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Introduction

Telephone numbers (TNs) continue to be used as the primary identifier to recognize users, network termination points and to route services to reach end users for traditional voice services, data services such as Short Message Service (SMS) and Multimedia Messaging Service (MMS) and new innovative IP based services.

While the end user identification mechanism essentially remain the same, service providers and network operators need to mask the complexity of the "behind the scenes" network interfaces, interconnection, addressing, and routing technology. One of the biggest interconnection challenges facing service providers today is determining the called party's service provider due to non-standard identifying mechanisms that each country uses to identify its operators, service providers and networks. National based identifiers associated to networks and network operators are used, for instance for routing purposes and number portability. These national schemes are known inside the country but internationally there is no standard or consistent approach that is recognized among or between operators. Another challenge for the *calling* party's service provider consists in identifying a service provider that can transit calls to the called party's provider.

Additionally, as competition drives prices to new lower levels, efficient and cost-effective routing becomes even more important.

Business Case

Service providers thus have the continuing need of determining and validating, from a destination telephone number, the called party's service provider, network operator and location of a network interconnection point from which the service provider can deliver the service as underlying telecommunications networks cross network technologies; e.g., TDM and IP and traffic transits multiple countries.

The figure below represents the complexity of managing the different identifiers used between various service providers, operators and networks today as there are many parameters used to route calls depending on technical requirements and operational arrangements.

Figure 1: Existing Environment

Currently, many identifiers are used for different purposes and different data elements are provided depending on the mechanism by which the information is obtained. For instance, when National Numbering Plan (NNP) block data are assigned to an operator or service, usually only the "name" of the block holder is returned. Additionally, when access is via a local interface numerous IDs are returned including Operator ID, Network ID, Routing number, etc., for any given TN, this is especially relevant where number portability has been implemented. These fields need to be matched with the operator or service provider that is the block holder to provide consistency with identification plans and to identify particular operators and service providers within a country. In most countries, network and service provider identification data are not the same, since for instance NP is defined nationally with national requirements.

Additionally, if a query service is included to perform additional validation or authentication such as for mobile numbers an IMSI might be returned to identify the "owner" of the telephone number. In another case, the operator may make use of a 3rd party service or clearinghouse for obtaining this information even if each operator knows all the national identifiers and correlated information for data management. There may also be multiple identifiers per operator that must be mapped or "normalized" into a consistent set of Service Provider Network (SPNs) identifiers for any given operator's use or considered as associated to the same operator or service provider. However, this mapping is a proprietary translation that each operator or service provider creates for its own internal use and depending on business agreements for the use of its customers. If in the example above a 3rd party is used to provide additional data, the mappings of the 3rd party provider SPN's is unique to them and would involve yet another layer of mapping to ensure internal consistency and identification of any given TN.

These multiple identifiers must then be "normalized" to create a common mapping between these different IDs to the Service Provider Network (SPN) IDs. This mapping must then be shared among the different operators and partner networks in order to provide a common mapping to identify the appropriate routing for any given TN. In some cases, operators may have a secondary mapping based on their own internal routing which makes the management of these identifiers ever more cumbersome.

The introduction of virtual network operators has caused some additional complexity in identifying the appropriate network for both routing and billing. Since the mechanism for identification has not been standardized this has been causing additional inefficiencies and errors across networks and between service providers .

Taking into consideration the number of international operators and 3rd party data providers involved in the flow of international voice and data traffic this has proven to be difficult to manage and maintain. Consequently, a unique international resource that can be used by all operators and service providers would provide a more effective and efficient way to mange SPN identification that can be utilized across technologies from TDM voice to IP enabled services such as SMS and MMS thus allowing for clear network and operator identification.

In summary, the new Service Provider Network (SPN) identifier supplies network identification that a Service Provide can use for routing and route identification along with reducing/simplifying network routing table maintenance. This benefit in particular is critical to international transit operators

Additionally, having a globally recognized SPN provides operators, service providers and regulators information that would assist them in identifying the originating network for the purposes of billing, settlements and dispute resolution.

Considerations

Previously, Q1/2 has reached out to the former SG 4 for comment on the use of ITU Carrier codes or other identifiers currently used in M.1400. SG 4 sent a response that can be found in TD PLEN 373R2 which does identify a gap where an SPN identifier would be useful. SG 4 does utilize an ITU Carrier Code that provides a unique identifier of an Operator within a Country. The ICC is a 1-6 character alphanumeric filed that is used as an indispensable part in the assignment of identifiers for interworking between Operators (but it is not exchanged in signaling between networks). It is permissible that an operator uses one ICC for assignment of identifiers, while other operator codes are used for ordering, billing, etc. However, the ICCs are normally administered by each country, have variable length fields, use county codes and have not been widely deployed. Therefore, it was suggested that a new international and uniform identifier be used.

In addition, Q1/2 has liaised with the SG17 relating to this topic but SG17 has been evaluating the use of SPN as it relates to identity management. Q1/2 has also liaised with the Data for Reachability of Inter/Intra-Network SIP (DRINKS) Working Group within the IETF which has preliminary indicated that there is not any limitation using an identifier of this type.

It has been recognized that utilizing an existing resource is more efficient then creating a new one but based on previous efforts there does not appear to be an existing resource that meets the identified requirements and is globally recognized.

It should be acknowledged that:

- existing international public numbering resources managed by ITU-T are able to assure an international unique and recognized identification resources;
- it is necessary to distinguish between identifiers used inside data management models and identifiers used by networks for user identification and addressing and routing purposes.

Service provider identification is just a part of identification, addressing and routing process for communication setup and charging;

- E.164 numbering is normally used for user identification, for routing and for charging;
- Recommendation E.212 MCC/MNC and IMSIs are widely deployed and globally recognized in mobile networks environment. E.212 numbering is not defined for communication routeing but for authentication and subscription identification;
- with the convergence of fixed and mobile networks the number of operators that will be able to "easily" get IMSIs from their national Regulators will arise;
- technology dependent international addressing scheme has to be used to finally identify specific network termination point (for instance IP addressing for IP network and NGN). Association between user identity and its network termination point address is to be maintained;

Use Cases

The Use Cases below discuss the need for a Service Provider Network (SPN) identifier which would provide a unique identifier for each network operator/service provider worldwide.

In-Country

Presently, each country and its domestic operators have developed service provider/operator identifiers that are recognized and used within a country and between networks in that county for identification purposes; to maintain interconnection arrangements, ensure correct routing and preserve network addressing requirements. In the US service providers and operators use Service Provider Identification (SPIDs), Operating Company Numbers (OCNs) and Carrier Identification Codes (CICs), in other countries service providers and operators use some form of Service Provider Identifiers including ITU-T Carrier codes. However, to this point there is no universally agreed to service provider network (SPN) identifier that can be used internationally or between countries. This has necessitated the need to perform multiple translations of TNs to network/Service Provider identifiers and has required each service provider to generate their own proprietary internal mappings.

In the US, each network operator is assigned an Operating Company Number (OCNs). Over time, as the competitive landscape changes and carriers are acquired, the acquiring company takes over the OCN(s) of the acquired company. When that happens, the OCN no longer accurately reflects the identity of the owning or serving operator. Through acquisitions, some operators have over 100 OCNs associated with them, but the OCNs still reflect the name of the original company that was assigned the OCN. Consequently, Carrier names change often and are not a reliable indicator of identity.

Another identifier for US and Canadian companies is the Service Provider Identification (SPID) assigned by the Number Portability Administration Center (NPAC). These 4-digit SPIDs are assigned to companies that wish to port telephone numbers. An individual operator may have multiple SPIDs assigned. Over time as operators are acquired, the telephone resources in the NPAC may get migrated to the acquiring company's SPID or may retain the SPID of the previous company depending on individual company legal requirements. SPIDs are also mapped to OCNs creating an even larger issue of identifying the network operator and the service provider who is actually serving the TN.

In addition, Carrier Identification Codes (CICs) are also assigned and used as carrier identifiers. CICs are a unique numeric code that is assigned to carriers or other entities that access a local exchange carriers' (LEC) network and are used to route and bill calls in the public switched telephone network. However, this again is an example of a domestic solution that cannot be used universally.

Given the multiple Service Provider identification methods and the constant changes in the competitive landscape, there is not currently one standard way to reliably identify the present network or service provider that supports a telephone number. Therefore, there is no reliable way to identify what TN belongs to what Service Provider and in this case a universally recognized identifier would resolve these multiple identification issues.

Non-US

Other countries that operate in a dynamically changing telecommunications environment have similar issues. In India for instance, there are numerous regional companies and due to mergers and acquisitions it is difficult to determine the correct service provide for any given TN. In one instance, there were 20 regional identifiers that link together different mobile providers to their parent company.

Other countries may face similar issues when using multiple identifiers coupled with mergers and acquisitions and not keeping the data up to date.

Multi-National and Transit Operators

Today operators have a defined identification plans for use within a country but not recognized by networks and operators outside of a country's borders. This limitation requires the transit network operator to develop a mapping mechanism between one county's networks and service provider identifiers and another countries set of service provider identifiers even through the operator is identical in both countries. There are also cases where the service provider identifier of the network operator, through mergers and acquisitions, is not the actual name of the operator who owns/operates the network. Having a universal service provider identifier would allow for operators to identify themselves domestically as well as globally as the network operator rather than the legal or official name that must be maintained.

Having a unique identifier would provide a common identifier for corporations like Telefonica and Orange that operate in several countries using multiple brand names (O2, Movistar, Mobistar, and Optimus) or one brand name like T-Mobile, Verizon Wireless, or TIM. It would also associate brands and subsidiaries of corporations operating in one location like Sprint/Nextel (Sprint, Nextel, or Boost) or Telenor (Telenor or Glocalnet). The unique identifier could enable the association of these entities and brands so they have a common identifier that may be recognized around the world.

Additionally, multinational operator transit networks require a globally recognized and standardized means to simplify international interoperability and identification of local, regional and national network operators who exchange traffic through their network.

Other Applications Use Cases

Virtual Service Providers

In the case of identifying virtual Service providers, who do not own their entire network, but have contracted with network operators for routing and other facilities based services there is no agreed to standardized mechanism to identify those virtual service providers. For example, in the US market, there is an established data field in the NPAC which maps into a field called the alt_SPID. The SPID identifies the "parent Network Operator" while the alt_spid identifies a virtual service provider or reseller that is using telephone numbers allocated (and owned) by the parent. Additionally, some virtual operators use the IMSI series identified by the 6th or 6&7th IMSI digit so MCC and MNC is not always sufficient and should be limited to cases where E.212 resources are necessary due to the scarcity of the resources.

The ability to recognize a virtual service provider based on a unique form of identification would be beneficial to all network operators and serving networks.

Here is an example where having a globally recognized SPN also assigned to a recognized virtual service provider would be beneficial:

In a North American MVNO case, a virtual mobile service provider is authorized to provide services, bills their end customers, but is not assigned numbering resources by the regulator, nor does the virtual service provider have its own network. The virtual service provider enters into a “reseller” or wholesale arrangement with a network operator that provides numbering resources and network facilities. Some VoIP providers would also fall under this example.

Number Portability

Number Portability is implemented in over 50 countries around the world with potentially 20 more launching by the end of 2010. Service Providers and network operators are experiencing significant inefficiencies and additional costs due to the inability to accurately determine the true destination operator nd network when selecting outbound routes. Exchange carriers and operators running multiple interconnects are maintaining their own number plan tables because there is no other source to get accurate information in a simple and cost effective way. The problem of maintaining the data has become more complex as more countries implement number portability and different classes of traffic are introduced. Having the “block data” for any one country is no longer sufficient and the need to identify the correct network and service provider for any given TN in a country is becoming problematic. Additionally, the non-standard way in which each country provides that identification makes the routing decision that much more complex.

Service Provider Identification on the IP eXchange (IPX)

The IP eXchange is an interconnect service that is offered by a variety of operators on a commonly agreed set of technical specifications. The specification of this service is under the responsibility of the GSM Association. The domain name resolution service on this infrastructure is based on the DNS protocol in a private environment using a public namespace. The guidelines that apply to this namespace and the infrastructure in general can be found in IR.67 - DNS/ENUM Guidelines for Service Providers & GRX/IPX Providers at http://www.gsmworld.com/documents/IR6741(1).PDF.

As described in this document, the domain names that are used today to identify service providers are derived from E.212 resources. For example, IMS networks can be identified by ims.mnc<MNC>.mcc<MCC>.3gppnetwork.org "*Where <MNC> and <MCC> are the MNC and MCC of the Service Provider represented in decimal (base 10) form, with any 2 digit MNC padded out to 3 digits by inserting a zero ("0") on the beginning e.g. 15 becomes 015*." (see page 16). There are several constraints with this scheme. The first is that only MNC assignees can use such names. It may also encourage some service providers to apply for MNCs for this sole purpose of being identified on this infrastructure, which arguably might not be a reasonable use of new E.212 resources. Creating a new service provider identification scheme such as SPNs would make it possible to identify service provider networks in a separate name space (root) that would be both independent from E.212 but still be internationally recognized such as SPN<#i>.ipx-root.org

What is Needed

Create a globally unique identifier that would represent a one-to-one association for any given TN to a network operator and/or the service provider. The creation of this resource would eliminate the need for network operators to maintain multiple proprietary mappings that are necessary today due to the required translations of various IDs for any given TN. The SPN would also provide a recognized identifier for virtual service providers

What is required is a naming plan that would allow for the service providers identification to be established and recognized on a global level so that transit interconnection and network identification efficiencies can be realized.

The synergy created by use of a common SPN is represented below

Figure 2: Synergy created

Figure 3 below shows an updated representation of Figure 1 if a unique identifier were available.

Figure 3: Use of Universal SPN in service provider networks

Proposal

In helping define the initial set of assumptions around this new resource the format should:

- Be a fixed length for ease of implementation
- The format should be 5-digit numeric since service providers throughout the world will recognize and use this resource. In the case of exhaust, the 5-digit resource can be potentially be expanded to include alpha-numeric's.
- Not include Country Code or geographic identification. There is no need to include a geographic or country designation because a large number of the service providers who require this resource are global and offer services are not confined to any given territory or a country.

Virtual service providers can also be identified via an SPN identifier, subject to agreement of the underlying network operator that is transporting the traffic on their behalf. Virtual service providers should be able to obtain their own SPN identifier or use the SPN identifier of the network operator however the application process will depend on the assignment requirements established in the proposed SPN Recommendation.

Annex A- Additional Considerations for SPN

During the late 70's, there was an aim to develop a globally unique identifier that could be used for identifying, addressing, and routing of traffic, including a one-to-one association for any given service to a network operator and/or the service provider. That work was subsequently introduced into ITU-T and ISO jointly as part of the extensive suite of Open Systems Interconnection (OSI) standards begun in the early 80's which resulted in the creation of the Object Identifier (OID) resource specified in the Rec. ITU-T X.660 | ISO/IEC 9834 series

Advantages:

Disadvantages

Additionally, the IETF, has been evaluating the need to provide a globally unique identifier for a service provider of record for a particular E.164 number. The business case as well as the use case for doing this is that it offers a first order LUF (Look Up Function in SPEERMINT terms) to a privately held LRF (Local Routing Function) that would be typically be exchanged in some form of bilateral-multilateral interconnection agreement. Its been postulated that the existing IANA Registry for Enterprise Numbers be repurposed for this task. The justification for this is equally clear. This is being recommended because it's a first come first serve low cost registry that many operators are using even now for various purposes.

Advantages:

Disadvantages

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