Multiple Network Operator Services Utilization Using Single SIM Card

N. Mallikharjuna Rao and P. Seetharam

Abstract—**Mobile phones, or cell phones as it is frequently called nowadays, have significantly revolutionized the way people communicate with one another. It has empowered a lot of people and has even made a lot of things possible because of its many features and capabilities. Dual SIM handsets have been around for a few years now. As of now few mobile manufacturers are manufacturing dual/3 SIM card mobiles. China Mobiles are the leading vendors of this type. First time Nokia has released dual SIM card mobiles into market. According to the surveys dual SIM card mobiles are disadvantageous and will stop working any one SIM card holder after certain time. The rapid growth in new Service Providers has made mobile usage so simple. Several providers are bringing SIM cards into market at very cheap cost, some times for even no single rupee. Now days every subscriber is having at least 5 to 10 SIM cards from different providers. In this paper, we proposed MNOS architecture; the proposed system will help multiple SIM card usage subscribers by activating all providers' services onto a single SIM card.**

Index Terms—**SIM, Network, IP Address, MT, TRAI**

I. INTRODUCTION

In 1985 - First mobile telephone service started on non-commercial basis in Delhi. While all the major cities and towns in the country were linked with telephones during the British period, the total number of telephones in 1948 was only around 80,000. Even after independence, growth was extremely slow. The telephone was a status symbol rather than being an instrument of utility. The number of telephones grew leisurely to 980,000 in 1971, 2.15 million in 1981 and 5.07 million in 1991, the year economic reforms were initiated in the country [1]. First mobile telephone service started on non-commercial basis in Delhi. The initial Handset costs around Rs.40, 000 & Call Tariff at 17 Rs/min. Both Incoming and Outgoing were charged at that time. The incoming charges were charged up to year 2005. In this paper, we are consider and taken as example of Andhra Pradesh state in India , there are more than 10 mobile service providers; almost every mobile subscriber in AP has got atleast 5 to 10 SIM cards from different providers. Only dual SIM card mobiles are only the way to keep 2 SIM cards for use of 2 different service providers' services.

Dual SIM mobile phones are designed in nearly the same way as any other phone with the addition of a second transceiver which allows it to implement two separate Subscriber Identity Modules (SIMs). These small chips or cards slide into the backs of most mobile phones and help pick up cellular signals. They are generally programmed to pick up the signal from a particular mobile network, receiving signals from that network's cellular towers. Mobile phones, or cell phones as it is frequently called nowadays, have significantly revolutionized the way people communicate with one another. It has empowered a lot of people and has even made a lot of things possible because of its many features and capabilities [2], because of these reason mobile subscribers are taking more numbers of SIMs from several operator. Mobile subscribers are investing more money for purchasing dual SIMs mobile phones and subscribers frequently changing mobile models.

In this paper, we are proposing a technique to use multiple service providers' (Multiple networks) with single SIMs card. In this paper, section 1 we discussed background and existing problem, in section 3 proposed methods and given set advantages as well as implementation steps, conclude in section 5.

II. BACKGROUND AND EXISTING PROBLEM

There are certain mobile phone manufacturers whose devices are mostly maintain the use of one sole network or Phone Company [3] [4]. That is, each SIM card operates under the same wireless provider. In some instances it may be possible to use a SIM card from a second provider with the same phone, provided the additional card is the proper size and with the assumption that the mobile phone is not locked [3]. But this ratio is very small when compared with the companies manufacturing dual SIM card mobile which can support any service provider. The conversion of old mobile phones to support dual SIM is not that much difficult with the technology available.

Not all phones can accept dual SIM cards, but there are adapters available to turn almost any late model phone into a dual SIM phone. Some adapters may require both SIM cards to be cut down and fitted, while others may offer a more tailored fit. When using adapters instead of dual SIM mobile phones, it may not be possible to use both SIMs at the same time. Users must switch from one to the other by using an on screen menu.

Full functioning dual SIM mobile phones [5], by comparison, do not usually require the user to choose between one SIM and another. Both phone numbers can be

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used at the same time. This feature is convenient for those who wish to separate business and personal calls using two separate phone numbers, as well as those who travel frequently and want a local number for each location.

In some parts of the world the dual SIM phone has been taken a step further with phones that can hold three SIM cards. These are generally bulkier than traditional one-SIM phones. They are also not as widely used or desired as single and dual SIM mobile phones.

A. Advantages with Dual SIMs

With a dual SIM phone you are not stuck with a single network providers pricing plan. You can take advantage of the best offers from multiple networks. There are numerous ways to mix and match the networks and get a great deal. For example: pickup a second SIM card on the same network as someone you speak to often and use this to get better rates. Acquiring a spare SIM card is simple, with most networks happy to let you order them for free on their websites in the hopes of gaining more customers. The greatest advantage is that with multiple network coverage can resolve troubles with other network coverage problems sometime. Mobile users in remote or rural areas in particular know well the pains of mobile network black spots. Even personally I have faced a problem when my brother got jammed in heavy rains during the year 2005, I have tried a lot to communicate with him through my mobile, unfortunately my mobile service provider network got down and I have no other go to call him whole the day till he reached to home.

B. Drawbacks with Dual SIMs

Drawbacks to owning a dual SIM mobile phone include a larger and more bulky appearance, as well as a shorter battery life. Dual SIM phones generally must be charged much more frequently unless they contain dual batteries, one for each SIM card. Phones that have one battery for each SIM fair much better in this respect, but are also much larger than traditional dual SIM mobile phones [5]. The trade off in style for longer battery life or vice versa is at the discretion of the mobile subscriber, with either option having obvious advantages and disadvantages.

III. PROPOSED MNOS ARCHITECTURE

Mobile IP is an Internet Engineering Task Force (IETF) standard, outlined in RFC 2002. A number of other IETF standards also address Mobile IP, including RFC 2003, RFC 2004, RFC 2005, and RFC 2006 [6].

One Mobile IP feature that you should be familiar with is Local-Area Mobility (LAM). This features allows a device to roam from a local IP subnet to another local IP subnet, all while keeping the same IP address. This means you could walk from network to network between buildings on a large campus while using your device. The mobile IP data communication is widely spreading. Accordingly, it is pointed out that the number of IP addresses in IPv4 will be short if every mobile terminal has its IP address. In order to solve this address starvation problem, we propose an approach to realize mobile IP protocol by assigning a private IP address to a mobile terminal. Basing on that here we are using IP addresses purely for local area network connection, as each provider will be maintaining his own LAN for mobile services. Hence there will no concept of IP conflicts with other networks.

Mobiles within a private network are each assigned a unique address in order to data and services between mobile and service provider. The network router, which routes information, will pass data back and forth among the connected mobiles, using the respective addresses. Every service to mobile will be activated on the IP address given to it.

In this paper, we are proposing the following set of points have to be considered by the Telephonic Regulatory Authority of India, the commission while implementing the proposed system with a base model of MVNO. A Mobile Virtual Network Operator (MVNO) is a mobile operator that does not own its own spectrum and usually does not have its own network infrastructure [11] and now, MVNO is a new trend for mobile (cellular) business model. A company that does have frequency allocation(s) and infrastructure is known simply as a Mobile Network Operator (MNO). Here TRAI itself will act as MVNO which will integrate all other network service providers.

There are three primary motivations for mobile operators to allow MVNOs on the networks. These are generally:

1) Segmentation-Driven Strategies – mobile operators often find it difficult to succeed in all customer segments. MVNOs are a way to implement a more specific marketing mix, whether alone or with partners and they can help attack specific, targeted segments.

2) Network Utilisation-Driven Strategies – Many mobile operators have capacity, product and segment needs – especially in new areas like 3G. An MVNO strategy can generate economies of scale for better network utilisation as we shown in figure 2.

3) Product-Driven Strategies – MVNOs can help mobile operators target customers with specialised service requirements and get to customer niches that mobile operators cannot get to.
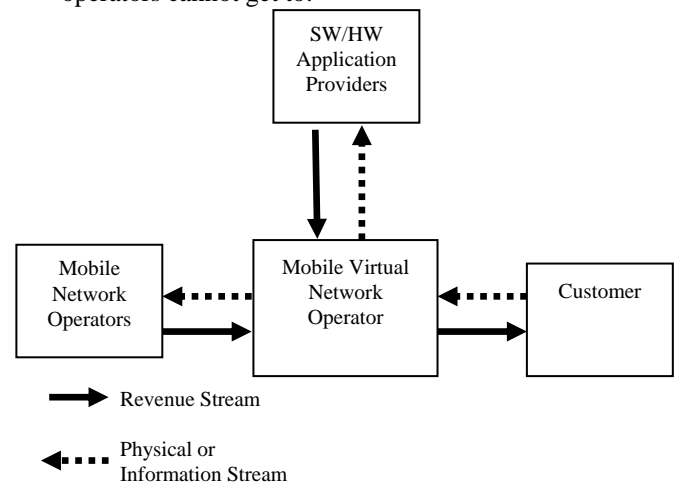

Figure 2: MNOS and other Business Sector

The following things are to be considered while implementing the proposed MNOS system.

1) SIM card has to be issued by TRAI or its allied authority

companies.

2) IP's has to be registered by Mobile Operators serving in India.

3) Each subscriber will get an IP address from respective Service Provider soon after activating services onto his number.

4) Each Service Provider is meant to maintain static IPs which has to be strictly private.

5) If a subscriber has got to use 5 different service provider's services, he will get 5 different IPs.

6) Mobile functionality need to be changed which supports IP based identification in Mobile Network.

7) IP is only meant for physical identification of a mobile in a mobile network.

8) The subscriber profiles need not to be changed with this concept.
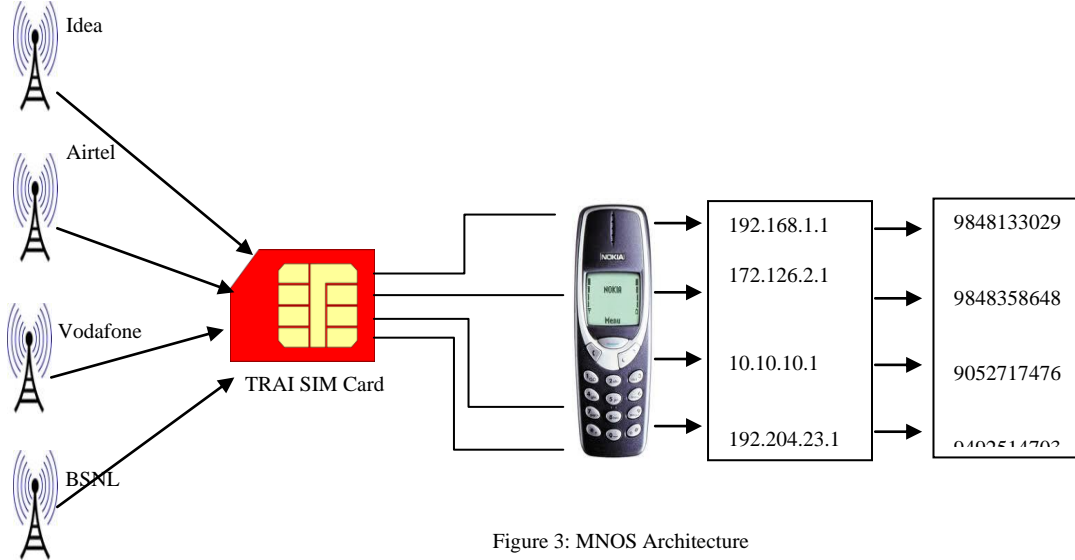

Figure 3: MNOS Architecture

First the subscriber has to obtain TRAI SIM card by registering it at authorized centres with proper identify proofs, the authorized agents are those who are appointed by concerned telephonic authorities. Once the subscriber is registered with TRAI, he will obtain SIM card with Unique ID. The mobile subscriber has to then approach to any mobile service provider of his interest for activating respective operator's service, the activation of respective service of provider has to be done only through online. Here in this system the entire mobile operator's database will be synchronized with TRAI database. While activating service, the agent of respective service first needs to enter the unique ID provided by TRAI. Soon after entering, it verifies for the unique ID, if it is a valid then proceeds for next step of activation. Once the service provider activates the services for respective ID, the SIM card will automatically receives an IP from the respective provider and there from services starts. The proposed system is as shown in figure3.

If the subscriber approaches to another service provider, the respective service provider's dealer need to follow same instructions, but here after entering unique ID, the dealer can see all the previous activated services for that SIM card. This makes a proper security where the subscriber cannot escape from providing duplicate IDs to different service provider. TRAI here is the ultimate body which needs to control and verify the identity proofs of the subscriber. We are proposing this system showing in figure 3; TRAI as the ultimate body for issuing such type of SIM cards. Here the TRAI can appoint any one dealer for providing such kind of SIM cards.

In this study, we proposed the following steps to issue the SIMs card to the mobile subscribers.

Step 1: TRAI issues SIM card

Step 2: Subscriber need to register with TRAI before he/she subscribes for any service provider services.

Step 3: Service provider activates his/her services basing on the Unique ID provided by Telephonic Regulatory Authority of India.

Step 4: Subscriber mobile then fetches for any IP, the IP is automatically obtained by the provider once he/she activate his/her services to the mobile.

Step 5: Mobile number will be issued by the provider while at the time of activating.

Step 6: Mobile number is linked with the IP number assigned to the mobile.

Step 7: All the respective services of the provider need to be activated basing on IP given to the subscriber.

Step 8: A hotkey in the mobile need to be assigned for TRAI SIM for showing list of service providers activated on the SIM as we shown in figure 4.

While pressing the hotkey shows a list of currently subscribed operators, the subscriber needs to select one default operator from the list for present outgoing calls.

Figure 4: MNOS operators

The selected operator will remain as default operator till next selection, and on the other way the subscriber can

receive incoming calls on any number subscribed by him. If the subscriber subscribes for more than one SIM card from same operator, the operator database creates an array of mobile numbers identified commonly by same IP number as we shown in figure 5.

When select a particular operator, it popup a submenu showing options like Service1, Service2….etc. When a subscriber subscribe for new service from same operator, he will receive a message saying on which service number the new activated mobile number is assigned.

When mobile equipment is turned ON, the default operator will searches for its own network and its name is displayed as default operator. The other service providers which were being activated on the SIM will automatically searches for their parent networks internally and will get their respective IP addresses.

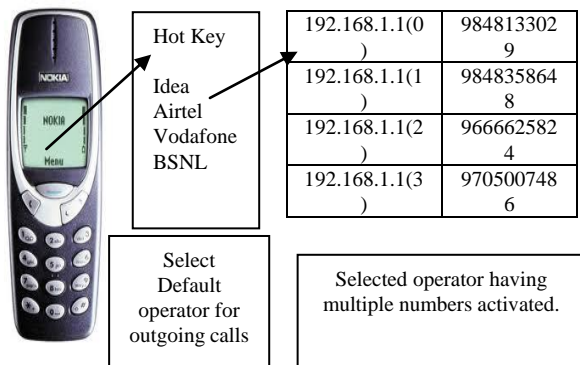| Hot Key | 192.168.1.1(0) | 9848133029 |
Idea Airtel Vodafone BSNL	192.168.1.1(1)	9848358648
	192.168.1.1(2)	9666625824
	192.168.1.1(3)	9705007486
Select Default operator for outgoing calls	Selected operator having multiple numbers activated.	

Figure 5: MNOS array of IP numbers

The registration with the Base Station is fully depended upon the default operator selected from the list.

In Figure 6 we have shown the mobile network reference model of a GSM network. HLR contains subscriber's profile and is responsible for holding any services activated by the subscriber. When mobile contacts HLR, it assigns the IP address through the Base Station. The IP address is responsible for maintaining mobile services for respective operator. While the user in roaming environment the IP address along with subscriber profile his mobile will move from VLR to VLR.

In our previous work [10], The Location and call registration algorithm makes use of the fact that an average mobile user has limited number of frequently visited locations. Usually a type of activity such as work, school, or shopping, occurring at a particular location. As an example, the shopping locations are located at specific sites, and for most users, the work, school, and home locations are fixed. We are considering 'm' days of observation period for a VLR to find its common mobile station and the searching must be based on IMSI of the visited MS during that time frame of mobile subscriber.

In previous work [10], for the delivery algorithm the VLR maintains two entries for storing the subscriber's data. One is for the high-tier database is called VLR and another is for the low-tier database is called Fuzzy VLR for storing fuzzy related values. Mobile subscriber roams in the same area frequently; it not required getting the subscriber record from HLR for identity, that record will be their fuzzy VLR

database up to some period. If the subscribers are not come that location in specified period of time record will be deleted automatically. Call delivery setup will have two Databases one as HLR and another as VLR, in our proposed system the VLR database will be divided into 2 tier architecture database which will have High tier database as VLR and Low Tier database as VLR Fuzzy.
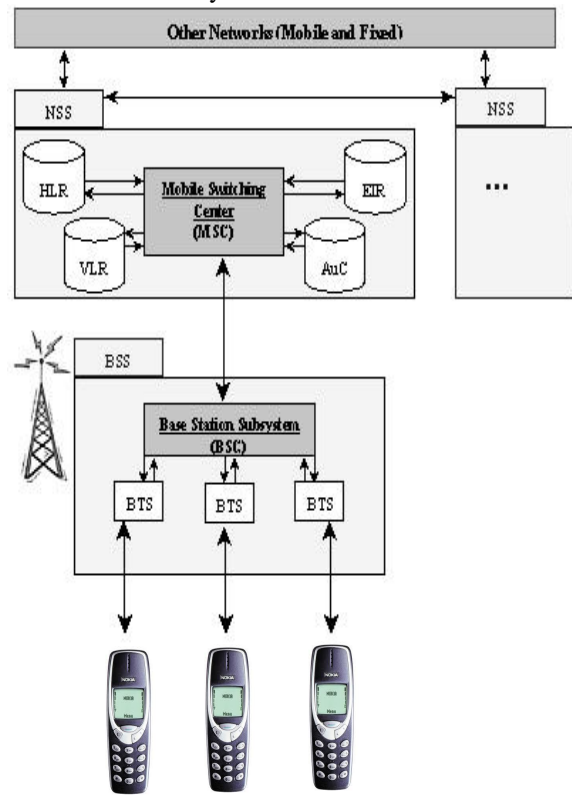

Figure 6: Mobile reference network model

The Intelligent Call registration and Call Delivery [10] using fuzzy concepts will make IP registration easily with VLR in subscriber roaming environment.

IV. ADVANTAGES

As the mobile usage in India is rapidly increasing day by day, maximum mobile service providers are offering their services at very greater level in the market. The unhealthy competition among the service providers is benefiting subscriber ultimately by giving number of choices while making calls and sending SMS. Maximum subscribers in now days are switching between providers who ever gives best option for outgoing calls. No single subscriber is maintaining a number constantly. TRAI is offering a service called Number Portability which allows the subscriber to move among the providers with same mobile number. This is a best idea for changing service providers who ever gives best option, but implementation will be tough as maximum providers will not accept because of unhealthy competition among them. This system will allow several operator services that can be activated onto a single SIM card.

The major advantage to the Government and Telephonic Authorities in this proposed system is security, as subscriber goes on activating different provider services, the identification proofs he used to produce before activation

will be verified thoroughly with previous proofs submitted to other providers. Usage and the roaming behaviour of the subscriber can easily observed with this concept.

The subscriber can choose any provider for his/her outgoing calls. The subscriber can receive calls on any number being activated on his SIM.

Network coverage problems can be easily solved by this as the subscriber can have several service providers services on his SIM can easily switch between them to make a call.

V. CONCLUSIONS

The proposed MNOS system can yield good results when applied practically. Dual SIM operations always give positive results in the terms of multiple network operators' usage. In this paper, we have proposed an approach to allocate private IP addresses to individual mobile nodes in their home network. IP address starvation in the mobile IPv4 can also be resolved by introducing private IP addresses for mobile nodes.

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