NUMBERING PLAN FOR INTERNET TELEPHONY

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Abstract

In the last few years, there have been a revolution in the telecommunication scenario of the country. There are new services like paging, cellular, etc. Some private basic service operators have started providing service. Iridium is to soon launch satellite-based telephony service. There are IN services like universal number, freephone, premium call services, etc., which are being introduced. All these services require a common resource, that is, a number. Recently, there was a newspaper report suggesting that DoT and TRAI are considering an overhaul of the numbering plan for India.

This paper considers another type of nodes that may have to be assigned numbers from the telephony address space (E.164 numbers). With the growing interest in Internet telephony, and merger of data and voice networks, it is possible that in future users may like to receive calls on the PC they are working on. For this to happen, the PC should be addressable in the E.164 domain.

In this paper, we describe various numbering schemes that can be used to assign telephone numbers to PC. We compare the scheme, and suggest the one that we may adopt for the country.

INTRODUCTION

Today's Internet carries voice. Indeed there are telephone operators around the world who would let you make a phone call over their Intranet for a fraction of the cost of the call over normal telephony network. Internet telephony started with two nodes on the network exchanging voice over the Internet. For example, two PCs having a sound card, speakers, and a microphone each, and with appropriate software could carry out voice communication.

Slowly, people realized that one could use this medium as an alternative transport. One could call up a server, and dial the number that one wants to reach. The server would establish an IP "connection" with another server, who will eventually make a local call to the phone. So for most part of the call, the voice is transmitted over Internet. But the call is between two PSTN devices.

Another possibility is to connect from your PC to a server using IP, and ask that server to make a regular telephone call. This way one could talk from a PC to a PSTN device. The call is transmitted over an IP network from source PC to the server, and on PSTN network from there onwards.

The last possibility which remains is to call from a regular telephone to a PC, and be able to carry out a conversation. For this to happen, it is clear that the PC should be assigned a number that is understood by telephony switches.

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There are several different numbering schemes which one can use to assign numbers to PCs. We study these schemes, and select one on the basis of portability of the numbers, faster introduction of such a service, and allowing us to route the call flexibly.

Portability implies that a subscriber may move anywhere on the globe, and still continue to receive the calls at the same number. After all, Internet is one large network, and IP addresses are not geographically assigned. So, as long as the subscriber can inform the telephone network of its current IP address, the call should be forwarded there.

Flexible routing is important since a call routed over IP network is usually cheaper than the one which is routed over the PSTN network. The numbering scheme that makes it easier to identify a call as a call to IP endpoint is better, since it can be transferred to the IP network early on.

If the numbering scheme requires any approval from ITU, it is going to take a lot of time. Since one would like to provide the service as soon as possible, that cost has to be weighed in.

How the call will be handled

The call is originating from a regular phone, and the destination is a node connected to Internet. There is a gateway which is connected to both PSTN and the IP network.

The call will progress in the following stages. The call will be carried over PSTN for some part. It will be routed to an IP/PSTN gateway. There may be a large number of such gateways. The numbering plan should help in routing to the "nearest" such gateway. The gateway will consult a database to map the called number to the IP address. We assume that subscribers will register the IP address of their PC and their assigned number in this database. Subscribers will have the flexibility to change this registration any number of times, if their IP address changes. Finally, the gateway will establish a connection with the PC, and deliver the call.

E.164 Numbers

The format of E.164 numbers is: **CC + NDC + SN**, where **CC** is the country code (assigned by ITU, e.g., India's country code is 91), **NDC** is National destination code (commonly known as STD code, e.g., Kanpur's NDC is 512), and **SN** is the subscriber number. Individual country's decide the structure of NDC+SN part.

Considering the three parts of an E.164 numbers, three obvious scenarios emerge for Internet telephony. First, a new country code can be assigned for this purpose. (The country code can indeed refer to networks, and services. The global satellite-based telephony networks like Iridium are being assigned a new country code. Also, universal personal number and international freephone services have also been assigned new country codes.) Second, within the country, we may assign a specific NDC (or STD code) for Internet telephony. (Again DoT has assigned an NDC of 600 for freephone, 602 for premium services, etc.) Third, we simply assign any subscriber number for Internet telephony.

We will consider these three schemes in detail next.

GLOBAL SCHEME

In this scheme a new country code is created by ITU for IP endpoints. Internet Telephony is to be treated as a new service.

In this case the overall responsibility of number administration is with ITU, though it may allocate small parts of address space to various national administrators. All calls will be dialed as one would dial an international call (In India, one would dial, 00-CC-number). The originating switch will recognize that 'CC' is a type of service and will forward the call to the closest IP/PSTN gateway.

The biggest advantage of this scheme is portability. A number can be assigned to a user, who can assign it to any PC wherever s/he is, as long as there is a database where the user registers, and which can be contacted by the routing algorithm to find the latest mapping between telephone number and the IP address. Also, since the originating switch itself recognizes the destination as an IP one, the call travels on the PSTN network for least distance. Hence the cost of the call should be very low.

The biggest disadvantage of this scheme is that one has to dial a large number of digits even to access one's neighbour. And of course, politically it may be very difficult to get ITU to agree to such an assignment. Once ITU approves this scheme, all telephone switches in the world will have to start recognizing this new country code, not a very trivial problem.

NATIONAL SCHEME

In this scheme, we assign one unique code to this service. The code may be like an STD code (so that one dials with a prefix '0') or it may be like a service code (so that one dials with a prefix '1'). The number administration is with a national body, perhaps Telecom Regulatory Authority of India (TRAI).

The telephone switch where the call is originating will recognize the STD code or the service code as belonging to Internet telephony, and route the call to the nearest IP/PSTN gateway. This is just like the global scheme, except that Internet telephony calls outside the country will not be recognized as such, and international component of the call will be carried over regular telephony circuit. (Of course, one could potentially tweak SS7 signaling scheme to get the information about the destination before actually setting up the connection.)

The major advantage of this scheme is that one does not need permission from ITU, and service can start soon. The number is portable within a country, and even if one goes outside, the number is portable in the sense that all calls to this number will be routed first to the "home" country, and then go over the IP network to the final destination which may be in a different country.

The major disadvantage of this scheme is that portability has somewhat reduced (if one moves to a different they are best advised to get a new number, otherwise even a local call in the new country will incur international call charges). Also, the international calls remain expensive. A major goal of Internet telephony is to reduce the cost of international calls, which is not being achieved here.

Once India adopts a new NDC for this purpose, all trunk switches in the country will have to reprogrammed.

LOCAL SCHEME

In this scheme the Internet telephony numbers are assigned from the local number space. They could have a specific first digit (like cellular, paging, etc., in the proposed scheme), or can even be part of regular number space. Of course, the latter will require updating of the telephone switches in a bigger way.

The routing of the call is over PSTN network for the most part, until the call reaches the local exchange or the trunk exchange. This exchange will recognize the destination as an IP device, and route it to the nearest IP/PSTN gateway.

The portability of these numbers is similar to that of national scheme (slightly less). But the infrastructure requirement is also very less. We don't need to upgrade all the switches in the country to start this service. We can start the service as an experiment in just one local exchange area.

Since the call is routed over PSTN for most part, the cost of the call remains high. This scheme is only to provide flexibility to the subscriber that s/he can receive calls at their PC, but does not give any cost advantage.

COMPARISON

We note that in the three schemes, the portability keeps getting reduced from global scheme to local scheme.

Also, when we go from global scheme to local scheme the cost of a call keeps going up, since the default route (PSTN) is much more expensive than the alternative IP route. There are solutions to this, however, as we will discuss later.

The ease of service introduction is highest in local scheme. It is most difficult to introduce in the global scheme. We will need to modify telephone switches all over the world, besides having to get it approved in ITU.

The number of digits to be dialed is highest in global scheme. (Every call is dialed as an international call with country code, etc.) And the number is least in case of local scheme.

One may note that the major advantage of the global scheme is its low cost (routing over IP network from the beginning). This is primarily due to the fact that the originating switch could easily identify the destination as an IP endpoint, and therefore could transfer the call to the nearest IP/PSTN gateway. If we can somehow inform the switch that the endpoint lies on IP network, then we can get the same cost benefit in other schemes as well.

We propose below several mechanisms by which a switch can find out if the destination is on the IP network.

1. We could decide on a dialing plan which uses a distinct dialing code before the phone number to indicate to the switch that it is a call to an IP destination. For example, in many cities, the digit '8' as the first digit tells the local exchange that the call is meant for a number in the neighbouring SSA (Short Service Area in DoT parlance). To call Unnao from Kanpur, for example, one has to dial '8' first. We could agree on a dialing plan where '81' may mean neighbouring SSA, '82' may mean a call to IP endpoint. Now, one has an option. Either call the number as any other number, and the call will be carried by PSTN for a longer distance. Or one may prefix the number by '82' and the call will be transferred to IP network at the earliest.

2. A database of all telephone numbers may be created, which has information like what services are supported by this number. For every number dialed, this database is checked, and this way a switch can find out whether the destination is an IP endpoint. Keeping a database of all numbers in a country is not a very far-fetched idea. Telephony signaling protocol (SS7) already supports such database queries. Freephone and other premium services use such a mechanism. In the US, where the number of telephone connections is over 100 million, there is move to create such a database which will be checked for every call. This database can be distributed one. Essentially, when the switch tries to setup the call, the message (connection request) reaches the PSTN switch closest to the endpoint which may have the information stored. That switch will respond back with the requisite information. So this suggestion is realistic. Such a database will also be used in other services like providing local number portability.

RECOMMENDATION

We will like to have a numbering scheme that permits the service to start at the earliest, but it should provide other advantages like flexible routing and portability in the medium to long term. If we want to have the service soon, the global scheme is certainly not the right model. In any case, the global scheme does not seem to have a clear advantage over the local scheme.

It may also be noted that a local scheme does not preclude a national scheme later, and a global scheme at an even later stage. It is possible to start the service by modifying a few switches, and letting the call come to the destination over the regular PSTN route. At some point in time, one may assign a new NDC (decide to start a new STD code or a service code), and numbers for IP telephony may be changed at that time.

Considering all the points, particularly the last one about a local scheme not precluding a national scheme later on, **we recommend that we use a local scheme for Internet telephony.**

Service in short-term

In the immediate future, the service can start without PSTN switches having any idea of Internet Telephony. A service provider can get a block of numbers from Local Exchange Carrier (LEC, which is DoT or MTNL for most part, though other companies are also present in pockets), along with a 2MB channel (more if needed). The service provider sets up an IP/PSTN gateway. The 2MB channel (32 voice channels really) terminates at this gateway. The customers may be allocated a number from this block of numbers. The service provider provides a secure way to register the IP address. Customers may get their IP connectivity from any ISP.

When someone calls this number, the PSTN will route the call to IP/PSTN gateway. The gateway looks up the registration data, finds out the current IP address corresponding to the dialed phone number, and sets up an H.323 connection with the IP-terminal.

Service in medium-term

In the medium term, it is expected that all service providers will unify their registration database. There may be a new dialing prefix, or new NDC or some such mechanism to identify a call destination as lying on IP network. There may even be Internet Telephony Carriers (like long distance carriers), and there may be some mechanism (like access code) to choose one Internet telephony carrier over the other.

Service in long-term

In the long term, a database of all numbers in the country will be created. The database will have information on the capability of the endpoint or terminal. When a call is made, this database will be dipped into, and the originating switch can route it to the nearest IP/PSTN gateway of the chosen Internet telephony carrier.

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