Title: GSM SUB-NET BASED ON DISTRIBUTED SWITCHING AND ACCESS NODES WITH OPTIMISED BACKHAUL CONNECTIVITY

Abstract: A method for implementing a low capacity GSM cellular based communication Sub-Net that offers its resources to be accessed by a first plurality of Mobile Stations ["MS"] for data and voice communication among the said first plurality and a second plurality of other hand held and stationary communication devices that do not access the resources of such network and an apparatus for implementing a low capacity GSM cellular based communication Sub-Net that offers its resources to be accessed by a first plurality of Mobile Stations ["MS"] for data and voice communication among the said first plurality and a second plurality of other hand held and stationary communication devices that do not access the resources of such network, and which includes a first base station subsystem for communicating with a first and second Mobile Station of the first plurality of Mobile Stations, with their allocated signaling and bearer data channels.
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GSM SUB-NET BASED ON DISTRIBUTED SWITCHING AND ACCESS NODES WITH OPTIMISED BACKHAUL CONNECTIVITY

FIELD OF THE INVENTION

A method and apparatus for implementing a low capacity GSM cellular based communication sub-network ["Sub-Net"] comprising a plurality of Distributed Switching and Access Nodes ["DSA"] which can be accessed respectively and individually by a plurality of Mobile Stations ["MS"] for data and voice communication, and which have an optimized backhaul connectivity.

BACKGROUND OF THE INVENTION

A macro cell deployment of the PLMN is a known method of facilitating Cellular based GSM communication to and from a first plurality of mobile stations that access the PLMN from within a building. However, this has the inherent disadvantage of tremendous RF power waste, required to overcome the blockage offered by the building to Radio Frequency and also leads to pockets within the coverage area devoid of any RF presence. This disrupts the communications in parts and in any case largely compromises the quality of communication.

In the Diagram 1, 100, 101 and 102 are the MSC, BSC and BTS respectively of a PLMN system. 106 is the coverage area of the PLMN BTS. 103 is the building requiring in-building solution, falling within the coverage area 106, and 104 and 105 are the mobile station 1 and mobile station 2 respectively of a first plurality of mobile stations. 103 in the said Diagram offers resistance and blockage to the signals from BTS 102, leading to loss and deterioration of signal presence within the area 103. Mobile station 104 shall have difficulty to communicate with and from the second mobile station of the first plurality, mobile station 105, as also with and from a second plurality of communication user equipment stationed outside the building 103.

Hierarchical Cell Structure for indoor coverage has also been employed. In this arrangement, the BTS is brought inside the building, but connected to the BSC
outside the building. This embodiment envisages a hierarchical cell structure, with the Pico/ Micro cells providing RF coverage from inside the building, but connected to the BSC outside the building. The signal strength inside the building is definitely improved, the spectrum is efficiently utilized, yet the backhauling of the Pico/ Micro cells with the external BSC is abysmally sub optimal, especially in the case of large indoor capacity requirement solutions. Reference is invited to Diagram 2. Mobile Stations 111 and 112 are present within the range of operation of BTS 110, within a building 109. The BTS 110 is within the building 109, and connected by backhaul connectivity with the outside-located BSC 108 and MSC 107. The backhaul connectivity is not only cumbersome, but usage is sub optimal.

In another arrangement, both the BSC and BTS are collocated within the building as an integrated BSS, thereby to some extent overcoming the disability connected with backhaul to some extent, but not altogether. The BSS in the case of a GSM based PLMN offers an entire Radio Access Network ["RAN"] inside the building itself. Thereby reducing the requirements of backhauling with the BSC outside the building. The BTS-BSC backhaul in this arrangement is attempted on the convenient IP over Ethernet model, saving on the typical TDM E1/Tl route of transport. In this embodiment in the Art, the BSS is connected with the external switching node (MSC and SGSN) with standard A/Gb interface over either standard TDM E1/Tl or again over Internet Protocol alternatives. In Diagram 3, the BSC 114 and BTS 115 are collocated within the building 116, within the area of coverage of which Mobile Stations 117 and 118 operate and intend to communicate with each other among others of a plurality. The BTS-BSC is backhauled with the external switching node [MSC-SGSN] through a plurality of TDM E1/Tl interface shown as 119 in Diagram 3. However, the main disability and limitation is that the connectivity on the backhaul between a plurality of Access Nodes from a plurality of buildings served by the external mobile switching node, is sub optimal and also on account of the fact that the Mobile Switching Centers in the Art and utilized in the embodiment have limitations in supporting a multiplicity of A interfaces, and hence a limitation on the plurality of Access nodes it can support. Further, in this particular embodiment in the Art, even for calls originating and terminating in the same building, it is the external switching node that is the cross connect point, leading to avoidable and unnecessary connectivity transport and switching capacity of the external switching node.
In another embodiment in the Art, as regards GSM based in-building solutions, a Cellular PABX method is adopted. Wired and Cellular Private Branch Exchanges [PABX] are known in the Art, and have their respective advantages as well as limitations. In this method, GSM radio access technology is used for facilitating subscriber access, wherein standard GSM BSC are employed for handovers across a plurality of coverage zones catered to by a plurality of BTS. The private PABX includes a private mobile switching center, a private registry and capability of intelligent hierarchical switching. The private PABX is connected via backhaul to a public mobile switching center.

In this embodiment in the Art, Local switching and mobility management for the private subscribers is done at the private MSC level, which works on standard GSM MSC specifications. As regards the public subscribers, the private PABX functions as a standard GSM specification BSS which is connected with the existing public Mobile Switching Center, over standard A interface, thereby providing access to PLMN (public) subscribers visiting the network in the embodiment. In this particular embodiment in the Art, the cellular based PABX system acts as a standard BSS when viewed from the PLMN perspective, subject to suitable radio planning to be done by the PLMN operation. Even when the A interface with the public mobile switching center fails, the cellular PABX continues to provide local switching to the first and second plurality registered with the system just prior to the backhaul failure.

In this embodiment in the Art, a plurality of interconnected cellular PABX systems provides roaming opportunity to private subscribers in the plurality of systems. In Diagram 4, 120 is the public mobile switching center, connected on A interface with the private cellular PABX 121, which is in turn connected by way of suitable interface with private BSC 122, and in turn with private BTS 123. Mobile stations 127, 128 and 129 are within the system coverage whereas Mobile Station 124 is within the coverage of the PLMN. In a communication between mobile stations 128 and 129, the private mobile switching centre, which is a part of the cellular PABX 121, acts as the cross connect point and offers switching and mobility management, rather than the tedious route of the external public mobile switching center 120 acting as the switching node. In a communication between mobile station 124 and mobile station
127, the cellular PABX 121 acts as a standard GSM BSS, working in tandem with the public mobile switching center 120.

The cellular PABX system is connected through appropriate interface with a plurality of such cellular PABX based sub systems, and the private mobile stations registered with any of the private cellular PABX systems shall have the ability to roam into any such interconnected cellular PABX subsystem/ coverage. However, it must be noted that while a plurality of public mobile stations shall have the potential (depending upon due and valid authorizations) to have seamless access to communication as they walk in from a PLMN coverage area to the private cellular PABX coverage area, and vise versa, the same shall not hold good for a plurality of private mobile station subscribers of the cellular PABX system when they go out of the coverage area of the private cellular PABX system and into the PLMN.

Another of the Art's inherent disability is the mode, method and architecture of connectivity of a plurality of access nodes to the Public Mobile Switching Centre, and other resources like HLR and other servers of a PLMN. Not only is the Art's process and system inept and wasteful, but also sub optimal. The Art's architecture demands a plurality of backhaul connectivity each sub-optimally utilized in terms of capacity utilization. The present Sub Net substantially deals with this issue.

DEFINITIONS

"Sub-Net": Sub Network element of a GSM Evolved Network consisting of a Number of distributed and access node ("DSA")

"External": External to the Sub-Net in the embodiment

"MVNE": Mobile Virtual Network Enabler

"MANO": Mobile Access Network Operator

"DSA": Distributed Switching and Access Node with circuit mode and packet mode (GPRS & EGPRS) access and switching.

"pABX": Public Automatic Branch Exchange

PLMN Public Land Mobile Network

HLR Home Location Register
SUMMARY OF THE INVENTION

A method, apparatus and architecture for implementing a low capacity GSM cellular based communication sub-network ["Sub-Net"] that offers the resources of a plurality of its Distributed Switching and Access Nodes ["DSA"] to be accessed respectively and individually by a plurality of Mobile Stations ["MS"] for data and voice communication amongst a first of the plurality of the MS, and a plurality of other hand held and stationary communication devices which plurality does not access the resources of such "DSA". The Network's DSA are connected on an existing network Backbone, through a gateway node, to the External MSC, PLMN, HLR, CGSN and other servers of a PLMN, in an innovative fashion so as to optimize such backhaul connectivity, while allowing existing roaming arrangements to seamlessly continue to offer connectivity to existing MS so authorized.

STATEMENT OF THE INVENTION

Accordingly, a method for implementing a low capacity GSM cellular based communication Sub-Net that offers its resources to be accessed by a first plurality of Mobile Stations ["MS"] for data and voice communication among the said first plurality and a second plurality of other hand held and stationary communication devices that do not access the resources of such network.

Accordingly, an apparatus for implementing a low capacity GSM cellular based communication Sub-Net that offers its resources to be accessed by a first plurality of Mobile Stations ["MS"] for data and voice communication among the said first plurality and a second plurality of other hand held and stationary communication devices that do not access the resources of such network, and which includes a first base station subsystem for communicating with a first and second Mobile Station of the first plurality of Mobile Stations, with their allocated signaling and bearer data channels.

Accordingly an architecture for implementing a low capacity GSM cellular based communication Sub-Net that offers its resources to be accessed by a first plurality of Mobile Stations ["MS"] for data and voice communication among the said first plurality and a second plurality of other hand held and stationary communication

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devices that do not access the resources of such network, and which includes a first base station subsystem for communicating with a first and second Mobile Station of the first plurality of Mobile Stations, with their allocated signaling and bearer data channels. The Sub-Net evolves into a Network in which the DSA are connected on an existing network Backbone, through a gateway node, to the External MSC, PLMN, HLR, CGSN and other servers of a PLMN, in an innovative fashion so as to optimize such backhaul connectivity, while allowing existing roaming arrangements to seamlessly continue to offer connectivity to existing MS so authorized.

DETAILED DESCRIPTION OF THE INVENTION

The Sub-Net comprises a first base station subsystem for communicating with a first and second Mobile Station of the first of a plurality of Mobile Stations, with their allocated signaling and bearer data channels. The plurality of base station subsystem ["BSS"] are respectively part of a first and second of a plurality of Distributed Switching and Access Nodes ["DSA"] and the Sub-Net includes a plurality of mobile services switching centre each an integrated part of the plurality of DSA", collocated with the plurality of BSS. Each DSA” in the present invention is optimally connected to an "External” mobile services switching centre ["MSC"], HLR and other servers of a PLMN. The Sub-Net works within and/ or overlaps the network reach area of the said PLMN, and / or works on a stand-alone basis.

The Sub_Net consists of a plurality of DSA, so placed in a novel manner as to optimize overall signal strength, coverage and transport and backhaul requirements. The Sub-Net works on a distributed switching model so as to ensure that local requirements are addressed by locally available switching and radio resources, and has an optimized backhaul connectivity with a PLMN, with the advantage of flexibility of use of emerging backbone network technology. The system is advantageously optimized as regards backhaul, bandwidth and signaling requirements.

The Sub Net's DSA" are connected on an existing network Backbone, through a gateway node, to the External MSC, PLMN, HLR, CGSN and other servers of a PLMN, in an innovative fashion so as to optimize such backhaul connectivity, while
allowing existing roaming arrangements to seamlessly continue to offer connectivity to existing MS so authorized.

The Access Network and Distributed Switching ["DSA"] in the present method provides for distributed switching capability within the access node network, specifically addressing the local needs of a concentrated pocket of coverage. The DSA has the combined and integrated capability of access and switching. This eliminates the need for a large plurality of A interfaces with the external switching node, the inefficiencies associated with sub optimal connectivity transport and wasteful utilization of public mobile switching center switching capacity. The method is easy to integrate within and ensures smooth adoption by an existing GSM based PLMN. However, the overlap of the private system with the PLMN coverage area ensures seamless handovers for a first plurality of GSM subscribers. The switching is conducted by the DSA, which also has the integrated capability of providing Mobility Management and cross connecting thereby ensuring reduced transport, signaling and backhaul requirements.

In one such embodiment relating to GSM based in-building solution, as shown in Diagram 5, 133 is the coverage area of the PLMN, which is serviced by its MSC, BSC and BTS. The HLR and other servers are represented by 132. The HLR and other servers are duly connected to the public MSC by way of appropriate and standard interface. 131 represents the area of indoor coverage by one of the DSA of the Sub Net, consisting of integrated BTS (138), BSC (139) and MSC (140), physically collocated (for example, on the same chassis in a box), collectively called DSA 134. Mobile Stations 141 and 142 are within the network area of coverage of the Sub Net and Mobile Station 143 and is within the area of coverage of the PLMN Mobile Operator.

In this embodiment, there is no private mobile station (i.e. a MS that shall work exclusively and solely when accessing the resources of the Sub Net and not otherwise), and hence the Sub Net resources are available for use by any MS who otherwise fulfills all authorization conditions of the PLMN. In a call to be completed between Mobile Stations 141 and 142, the access and switching shall be handled by the DSA within the area of coverage of which the first of a plurality of Mobile Stations is located (i.e. Plurality of MS which access the resources of the particular
DSAn and the call shall be routed and completed at the DSA" level itself. In case of Mobile Station 143 attempting to complete a call with the first of the said Plurality of MS, say 141, the call shall be routed and completed through the external mobile switching center of the PLMN, and the DSAn in the area of operation of which the Mobile Station 141 is located. Once Mobile Station 141 walks out of the area of coverage of the Sub_Net, the GSM based communication shall be seamlessly transferred from the DSA" of the SubJNet into the coverage area of the PLMN and all further calls shall be handled by the public PLMN. There shall be no loss of communication at any stage in the handing over process.

Similarly, when the Mobile Station 143 walks out of the coverage area of the PLMN and walks into the area of coverage of the Sub_Net DSAn, there shall be a seamless handing over of the call from the BTS of the PLMN onto the concerned DSAn in the Sub_Net embodiment, involving no disruption of communication. Once the Mobile Station 143 is handed over to the DSA" of the Sub_Net embodiment, its details shall be recorded in the Visitor Location Registry ["VLR"] of the DSAn.

In another embodiment of the invention, a plurality of small capacity Switching and Access Nodes are utilized ["DSA"" ] all of which need to be backhauled with the external Mobile Switching Center of the PLMN, based on suitable interface methodology. In this embodiment, each of the plurality of DSAn in the system are individually connected by way of an existing available access network backbone on to a G Node, where all the DSA" signaling and bearer traffic are terminated and concentrated and or aggregated. From the perspective of the public mobile switching center and other public network elements of the PLMN, the G Node is a single network entity and there is a single network connectivity between the intended public mobile switching center and the G Node in Diagram 6 illustrates one arrangement of the method, apparatus and architecture. 144, 145, 146... n are the plurality of DSA" set up to address the access and switching requirements of a number of concentrated hotspots spread out non-contiguously. 147 is the existing available access network backbone and 148 are the individual connects that link the plurality of DSA" with the aggregating G Node 149.

The signaling and bearer traffic is terminated at the G Node, from where the same is transported by way of an optimized connectivity solution 150 on to a MSC of a
PLMN. 152 links the G Node with the MSC, HLR, and other public servers of a
PLMN [153]. For all the public network elements of the external PLMN, the G Node
149 looks to be a single network element in the Sub_Net, hiding behind it the
individual DSA". This arrangement addresses the disabilities in the Art, and
innovatively optimizes the transport requirements on the backhaul part of the network.
This arrangement also offers an advantageously convenient operation management of
adding a plurality of DSA" in an existing network setup and in the process optimize
the transport for their connectivity with the existing network, something not addressed
by the existing Art.

In the Sub_Net the DSA" are opaquely shielded from the public network resources
like the public MSC and other originating elements of the PLMN5. Further, the G
Node 149 optimizes the requirement of Els for connectivity with the public MSC, and
also makes it practical to connect a large plurality of DSAn with a limited number of
Els that a public mobile switching center can handle in the present Art. The
architecture and method described herein also offers the added flexibility and ease of
operation to take significant benefits offered by existing and evolving Backbone
Transport Technology and associated routing techniques to address emerging cellular
infrastructure deployment needs cost effectively and with ease.

The Sub Net is capable of carrying out call routing as per specified GSM call control.
Additionally the Sub Net is capable of automatically detecting the status of the
external network connectivity and kept as a Boolean Net-Connectivity-Failure status
flag. In case of Net-Connectivity-Failure, when all the call should have failed, the Sub
Net is capable of completing the call if the called MS is concurrently being serviced
by the same DSA". This is done by interrogation of VLR in the Sub Net, and if the
called MS is found the call completion routine satisfactorily proceeds. This will also
be equally valid in case of MS of pre-paid category based on GSM CAMEL
architecture where the interaction with the external SCF is needed for call completion
and maintenance. This shall also be equally applicable in cases of MS visiting from a
plurality of PLMN. These mechanisms are flexible so as to be operator configurable
in order to be aligned with PLMN operation policy.

In the preferred embodiment of the invention as described above, the DSA5, from the
view point of network hierarchy routinely sit behind any of the existing public mobile

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switching center, and share the same Global Titles and MSRN range allocated and specified in the roaming agreement documents [ER21, 24 etc.] between a plurality of networks. In this arrangement, the network continues to facilitate roaming capabilities to mobile stations that routinely roam into the coverage of the preferred embodiment, without the need to make any changes or adjustments on an administrative level as far as the network administration is concerned. This innovative embodiment offers tremendous ease of operation and convenience of setting up the preferred embodiment network.

In another embodiment, a first of a plurality of DSA" facilitate access and switching requirements in a concentrated rural area, which is non contiguous to other areas. The first of such plurality of DSAN are connected through a G Node whereas a second of the said plurality of DSA" , offering similar access and switching options to another non contiguous rural area is similarly connected to the same G Node. The arrangement consists of the said plurality of DSAN similarly connected to one G Node, which G Node terminates the signaling and bearer data channels of the individual DSA", and collates, concentrates and aggregates the same for onward transport to a public mobile switching center of a PLMN, optimally facilitating intercommunication between a first plurality of mobile stations and a second of a plurality of Mobile Stations non contiguously placed. Additionally, the plurality of mobile stations accessing the Sub Net in the present embodiment shall have the ease of roaming into the coverage of a plurality of DSANs within the Sub_Net. The entire solution is optimal in terms of bandwidth, transport, backhaul and switching capacities.

Diagram 7 demonstrates the method, apparatus and architecture of this arrangement. 154, 155 and 156 respectively are Rural Areal, Rural Area 2,......Rural Area N respectively. 163, 164 and 165 are the DSA" 1, DSA" 2, ......DSA" N in the respective Rural Areas. 157 is the existing and/ or emerging access network backbone, and 158, 159 and 166 are the respective links connecting the respective DSA" in the respective Rural Areas with the G Node [Gateway MSC] 160. The bearer data traffic and signaling traffic is terminated by the respective links on to the G Node, where it is aggregated, concentrated, collated and further sent to the public MSC 161 over an
optimized link 167. 168 is a link that makes available the HLR/VLR/SGSN and other servers of the PLMN [162].

In yet another embodiment, by the addition of certain elements like HLR etc. to the Sub-Net, the Sub-Net graduates and "Upgrades" into a PLMN, with full GSM capabilities and ability to have its own Home Subscribers.

In still another embodiment, the Sub-Net, even without the addition of any HLR, works as a MVAN, and has the capacity to offer its infrastructural resources to other GSM service operators as also other MVNO to enable and facilitate seamless communication when MS registered as home subscribers with such operators and / or MVNO are able to access the resources of the Sub-Net as PLMN.

In one embodiment, relating to indoor GSM solution, the Sub-Net of claim 1 to 5 facilitates improved strength of signal across the coverage area, reduced transport requirements, local switching at the DSA" level there by reducing the switching requirements of the PLMN's MSC.

In a preferred embodiment of the Sub-Net of Claim 1 to 5, a first plurality of mobile stations operating within the area of coverage of a DSA" shall continue to communicate with a second plurality of mobile stations that are home subscribers of/ visitors to the PLMN connected with the G Node of the embodiment, and which have seamlessly migrated into the area of coverage of the same DSA" from the area of coverage of the said PLMN, even when the backhaul connectivity connecting the DSA" of the network with the public mobile switching center of the PLMN fails.

In a preferred embodiment of the Sub-Net of Claim 1 to 5, additions in capacity can be done conveniently and with practical ease.

In a preferred embodiment (large DSANs of low traffic capacity) of the Sub-Net of Claim 1 to 5, the link between the G Node and the PLMN MSC shall be optimal by traffic aggregation and shall also save on the number of E1/ T1 links that would otherwise be required.

In a preferred embodiment of the Sub-Net of Claim 5, the Sub-Net can use emerging backbone transport technology.
In a preferred embodiment of the Sub-Net of Claim 1 to 5, the overall transport requirements are reduced and optimized.

In a preferred embodiment of the Sub-Net of Claim 1 to 5, a large plurality of DSAn can be supported on a single public mobile switching center, with the advantage of ease of installation, commissioning and operational management.

In another embodiment of the Sub-Net, the subnet of Claim 1 to 5 offers a simple and cost effective solution to reach, interconnect and facilitate GSM based communications to remote, rural and other concentrated non-contiguous hotspots.

In a preferred embodiment of the Sub-Net of Claim 1 to 5, there is substantial enhancement in the battery life of the MS accessing the resources of the network.

In a preferred embodiment, the Sub-Net of claim 1 to 5 has the ability to graduate into a PLMN.

In a preferred embodiment, the Sub-Net of claim 1 to 5 can act as a MVAN, and offer its resources to be accessed by other service operators. In this embodiment, the Sub-Net shall have 0% home subscribers, and 100% visitors. No HLR shall be required within the Sub-Net in this embodiment.

The Sub-Net consists of a plurality of DSA", so placed as to optimize overall signal strength, coverage and transport and backhaul requirements. The Sub-Net works on a distributed switching model so as to ensure that local requirements are addressed by locally available switching and radio resources, and has optimized backhaul connectivity with a PLMN, with the advantage of flexibility of use of emerging backbone network technology. The system is advantageously optimized as regards backhaul, bandwidth and signaling requirements.

The Network's DSA" are connected on an existing network Backbone, through a gateway node, to the External MSC, PLMN, HLR, CGSN and other servers of a PLMN, in an innovative fashion so as to optimize such backhaul connectivity, while allowing existing roaming arrangements to seamlessly continue to offer connectivity to existing MS so authorized.
WE CLAIM-

1. A method for implementing a low capacity GSM cellular based communication Sub-Net that offers its resources to be accessed by a first plurality of Mobile Stations ["MS"] for data and voice communication among the said first plurality and a second plurality of other hand held and stationary communication devices that do not access the resources of such network.

2. A method as claimed in claim 1, wherein the Subnet in which a first base station subsystem communicates with a first and second Mobile Station of the first plurality of Mobile Stations, with their allocated signaling and bearer data channels.

3. A method as claimed in claims 1 and 2, wherein the Subnet is with a plurality of Distributed Switching and Access nodes ["DSA"] , each catering to a specific concentrated area of coverage and facilitating local access and switching.

4. A method as claimed in any of the preceding claims, wherein the Subnet is having a plurality of DSAN that are individually connected to a G Node (G MSC) which collates, concentrates and aggregates and terminates the bearer data and signaling traffic of the plurality of DSA”, and then optimally transports such terminated traffic to a public mobile switching center. The G Node is also connected to a public HLR/ VLR/ SGSN and other relevant public servers of a PLMN.

5. An apparatus for implementing a low capacity GSM cellular based communication Sub-Net that offers its resources to be accessed by a first plurality of Mobile Stations ["MS"] for data and voice communication among the said first plurality and a second plurality of other hand held and stationary communication devices that do not access the resources of such network, and which includes a first base station subsystem for communicating with a first and second Mobile Station of the first plurality of Mobile Stations, with their allocated signaling and bearer data channels.

6. An apparatus as claimed in claim 5, wherein the network consists of a plurality of Distributed Switching and Access nodes ["DSAn"], each catering to a specific concentrated area of coverage and facilitating local access and switching.
7. An apparatus as claimed in claims 5 and 6, wherein the plurality of DSAN are individually connected to a G-Node (Gateway Node) which collates, concentrates and aggregates and terminates the bearer data and signaling traffic of the plurality of DSAn, and then optimally transports such terminated traffic to a public mobile switching center.

8. An apparatus as claimed in claims 5 to 7, wherein the GNode is also connected to a HLR/SMSC/ GGSN/SGSN and other relevant servers of a PLMN.

9. An architecture for implementing a low capacity GSM cellular based communication Sub-Net that offers its resources to be accessed by a first plurality of Mobile Stations ["MS"] for data and voice communication among the said first plurality and a second plurality of other hand held and stationary communication devices that do not access the resources of such network, and which includes a first base station subsystem for communicating with a first and second Mobile Station of the first plurality of Mobile Stations, with their allocated signaling and bearer data channels. The Sub-Net evolves into a Network in which the DSAn are connected on an existing network Backbone, through a gateway node, to the External MSC, PLMN, HLR, CGSN and other servers of a PLMN, in an innovative fashion so as to optimize such backhaul connectivity, while allowing existing roaming arrangements to seamlessly continue to offer connectivity to existing MS so authorized.

10. A method for implementing a low capacity GSM cellular based communication Sub-Net substantially as herein described along with the accompanying drawings.

11. An apparatus for implementing a low capacity GSM cellular based communication Sub-Net substantially as herein described along with the accompanying drawings.

12. An architecture for implementing a low capacity GSM cellular based communication Sub-Net substantially as herein described along with the accompanying drawings.