Response document

to

Public Consultation

on Policy & Regulatory Framework

for Next Generation Networks (NGN)

Contents

Purpose of the document

This document was established in response to the Public Consultation on Policy & Regulatory Framework for Next Generation Networks (NGN) by Telecommunications Regulatory Commission of Sri Lanka (TRCSL).

Instead of directly answer the question raised in the consultation document. (Ref.: Public Consultation on Policy & Regulatory Framework for Next Generation Networks, dated 29th September,2010) it give the overview of telecom market, status and trend of the networks and services, customer demand, and how the operators are thinking about the telecom business in order to roll-out the network in the future. Case study from the successfully migrated network is added to reflect the migration strategy and timeline used for migration.

Information will be used by the regulatory body to create the framework to regulate the telecom industry according to regulation aspects especially to balance among the competition, investment, national resource management and the consumer protection.

Two of regulation topics were added to address the Social security could be expected from the communication network i.e. Number Portability to support the National resource management and the competition aspects, and Lawful Interception to support Social security and customer privacy aspect.

Telecom status quo

Telecommunication industry has been changed rapidly. Voice service revenue is going down while data communication demand is increasing drastically. Incumbent operators who operate only circuit switches on the voice service are facing declining in voice revenue. Data revenue has grown up along the time until the disruptive services, devices and social networking become popular.

At the first phase, operators were offering the unlimited all-you-can-eat package to stimulate data usage which seems successfully achieved. As the time goes by, a lot of new high capability devices and applications, which are higher bandwidth consuming, have been launched. All-you can eat package create new challenges to the operator i.e. high bandwidth demand, Quality of services demand due to high bandwidth consuming applications e.g. Voice-P2P, download-P2P but generate no revenue.

Both Fixed and mobile Technologies have evolved at an unprecedented rate to deliver hundreds of megabit per second to any devices, anywhere. Microwave and radio technology have allowed operator to extend their coverage to area previously not possible due to distance, terrain and cost. Optical fiber has enabled networks capable of supporting hundreds of terabit per second. Now even the most remote area can be connect to the internet with single radio tower capable of supporting multi gigabit speed.

In the 1990s internet access evolved from 56 kbps service over analog lines to 512 kbps digital subscriber lines. That was followed quickly by major bandwidth improvement that allowed connection speed up to 24 Mbps (ADSL2+) for consumer lines. Now fiber has begun to encroach on the last mile with promises of gigabit speeds to the home.

Even with the huge investment in fixed asset however, developing nation has struggled to keep pace with internet demands. Luckily the noughties brought with them a shift in focus from fixed to mobile technology as a means of offering data services. Start with the basic 8 kbps service in early 2000, 2G, 3G, 4G mobile technologies have been almost solely focused on driving up the capacity of mobile infrastructure, Currently the 3GPP required candidate technologies to support 1 Gbps of bandwidth in 100Mhz spectrum to qualify as 4G. With a typical 50-100 users per cell that means user can expect similar bandwidth to fixed broadband. Even current 3G technologies have been amended with enhancements that enable hundreds of Mbps per cell tower making it a viable alternative to fixed services.

Social Network and Community

Social network and community are very powerful. Users generate their own content and share among the group of the same interests, keep staying in touch with each other within and outside the groups. This will not only increase more content in the social network and community but also create a lot of bandwidth demands in both upload and, download directions.

Cloud computing

The transition to cloud computing is accelerating because of a desire to reduce capital expenditures and to drive down costs. Customers also expressed a desire to add new capabilities not available in current IT models as a reason to move to cloud computing. Developers of applications are interested in create their applications on the web based cloud computing platform. This will cause a huge transferring of data between the client and cloud computing server at the same time will enable the ubiquitous information access from different devices anywhere and at anytime.

Smart devices and smart applications

Lots of devices and applications have been introduced into the Telecom value chain. Devices can be used alternatively to access the services and contents allowed user to access the applications from anywhere at any time.

Device manufacturer also created application associated with the devices e.g. application store and allow application developers to generate attractive application to be used with their devices. More and more applications have been lunched to the user for free, some with a little fee. Users are enjoying using these applications which in turn, generate the revenue to device and application developers.

User demand

Users are now use their devices to access the service content and applications everywhere at anytime with different devices e.g. Access the internet when they are at home, access the social networking and community information both at home and on the move.

Due to the changes of users' behavior, network operators need to provide the ubiquitous service which requires fixed and mobile network convergence in order to provide mobility to respond to the user requirements.

In the internet era, high bandwidth demand application has been introduced and become popular easily. Users often use the application with no limitation on their packages.

Fixed Mobile Convergence

In order to offer a new convergence and ubiquitous service to the end users, operators are looking forward to establishing Fixed-Mobile Convergence at the same time reduce the CAPEX for network expansion due to its increased efficiency. Multiple services can be launched to the market via Fixed-Mobile Convergent network and deliver the new experience to the end users e.g. Package bundling, ubiquitous service which they are able to access anytime anywhere and by any device, one stop customer services.

NGN

NGN Definition

NGN by the ITU formal definition in Y.2001 recommendation

A Next Generation Networks (NGN) is a packet-based network able to provide Telecommunication Services to users and able to make use of multiple broadband, QoS enabled transport technologies and in which service-related functions are independent of the underlying transport-related technologies. It enables unfettered access for users to networks and to competing service providers and services of their choice. It supports generalised mobility which will allow consistent and ubiquitous provision of services to users

How we understand the NGN

From this broad definition, a number of fundamental characteristics and aspects of NGN can be derived:

- It usually refers to the transmission of packet-based data using the Internet Protocol (IP) as a standard.
- A typical NGN will be able to deliver services in a technology-neutral manner, independently of the underlying technology (fiber, copper, coaxial, wireless, etc.) or the underlying architecture. The transport of the packets does allow for a differentiation of end-to-end Quality of Service (QoS) characteristics;
- Service provision is decoupled from transport – unfettered access by users to different service providers;
- Open interfaces support interworking with legacy networks;
- Converged services are delivered over fixed and mobile networks. The delivery of services will include mobile, nomadic and fixed users.

NGN could be simply explained as a “communication network that allows unfettered access to all communication products and services, irrespective of the service provider or network

connection”

NGN benefits

Benefits to Telecoms Operators

As mentioned above, one of the main reasons for operators to migrate to a single NGN network is to optimize both OPEX and CAPEX, enabling them to maintain their profit margins in a telecoms market that is becoming increasingly competitive. Also, in Sri Lanka as in many other countries the public switched telephone network (PSTN) is reaching the end of its life and needs to be replaced. It is increasingly difficult and expensive to find equipment vendors that can support and maintain legacy telephone switches and it is even more difficult (and very expensive) to replace these switches as all the equipment vendors have now refocused their portfolio on NGN equipment. Therefore, there is a strong incentive for operators to migrate their voice services from the legacy PSTN onto an NGN network.
In addition to these cost savings, NGN provides opportunities for operators to generate new lines of revenue – which are much needed, given the competition in traditional voice services. For example, NGN allows operators to offer TV services such as Video on Demand (VoD). Because NGN networks can support all type of services, there is no requirement to build service-specific networks and therefore the time to market for new services is significantly lower than that associated with legacy networks.

National Benefits of NGN

In an era where many countries have embarked on a fundamental transformation catalyzed by the progress in telecoms technology, normally the potential benefits in three key areas are examined:

(a) Social benefits,
(b) Economic benefits

and additionally

(c) Environmental benefits

Way Forward to NGN

NGN Infrastructure Development

Core and Transport:

Usually refer to the replacement of legacy transmission and switching equipment by IP technology in the core, or backbone, network. This includes changing telephony switches and installing routers and other equipments. The migration from traditional to NGN core network potentially necessitates several structural changes, such as to the core network nodes and in the number of network hierarchy levels. As a result, a reduction in the overall number of interconnection points is likely to take place. Although NGN core networks tend to be based on fixed infrastructure, the possibility of improving interconnection with mobile networks is being explored to facilitate access to IP services from anywhere.

For fixed operators, the expected cost savings from an IP core network is the key driver for investment to upgrade their network. For mobile operators, a more important consideration when upgrading their core network is the ability to offer richer IP multimedia services to customers

Access:

Typically refer to the network segment which connects an end-user to the nearest location which houses the network access provider‘s equipment. As the ITU definition of NGN implies, NGN access can be delivered by a number of different technologies. These include fiber, copper, coaxial lines as well as different wireless options.

NGN access networks are mainly considered to refer to the introduction of fiber into the local loop, either to a street cabinet in conjunction with VDSL2 or ADSL2 deployment or the deployment of fiber all the way to customer premises (typically apartment blocks rather than individual houses). This means that an operator can choose between the following options

Fiber to the cabinet (FTTC) - Deployment of fiber to a street cabinet and provision of broadband based on VDSL/VDSL2 over copper loops from the street cabinet to end-user premises.

Fiber to the building (FTTB) - Deployment of fiber until the basement of a building and provision of broadband based on VDSL/VDSL2 over in-house copper wiring.

Fiber to the home (FTTH) - An end-to-end fiber solution to end-user premises. In this scenario, the entire copper loop is replaced by fiber, along with the main distribution frame (MDF) and street cabinets, although some of these may be used for the optical distribution frames (ODF) and optical splitters. FTTH deployment can be achieved by deployment of either a point-to-point (P2P) or a passive optical network (PON) topology. The broadly-defined term fiber to the premises (FTTP) is sometimes used to describe FTTH and/or FTTB

Service Delivery Framework

Decoupling Service from Underlying Network

NGN's architecture allows decoupling the network's transport and service layers. It means that, whenever a provider wants to enable a new service, they can do so by defining it directly at the service layer without considering the transport layer - i.e. services are independent of transport details.

Architectural Layering

NGN separates service/session control from the underlying transport. The separation between access, service, and communications session control within the Service Layer allows each type of session to be treated independently from the others. Multiple service sessions can be started from a single access session. Same as communications sessions can be treated separately from the overall service session they are part of. Most importantly, these separations allow for services to be developed independently from underlying transport and connectivity considerations. Thus, service developers will no longer need to know anything about the type of transport used for the services they are developing.

Open API

Another essential attribute of the Next Generation Service Architecture is an open development environment based on an Application Programming Interface (API) which will enable service providers, third party application developers, and potentially end users to create and introduce applications quickly and seamlessly. This will speed the introduction of new services by giving service providers more control over the service introduction process and allow for the reuse of existing application components. It will also open the opportunities for creating and delivering services to a broader audience.

Distributed Network Intelligence

In an NGN services environment, the scope of marketable services can be greatly extended to include a much richer variety of services and associated network intelligence. The NGN will decouple this network intelligence from physical network elements. Thus, network intelligence can be distributed to the most suitable locations in the network. Functional capabilities will no longer be coupled with the physical network elements.

Migration to NGN

Migration strategy

Strategies were selected mainly from the point of view of carrier's goals and influence of factors like cost of maintaining the public switched telephone network (PSTN), competition and development of voice over IP (VoIP) and multimedia services market. While each operator develops its own unique network migration path, carrier strategies can be categorized into three main groups:

- Full replacement
- new generation network (NGN) overlay
- NGN construction step by step

From the beginning. Replacement depends on the removal of time division multiplexing (TDM) switches and access infrastructure. It enables seamless transition of plain old telephone services (POTS) users to IP call/session control. Overlay enables migration of subscribers to IP-based multimedia environment. It includes continued support of existing infrastructure. Carrier's migration paths include some combinations of particular options, especially partial PSTN replacement with NGN overlay. Combination ensures swiftest transformation, but requires significant capital expenditure (CAPEX)

Case Study

Below is an example of NGN migration in the East Europe country:

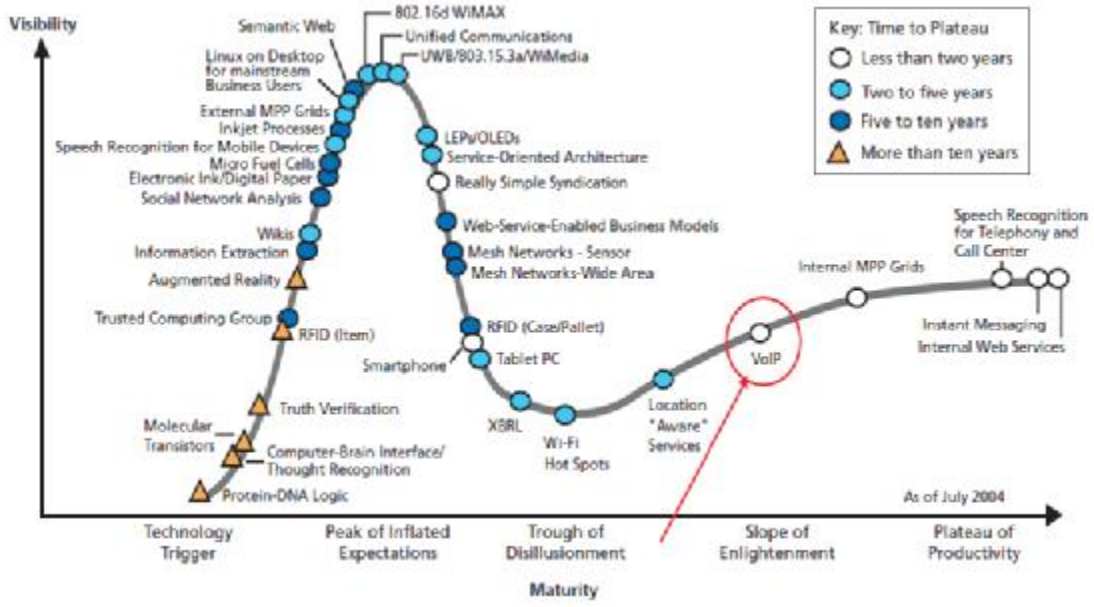
After much analysis and research, Operators finally decided to optimize the current network with the step-by-step introduction of NGN, which operators believe offers a total network solution capable of providing voice, data and video services over an IP network. With the soft switch as the core layer and various gateways and terminals as the access layer, NGN not only promotes network competence but also greatly reduces OPEX (Operational

Expenditure). According to a report by the consultants, Ditterberner, NGN can reduce OPEX by 40% when compared with a traditional network constructed with digital switches.

NGN's flat structure provides the following benefits:

- Network simplification.
- Reductions in operational and maintenance costs.
- Lower power consumption.
- Less physical space needed for equipment.
- Reduced bandwidth requirements

A digital switch can support tens of thousands of subscribers at most, while a softswitch can support hundreds of thousands, even millions of subscribers. Although NGN represents a new technology, its maturity can be illustrated as the following figure.



It is worth noting that by 2004, more than 200 carriers across the globe had replaced their PSTNs with NGNs, or had at least deployed trial NGNs. operators have therefore chosen the NGN / IP network solution to realize digitization.

Key issues

There's no doubt that NGN possesses numerous advantages over traditional PSTN networks. Key, applicable technologies and network development trends are the areas operator has been considering the most. NGN architecture consists of four levels:

(i) Service layer
(ii) (ii) control layer
(iii) (iii) IP bearing layer
(iv) access layer.

They believe that the last three layers provide the basis for the service layer, which is of course where revenue is generated.

When viewing the four together and therefore the network as a whole, the control layer is the most important as its high processing capability and reliability are integral to protecting network integrity. In addition to voice services, the control layer must also support integrated services such as multi-media.

The access layer must be able to access both broadband and narrowband devices, and provide narrowband voice services as well as broadband data and video services.

With NGN's innovative technology, operator can not only replace legacy switches but also offer end users new experiences by providing broadband applications. NGN is therefore essential in terms of maintaining the market dominance of fixed network carriers. Operator has carried out stringent tests to ratify NGN's feasibility.
Softswitch functions and services were tested in the first phase; its performance was evaluated during the second; and phase three assessed MSAN/softswitch interoperability. The tests confirmed their belief that NGN represents their way forward.

The NGN adopts a flat structure, with centralized user data and call control. This raises questions of reliability. So operator has utilized dual home design in the core layer to address any potential problems and already set up three pairs of softswitches nationally to ensure the network's carrier class reliability. The access layer features high bandwidth, IP architecture and high-density integrated access. Significant investment and a long term construction process are required for this layer, which, according to operator forecasts, may account for 80% of total investment. Therefore, their selection criteria with respect to the various access modes was suitably thorough.

Amongst others, operator considered "switch + DSLAM", "NGN + DSLAM" and user terminal transformation.

After lengthy evaluation and discussion, they found that both "switch + DSLAM" and "NGN + DSLAM" were too expensive and that maintaining the distributed network would have been too labor intensive. Network transformation beginning with intelligent terminals relies on a complete IP core network, sufficient bearing resources and a full logistics chain.

Transformation is also restricted by the maturity of the terminals.

Finally, therefore, Operator chose MSAN. The cost was acceptable and all the current network's traditional services can be inherited, including PSTN, ISDN, PBX and dedicated lines. Broadband services such as triple play can be supported by the available bandwidth, and MSAN also supports multiple access modes such as WiMAX and FTTH. They also believe that the access layer won't change too much during the decade after transformation.

Further step

After transformation of the core network and elements of the access layer is complete, operator will implement network evolution over two phases.

1. Profit generation and value-added service provision via network intelligentization. This will not only provide services for new subscribers, but also promote the service competence of the existing end offices and optimize the network structure. During NGN construction, the original PSTN can still generate profits and provide effective services. The intelligentized network will provide services such as RBT (Ringback Tone), ONLY (One Number Link You), PPS (Pre-Paid Service), WAC (Wide Area Centrex) and smart phone to the whole network subscribers. NGN services will also be offered including MVN (Multiple Virtual Numbers) and Number Portability (NP).

2. IMS development. This is currently being discussed by several international standardization organizations. IMS not only applies to the mobile network, but also attracts fixed network carriers. Fixed network standardization organizations such as ETSI and ATIS also support and adopt IMS architecture as the cornerstone for fixed network evolution. With the support of SIP by IETF, ITU's acknowledged expedience with respect to current network evolution, and the completion of OSA definitions by Open Mobile Alliance (OMA) and the Parlay Group, IMS has become the blueprint for FMC (Fixed and Mobile Convergence), and the best way of providing multi-media applications and multi-protocol service access operator is of course considering the development of both fixed and mobile networks in the context of NGN development. They believe IMS to be the future of their network, and equipment such as the softswitch must possess the capacity to evolve smoothly to IMS so as to protect network construction investment.

In summary, the next two to three years of network construction will see operator following the path of digitization, network intelligentization and integration. NGN assists the digitization process and promotes network performance. Opertor foresee the enrichment of communication methods through technical innovation and network transformation. NGN will also help operator develop into the future and construct a solid base for Country's communications infrastructure.

Other regulatory aspects

Number Portability

Number Portability has been deployed in many countries regulated by National Telecommunication Regulation body. To manage national resource (Numbering) efficiently and to stimulate the competition, in term of Service innovation and Quality of Service, NP has been deployed to enable the possibility of the customer to port from one network operator to another without changing their numbering.

Each country has its national numbering plan, which dictates which telephone numbers is used for what purpose, is managed by national regulators. Mobile Network operators (MNOs), in turn are supplied with a number range from the regulator, and they are held responsible for the responsible and judicious management of the numbers assigned to them. When an MNO required additional numbers, it had to apply to the regulator for the additional number range. MNOs were also required to provide periodic reports to the regulator on how they have managed the stewardship of their allocated number ranges.

MNOs in turn allocate a number range to their respective service providers (SPs). In the past, this was handled by assigning numbers on a particular Home Location Register (HLR) to the SP.

This method of number allocation worked well for the MNOs as it enabled their bases to be segmented along HLR levels and simplified systems, security and report related issues in the management of their customer bases. In addition to this, by allocating certain ranges of mobile phone numbers (commonly referred to as MSISDN's) to certain SIM card number ranges (also known as IMSIs), certain additional validation procedures could also be built into MNO and SP systems.

Advantages and Disadvantages to be considered by MNOs

One of the big advantages of allocating specific numbers to MNOs and SPs is that anyone with a rudimentary knowledge of the telecommunications industry can identify to which Network a subscriber belongs, and in some cases even to which SP they are contracted.

Although management of MSISDNs on an HLR and SP level helped to achieve certain productivity and data-integrity benefits for the MNO, the practice has a number of disadvantages, particularly for the end-subscriber.

These disadvantages are:

1. Allocation of large separate number ranges to each MNO in the country is not the most efficient method of managing this limited resource. There tends to be a great deal of wastage of MSISDNs due to this.
2. If subscribers wish to keep their mobile numbers, they have no alternative but to remain with their current Network and Service Provider, regardless of whether or not they are happy with the service, products and pricing that they are receiving.
3. Even if a subscriber is prepared to lose the number in order to obtain a better deal or level of service, the cost of changing the number can be significant, particularly if the mobile number has been supplied to customers and business associates, or where it appears on pre-printed stationery such as letter-heads and business cards.
4. Due to the reluctance of subscribers to change their numbers, larger more established players in the cellular market are at a distinct advantage over smaller competitors or start-ups in the industry. This is particularly the case where the market is nearing saturation, and most quality customers already have a service with one of the incumbents in the market.
5. Similarly to the above point, as MNOs and SPs are aware that many of their customers have no choice but to remain with them or lose their mobile number, the incentive to improve service, create new and innovative products and services or to improve their pricing is perhaps less than what it should be.
6. In an era where consumers are being offered an unprecedented level of choice and service, this practice has taken a significant amount of criticism from consumer forums and action groups.

All of the above factors can be viewed as creating an environment where anti-competitive behavior is encouraged. In order to rectify the above situation, the regulator has to clearly set an implementation plan to ensure that Mobile Number Portability (MNP) is available at the end of that period. MNP will allow subscribers to “port” their numbers from one Network and/or Service Provider to another practically at will. Obviously there are certain business rules, and subscriber contractual obligations that will limit the circumstances and frequency of MSISDN ports.

Critical success factors

The success of MNP in will be influenced by a number of factors, some of which have been

mentioned above (and will be repeated for the sake of completeness), and some that will be unique to each market. These factors are:

1. Ability of the MNOs to work together to implement the solution. Although the regulators usually are fairly prescriptive in the way that the solution should be implemented and operated, the actual legwork has been left up to the MNOs.
2. Porting time. As mentioned above, long porting times translate into lower numbers of ports.
3. Porting fees. In emerging countries currently implementing MNP, a vast majority of subscribers are prepaid users, with extremely high price sensitivity, high porting fees would essentially stifle the lion's share of porting opportunities.
4. As mentioned in the previous point, most of the subscribers will be on prepaid Tariff plans. Churn on these tariffs is currently around 35% – which indicates that a large portion of subscribers are not particularly attached to their mobile phone numbers. The number of ports from the prepaid base can therefore be expected to be relatively low in comparison to the base size.
5. A number of MVNOs (Mobile Virtual Network Operators) and Enhanced Service Providers (ESPs) are mooted to be launched during the coming years. If these new entrants' primary competitive strategy will be one of price leadership, the number of ports can be expected to increase. There will, however, be a reduction in tariffs and margins as the current players react to this pricing…"
6. The number of subscribers requesting ports in a particular market tends to decrease as the service parity between the various MNOs in the market increases. In other words, if all of the MNOs in a country have the same or similar services at similar prices, subscribers are less likely to want to change their current network provider.
7. In the some markets, some operators lack many of the data related products and services (3G and EDGE in particular) that its competitors sell. Despite the assumption that these will be a net gainer of subscribers, this lag behind the competitors could encourage movement of high usage subscribers to its competitors.
8. Lastly, the question of how the MNOs treat their external service providers (XSPs) will greatly influence the number of ports once MNP is switched on. If the current status quo is maintained, in an MNP environment, the XSPs will be in a position of relative strength, as they will be able to perform large scale migrations of particularly corporate clients to the MNO offering the best deal.

Lawful Interception

Due to the security aspect, Lawful interception concept has been established standardized, and has been deploy in Telecommunication network worldwide. It's the regulatory issues to determine deploying the LI concept for National security purpose in order to fulfill national requirement based on Crime Law.

The term *Lawful Interception* (LI) describes the process by which law enforcement agencies conduct electronic surveillance of circuit and packet-mode communications as authorized by judicial or administrative order. The means and authority of conducting LI is often recorded in government legislation or regulatory mandates.

LI is initiated by a warrant from the Law Enforcement Agency (LEA), which identifies a target identity, a specific LI service, and a period of time. It requires the service provider (SP) to deliver Intercept-Related Information (IRI) and/or Content of Communication (CC) associated with sessions initiated by a specific target.

Note that data retention is a different regulatory requirement than LI. It requires the SP to retain data associated to specific services (that is, fixed telephony, mobile telephony, Internet telephony, and Internet access) for every subscriber during a specific period of time. The data to be retained does not include the CC. The LEA sends a warrant to the SP to collect the data associated with past communications for specific targets and services for a period of time. Data retention is not in the scope of this document.

LI is a new requirement for GGSN. In the past, LI for mobile data traffic was requested in the SGSN only. The SGSN captures the IRI and the CC for most of the mobile data communications and, for LEAs, LI in SGSN was the first priority. It appeared recently that LI must also be supported in the GGSN for two main reasons:

- There is no SGSN in the home network for roaming targets.
- The SGSN does not handle the CC with the Radio Network Controller (RNC)-GGSN direct tunnel architecture that has been specified in 3GPP Release 7.

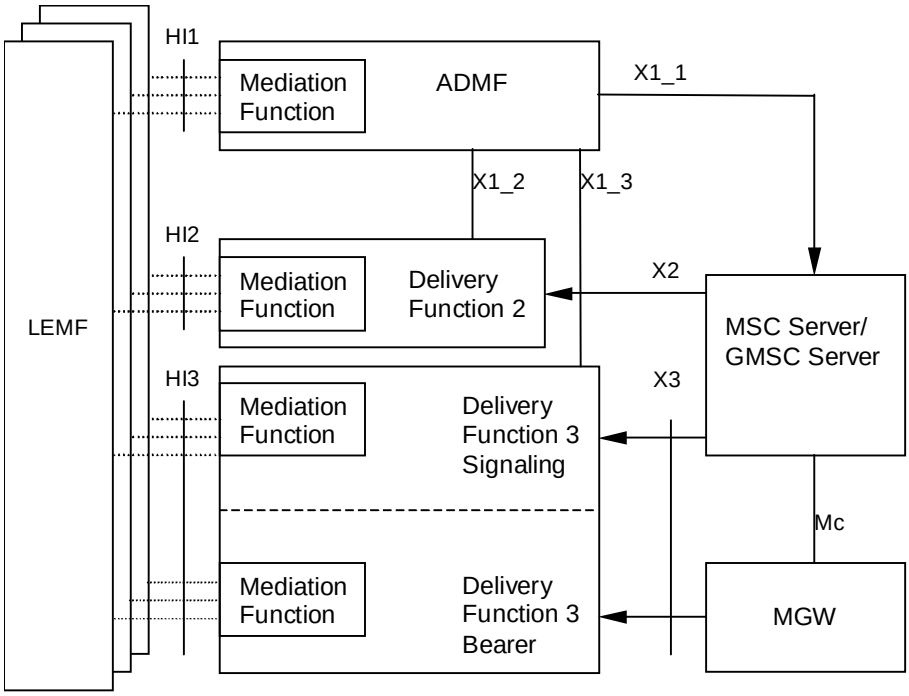
3GPP Standards

3GPP has published the following specification for LI:

- TS 33.106: *Lawful interception requirements* specifies the requirements for all 3GPP services.
- TS 33.107: *Lawful interception architecture and functions* specifies the functional architectures for different 3GPP services, including GPRS Support Node (GSN) packet data services.
- TS 33.108: *Handover interface for Lawful Interception* specifies the Handover Interface (HI) between the SP and the LEA. The objective of the Cisco 3GPP LI solution is to support a number of regional interception regulations using specific (regional) mediation functions, allowing only required information to be transported over the national HI.

Packet Switched Intercept Configuration

The Packet Switched Intercept configuration specified in TS 33.107 is shown in the following figure



The Mediation Function is split into three parts:

- Administration function
- Delivery function 2 for HI2
- Delivery function 3 for HI3

The GSN includes the SGSN and the GGSN. The GSN provides both the IRI and CC.

The interfaces X1, X2, and X3 are listed, but the specification does not define a protocol.

More ever the Lawful interception function is also available for other Network Element in the other technology in the NGN networks i.e. IMS and WLAN

-End-