:

said network access control (20) having means to created a call establishment listening port for dedicated-media enabled sub-nets, supporting Media Adaptation Layer (MAL) network protocol (80) or any higher-layer network protocol stacks having the ability to subscribes for the establishment of connection-oriented VCC and for access authentication;

said network access control means (20) creates a call establishment listening port, using a Permanent Virtual Circuit, (PVC) or Switch Virtual Circuit, (SVC), through said VCC-enabled DSLAM switch and VCC network switches to said VCC network switch central controller (31) for connectivity and communication with said VCC center controller (31), and said network access control means (20) allocated a carrier band with high quality of the transmission capability for said call establishment listening port transmission channel allocated for the used of network signaling capability;

during call establishment, said network access control (20) allocated the appropriate signaling protocol to said data-link control (21) for the establishment of point-to-point connections for upstream and downstream communication channels from said transceiver (12) to the requested network gateway, said network access control (20) is able to allocate the appropriate handshake protocol of network control protocols and/or end-point signaling protocols/network programming interface primitives to said data-link control (21) for the establishment SMI, associative addressing-enabled VPN, hybrid network system, and/or VDMI communication sessions among its sub-nets, which utilizes said SMI, associative addressing-enabled VPN, hybrid network system, and/or VDMI network protocol, respectively, supported by said SMI, associative addressing-enabled VPN, and VDMI network gateways in order for said data-link control (21) to establish the required communication links among those devices;

said network access control means (20) uses the user and network service profile information from said user network connection profile database (26) for said network access control means (20) govern the approval for connectivity of its plurality of sub-nets and/or end-users to the subscribed internetworking environment, and visa-versa; and

said network access control means (20) is able to manage and to portion multiple amount carrier bands allocated for each connection session in order to provide concurrent connectivity for:

public and shared-media Internet session (34) services;

IP-based and associative addressing switching-enabled Virtual Private Network (VPN) session (35) services;

hybrid network system connection sessions (33) services among disparate connection-oriented and connectionless network systems; and

end-to-end, connection-oriented, and circuit-switching connection sessions for VDMI-based application session (32) services.

17. A method of subscription and establishment of Internet connectivity session (34) service, wherein the method includes:

network access control means (20) able to manage and to portion multiple amount carrier bands allocated for each connection session in order to provide concurrent connectivity for:

public and shared-media Internet session (34) services;

Internet Protocol (IP)-based and associative addressing switching-enabled Virtual Private Network (VPN) session (35) services;

hybrid network system connection sessions (33) services among disparate connection-oriented and connectionless network systems;

end-to-end, connection-oriented, and circuit-switching connection sessions for VDMI-based application session (32) services;

network access control means (20) through call establishment listening port communicated with Virtual Connection Circuit, ~~(~~VCC~~)~~ network switch central controller (33) for establishment of connectivity to a VCC-enabled Digital Subscriber Line Access Multiplexer, ~~(~~DSLAM~~)~~, having means to connect to a Internet Service Provider, ~~(~~ISP~~)~~, network gateway for the subscription of public and shared-media Internet services;

said network access control means (20) is able to allocate appropriate handshake protocols of Shared-Media Internet's (SMI's) control protocol to data-link control means (21) for establishment SMI communication sessions among its sub-nets which utilizes said SMI network protocol, supported by said SMI network gateway, for said data-link control means (21) to establish communication links among those devices;

upon receipt of approval and acceptance for connectivity, said network access control means (20) allocates prescribe amount of either sequential range of carrier bands or carrier bands having low quality of transmission classification for connectivity to public Internet service via DSLAM and said ISP gateway, and record within its network connection database (28) device addressing identifiers and connection identifier along with associated carrier band identifiers allocated for upstream and downstream communication channels and utilized information from network connection database (28) for transmission services for and during said communication session usage; and

said network access control means (20) has ability to dynamically changes the amount of carrier bands allocated for Internet service by using said data-link control means (21) to increase and decrease the allocated amount of carrier bands associated with said upstream and downstream communication channels record said changes within said network connection (28) databases.

18. The method claimed in claim 17, wherein the subscription and establishment of IP-based and associative addressing switching-enabled Virtual Private Network (VPN) connectivity session (35) service is:

said network access control means (20) through said call establishment listening port communicated with said VCC network switch central controller (33) for the establishment of connectivity to a VCC-enabled DSLAM having means to connect to an Internet Protocol (IP)-based and associative addressing switching-enabled VPN network gateway for the subscription of said connectivity services;

said network access control means (20) is able to allocate the appropriate handshake protocols of said SMI's control protocol to said data-link control means (21) for the establishment SMI communication sessions among its sub-nets which utilizes said SMI

network protocol, supported by said VPN network gateway, for said data-link control means (21) to establish communication links among those devices;

upon receipt of approval and acceptance for connectivity, said network access control means (20) allocates the prescribe amount of either sequential range of carrier bands or carrier bands having low to moderate quality of transmission classification for connectivity to said VPN service, and record within its network connection database (28) said device addressing identifiers and connection identifier along with associated carrier band identifiers allocated for said upstream and downstream communication channels and utilized said information from said network connection database (28) for transmission services for and during said communication session usage; and

said network access control means (20) has the ability to dynamically changes the amount of carrier bands allocated for said Internet service by using said data-link control means (21) to increase and decrease the allocated amount of carrier bands associated with said upstream and downstream communication channels record said changes within said network connection (28) databases.

19. The method claimed in claim 17, wherein the subscription and establishment of hybrid network system connectivity sessions (33) among disparate connection-oriented and connectionless network systems are:

said network access control means (20), upon receipt of connectivity request from its dedicated-media enabled sub-nets for connectivity services without request for end-to-end dedicated media connectivity, said network access control means (20) is able to allocate the appropriate control protocol's handshake protocols and said associative addressing network protocol signaling to said data-link control means (21) for the establishment of communication sessions among its sub-nets with said associative addressing-enabled hybrid network gateway;

said network access control means (20), through said call establishment listening port, communicated with said VCC network switch central controller (33) for the establishment of connectivity to the subscribed Network Service Provider's (NSP) having hybrid-based network gateway for the subscription of IP-based associative addressing routing and address resolution enabled connectivity services;

upon receipt of approval and acceptance for connectivity, said network access control means (20) allocates the prescribed amount of either sequential range of carrier bands or carrier bands having moderate to high quality of transmission classification for hybrid network system connectivity session (33) among the disparate connection-oriented and connectionless network systems, and said network access control means (20) record said connection information within its network connection database (28) said device addressing identifiers and the associated carrier band identifiers allocated for said upstream and downstream communication channels and utilized said information from said network connection database (28) for transmission services for and during said communication session.

20. The method claimed in claim 17, wherein the subscription and establishment of end-to-end connection-oriented and circuit-switching connectivity session (32) for VDMI-based application services is:

said network access control means (20), upon receipt of connectivity request from its virtual dedicated-media enabled sub-nets for connectivity services, with request for end-to-end dedicated media connectivity, said network access control means (20) through said call establishment listening port, communicated with said VCC switch central controller for the establishment of end-to-end VCC connectivity to the subscribed Application Service Provider's, (ASP), network gateway or to said called end-point device supporting said virtual dedicated-media enabled network protocol, such as Media Adaptation Layer, (MAL), network protocol or other higher-layer network protocol stacks having the ability to subscribe for end-to-end connection-oriented and circuit-switching dedicated-media network communication session services;

said network access control means (20) is able to utilize said MAL's associative addressing capability for destination forwarding, multiplexing, and address resolution services;

upon receipt of approval and acceptance for connectivity, said network access control means (20) allocates the prescribe amount of either sequential range of carrier bands or carrier bands having high quality of transmission classification for connectivity from said transceiver (12) to said ASP's VCC interface and/or end-point device, for an end-to-end

connection-oriented and circuit-switching dedicated-media communication session among a plurality of VCC network devices and record said connection resources within said network connection database (28);

said network access control means (20) is able to allocate the appropriate signaling protocols/network programming primitives for said MAL network protocol's control protocol, for signaling, to said data-link control means (21) for the establishment of VDMI communication sessions among its sub-nets which utilizes said MAL network protocol and to said ASP's MAL-enabled network gateway which also implemented said MAL's associative addressing scheme for destination forwarding, multiplexing, and address resolution capabilities; and

upon receipt of approval and acceptance for connectivity, said network access control means (20) record within its network connection database (28) said device addressing identifiers and the associated carrier band identifiers allocated for said upstream and downstream communication channels and utilized said information from said network connection database (28) for transmission services for and during said communication session (32); and

said network access control means (20) has the ability to dynamically changes the amount of carrier bands allocated for said Internet service by using said data-link control means (21) to increase and decrease the allocated amount of carrier bands associated with said upstream and downstream communication channels record said changes within said network connection (28) databases.