

ENUM FORUM Working Document:

**US ENUM IMPLEMENTATION
Tier 1 Contracting Entity and Architectural Alternatives**

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US ENUM IMPLEMENTATION

Tier 1 Contracting Entity and Architectural Alternatives

1 Scope of this Document

This document outlines the issues that need to be addressed when evaluating the various alternative solutions for a US implementation of the DNS infrastructure to support ENUM rooted in e164.arpa¹. The scope of this document is limited to the Tier 1 level within the ENUM zone hierarchy. Some of the issues discussed could impact other countries within the North American Numbering Plan (NANP). In the final analysis, however, it is possible to choose a solution that is specific to just the United States.

This document discusses three major issues to be solved before a US implementation process can proceed. These issues are:

1. Whether the contracting entity for the Tier 1 entity(ies) should be run by the US government, or by those companies within the industries affected by and interested in a US ENUM implementation that wish to participate, or by some combination of the two.
2. Whether or not a zone² should be implemented for all of country code 1 and operated by an entity within North America as a separate registry that contains delegations of all NPAs as ENUM Tier 1 Registries. This separate registry is known as a “skinny Tier 1.”
3. Whether the zones for all NPAs within the United States should be operated by a single company (Single Tier 1) or whether multiple companies should share the operation (Multiple Tier 1s).

This report represents a consensus opinion of the ENUM Forum. However, in some cases the Forum has agreed to list several alternatives rather than reaching closure on just one. Individual companies may have varying positions on some issues, and they might express those separately. In addition, while Forum membership is open to any interested company or organization, the ENUM Forum does not claim that its views are all-inclusive.

2 Introduction

In February 2003, the ENUM Forum approved its baseline specification for the US implementation of ENUM ([Document 6000_1_0](#)). This document was presented to a set

¹ For the purposes of this document, the term “ENUM” is meant to denote the infrastructure rooted in e164.arpa.

² For the purposes of this document, the term “zone” applies to a set of phone numbers with exactly the same initial digits. All country code 1 numbers form a zone, and all numbers for one 1+NPA form a zone.

of agencies (principally NTIA within the Department of Commerce, the Department of State and the Federal Communications Commission) at a meeting on February 13th. During that meeting, the ENUM Forum was asked to continue to explore the various alternatives for a US implementation for which no conclusions had previously been reached. The ENUM Forum agreed to present the various alternatives and discuss the issues while not promising to select a single recommendation or any one alternative. This document addresses those alternatives and issues.

3 Tier 1 Contracting Entity Alternatives

Whatever option is selected for the Tier 1 implementation in the US, the ENUM Forum has identified the following attributes:

- There should be a short implementation timeframe
- Government oversight should be as light as possible
- Competition should be encouraged wherever possible
- All interfaces should be based on open industry standards & best practices that are stable, interoperable and uniform between the registrars and registry(ies)
- Intellectual Property should be owned by the contracting entity for easy movement from one entity to any potential successor
- The cost for procurement and operation should be minimal

The members of the ENUM Forum want to reconfirm their support of the principles described in NTIA's February 12th letter. In addition, the ENUM Forum has specifically addressed some of these concerns in the approved specifications document, 6000_1_0, as indicated below:

- **Preserve national sovereignty:**

Section 4.1 details an architecture that allows the US to manage its assigned numbering resources while allowing the other countries in the NANP to determine their own ENUM implementation.

- **Support competition:**

In Section 4.2, the proposed architecture allows for competitive selection of one or more providers for the necessary cooperative infrastructure (Tier 1 Registry) while supporting open competition among Tier 2 providers, ENUM Registrars, and Application Service Providers.

- **Promote innovation:**

Although the ENUM Forum has focused on detailing the ENUM infrastructure rather than its applications, the common effort was motivated by a belief that ENUM will support innovation by the open competition at Tier 2 and by allowing the easy identification of parties' communication capabilities and reachability.

- **Protect users' security and privacy:**

Sections 9 and 12 detail, respectively, how ENUM should be implemented to protect users' privacy, and provides authentication and authorization mechanisms to ensure that telephone number assignees control how and whether their numbers are provisioned into ENUM.

- **Minimize regulation:**

The ENUM Forum supports a minimalist regulatory model and believes the current arrangements, as discussed in Sections 1-4, accord to international bodies only the necessary coordination functions to ensure interoperability. Likewise the current arrangements require little more USG involvement than ensuring a fair and open selection of provider(s) of the Tier 1 Registry, much as would be the case for any other domain a national government would sponsor.

- **Preserve opportunity for alternative deployments:**

The ENUM Forum has recognized this principle since its inception and sees no obstacles in its proposals that restrict or inhibit the implementation of ENUM alternatives.

- **Allow for interoperability:**

Annex B discusses some of the ways in which interoperability might be achieved.

- **Preserve stability and security:**

Section 8, for example, details suggested performance requirements for the Tier 1 Registry. The remainder of the specifications is in line with industry best practices.

In determining a contracting model, the following need to be considered:

- The need for the US government to communicate with the Tier 0 administration to:
 - opt in and
 - designate the entity(ies) to which the Tier 1 should be delegated.
- The actual procurement process for the selection of the Tier 1 entity(ies).

- The ownership of the intellectual property involved in the operation of the Tier 1 Registry(ies).
- The oversight of the Tier 1 Registry(ies) to ensure compliance with any RFP and the ENUM Forum requirements as appropriate.
- The ongoing management and oversight of the Tier 1 Registry(ies) to ensure its/their smooth ongoing operation.
- The development of policy that will apply to the initial procurement and ongoing operation of the US ENUM implementation.

3.1 Government Procurement through Simplified FAR

3.1.1 Description

The Federal Acquisition Regulations System is established to ensure the implementation of uniform policies and procedures for acquisition by all executive agencies. The Federal Acquisition Regulations System consists of the Federal Acquisition Regulation (FAR), which is the primary document, and agency acquisition regulations that implement or supplement the FAR.

The FAR is issued as Chapter 1 of Title 48, in the *Code of Federal Regulations* (CFR).

Part 13 of the FAR prescribes a set of policies and procedures for the acquisition of supplies and services, including construction, research and development, and commercial items, the aggregate cost to the US Government of which does not exceed the simplified acquisition threshold (\$100,000). The purpose of Part 13 is to prescribe simplified acquisition procedures in order to:

- Reduce administrative costs;
- Improve opportunities for small, small disadvantaged, and women-owned small business concerns to obtain a fair proportion of Government contracts;
- Promote efficiency and economy in contracting; and
- Avoid unnecessary burdens for agencies and contractors.

The Simplified FAR process was used by the NTIA in the award of the .us domain to a new registry. During the process, the National Institute of Standards and Technology (NIST) was used to develop the RFQ and review the resulting submissions. The RFQ specified a cost of \$0 to the USG for the contract, but the successful applicant could recover their costs through fees charged to third parties for the services provided. The RFQ specified a base period of 4 years with two 1-year options for extension.

3.1.2 Achieving stated goals

Implementation Timeframe: The process for the .us domain space took more than 14 months from the time that a draft Statement of Work (SOW) was released for comment (August 17, 2000) to the time that the contract was awarded (October 29, 2001). It is unclear how long it took to develop the SOW before it was released.

Even if the USG were ready to immediately move forward with the FAR process, it is unlikely that this process would result in a US ENUM implementation before the beginning of 2005. As of the publication of this document, it appears that the USG is not ready to begin work on any draft statement of work (SOW). In fact, it is not clear when such work could begin.

Government Oversight: Using a simplified FAR process would certainly require the US government to play a role in overseeing both the procurement and the ongoing operation of a US Tier 1 structure. This alternative would minimize industry's exposure to liability in implementing ENUM.

Procurement & Operational Costs: While any implementation alternative would probably be based on the operational costs of the Tier 1 being borne by its users (i.e., by the Registrars and ultimately by the Registrants), the cost of selecting the Tier 1 entity(ies) would be borne by the contracting entity, in this case the government. The costs should be very similar to the costs of selecting a registry operator for the .us domain. It is not clear, however, if the budget for such costs would need to be explicitly provided and, if so, when such monies would be available for the process to begin.

3.1.3 Advantages

- No (or minimal) costs to industry.
- Antitrust protection
- Contract liability protection
- A well defined and understood process

3.1.4 Disadvantages

- Statutory authority not clear
- Unclear which agency would lead
- Funding not currently in place or proposed for FY05
- Not trivial in complexity or cost
- Difficult to coordinate with industry participants
- USG prefers light touch with new or emerging technologies
- If single or skinny Tier 1 is selected, US Government-based procurement of this multinational resource would need to be coordinated with the other NANP countries

3.2 *Industry LLC*

A Limited Liability Company (LLC) is a separate and distinct legal entity that affords its members statutory protection from liability. All liability is assumed by the LLC, which protects its assets against liability through insurance. LLC membership defines its rules, operating agreements, voting rights and functions.

3.2.1 Description

Creation of an LLC requires establishment of a legal entity. LLC's perform specific roles such as taking the responsibility for:

- developing and issuing an RFP;
- contract negotiation and execution;
- vendor supervision;
- determination of applicable database and /or system changes;
- governing of emerging issues (e.g. vendor/provider interfaces); and
- ongoing vendor change management.

In addition an LLC has the following attributes:

- liability protection for members;
- designated and recognized contracting entity;
- level forum for joint venture by competitors;
- unregulated status, yet can be authorized to conform to regulatory directives; and
- easy access for new entrants who meet established membership criteria.

Membership requirements for the LLC can be defined by mutual accord in the operating agreement. The operating agreement also can require members to conduct activities in a neutral matter and prohibit potential LLC vendors from being members of the LLC.

3.2.2 Profit Status

The LLC could act as a non-profit organization. Each member would contribute towards the operating costs of the LLC in its function to contract with and provide ongoing oversight for one or more Tier 1 providers. It would be expected that cost recovery would be permitted and that the costs of operating any Tier 1 infrastructure could be borne by the vendor(s) selected.

3.2.3 Government Oversight Role

The government could choose to have either an active role or a tacit role in supervising the LLC. In an active role the government or its designated party could perform a close advisory function that may mandate some, if not all the activities undertaken by the LLC. This role might also include formal acknowledgement and confirmation of some or all LLC activities.

In a tacit role the government could through regulatory directive provide guidance or establish the framework under which the LLC would operate. The government agency designated with supervising the LLC would establish the policy directives and general course of action used to set LLC goals and expectations. These policies would establish broad guidelines for LLC organizational behaviors and future decision-making. The government would also retain rights to take over the functions of the LLC should the need arise.

In addition, the LLC could contain provisions for involving the 19 member nations of the NANP such that they could maintain their national sovereignty as well as confirm their willingness to jointly support the activities of the LLC. The countries in the NANP are:

- Anguilla
- Antigua & Barbuda
- Bahamas
- Barbados
- Bermuda
- British Virgin Islands
- Canada
- Cayman Islands
- Dominica
- Grenada
- Jamaica
- Montserrat
- St. Kitts & Nevis
- St. Lucia
- St. Vincent & the Grenadines
- Trinidad & Tobago
- Turks & Caicos Islands
- the United States (including Puerto Rico, the U.S. Virgin Islands, Guam and the Commonwealth of the Northern Mariana Islands) (American Samoa will join in 2005)
- Dominican Republic

3.2.4 Advantages

Doing business as an LLC has a number of benefits for contracting and management of vendor contracts. Advantages of an LLC include the following:

- Likely to be well received by government³
- Can be done relatively quickly and efficiently with legal assistance
- Limits industry risk and liability without being wholly dependent on a government procurement process
- Has worked successfully in the past for other industry activities (e.g. LNP)
- Membership and LLC operating criteria can be clearly defined to ensure membership fairness and unbiased oversight behavior
- Can negotiate and execute contractual arrangements with all qualified vendors
- Can develop technical requirements, issue an RFP, and award a contract
- Can designate equal terms and conditions for all participants who use contractual services from the selected vendor
- Operates under an open meeting process unless proprietary matters are being discussed, such as contract negotiations
- Designated as independent, non-governmental entity that is not aligned with any particular telecommunications segment.
- Can be created and designated to represent the NANP and its countries
- Can be structured so that coordination with the government can be through the LLC or through an industry consortium

³ See August 13th letter from NTIA, FCC, DOS to ENUM Forum

3.2.5 Disadvantages

Despite the advantages of an LLC, there are also some downside factors that should be considered before an LLC is formed. Some of the disadvantages of operating as an LLC include the following:

- Members are responsible for initial funding and operational costs.
- The fewer companies that participate, the more each member must contribute.
- Requires independent legal assistance to draft and finalize membership operating agreements and to provide on-going advice.
- May be difficult to establish industry payment/contract cost recovery mechanisms without some confirmation from the government

4 Tier 1 Structure Alternatives

This section describes Tier 1 structure alternatives. Two aspects of the alternatives are the scope of Tier 1 and the delegations from Tier 0.

- Alternatives for the Scope of Tier 1:
 1. US numbers would be registered in a single Tier 1 for all NANP numbers,
 2. US numbers would be registered in a single Tier 1 for all US numbers, or
 3. US numbers would be registered in multiple Tier 1s for sets of NPAs.
- Alternatives for the Delegations from Tier 0:
 1. Tier 0 would delegate numbers at the 1+NPA level, or
 2. Tier 0 would delegate numbers at the country code 1 (NANP) level.

The following table gives a road map to the alternatives described in the following section.

Tier 1 Structure Alternatives	Scope of Tier 1	Level of Tier 0 Delegation
4.1 Single Tier 1 for all NANP countries	Single NANP Tier 1	Country code 1
4.2 Single Tier-1 Operator in the US		
4.2.1 Delegation of US NPAs from within Tier 0	Single US Tier 1	1+NPA
4.2.2 Delegation of the single US Tier 1 from within a Skinny Tier 1	Single US Tier 1	Country code 1
4.3 Multiple Tier-1 Operators in the US		
4.3.1 Delegation of US NPAs from within Tier 0	Multiple US Tier 1s	1+NPA
4.3.2 Delegation of multiple US Tier 1s from within a Skinny Tier 1	Multiple US Tier 1s	Country code 1

Table 1 - Road Map to Tier 1 Structure Alternatives

4.1 Single Tier 1 for all NANP countries

This alternative includes all NANP numbers in a single Tier 1 Registry. It relies upon the delegation of country code 1 from Tier 0 (i.e., 1.e164.arpa).

This alternative assumes that all the participating NANP countries may need to form one contracting/oversight entity to select the Tier 1 entity. It assumes that the contracting entity has agreement with, or at least acquiescence from, NANP member countries to include all NANP numbers into a single Tier 1 registry.

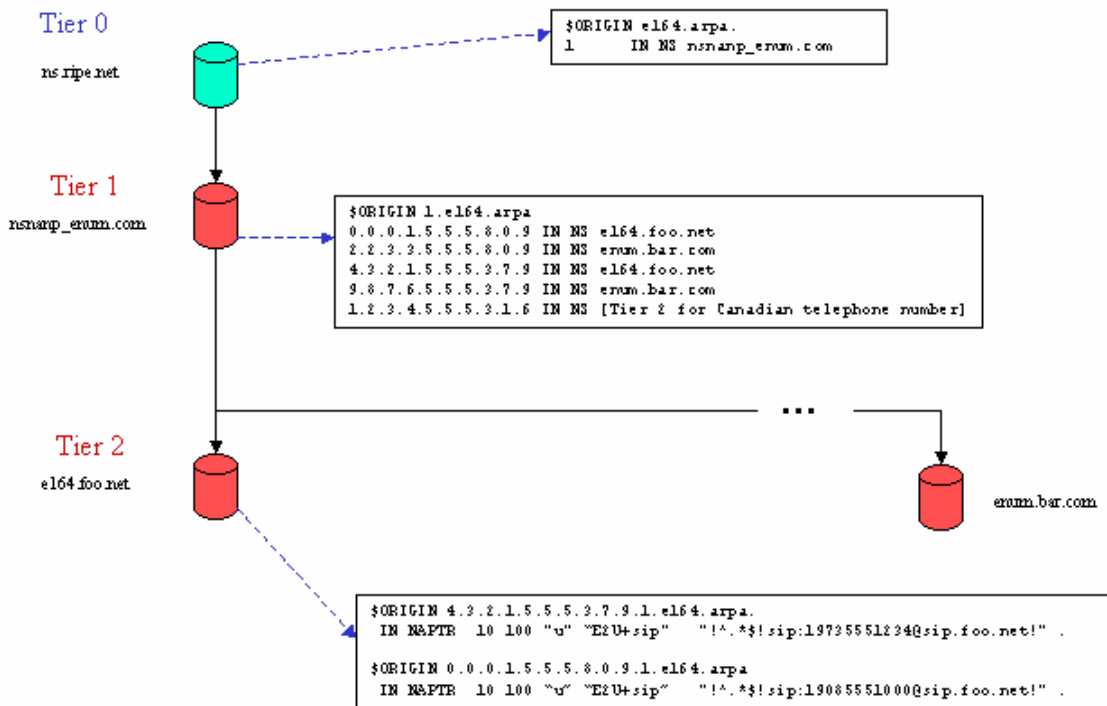


Figure 1 - Single Tier 1 for all countries in the NANP

Pros	Cons
<p>Only country code 1 has to be loaded into Tier 0.</p> <p>Only one representative from the NANP countries needs to deal with the Tier 0 Registry. The individual NANP countries deal with a single Tier 1 provider.</p> <p>Registrars that do business in many NANP countries need only to be certified once by the single Tier 1.</p> <p>Registrar Interfaces with only one single Tier 1 for all the registrations in many</p>	<p>All 19 countries in the NANP need to agree/acquiesce to have a single entity operate Tier 1.</p> <p>All 19 countries in the NANP must agree/acquiesce on the method of selecting and the selection of that entity.</p> <p>Restricts the business opportunity to a single entity at the Tier 1 level.</p> <p>Creates Potential risk of relying upon a single business entity</p>

NANP countries (e.g., no need to interface with multiple Tier 1s in the NANP).	
May simplify the inclusion of non-geographic numbers in ENUM	

4.2 Single Tier-1 Operator in the US

This alternative includes all US numbers in a single Tier 1 Registry. It relies either upon the delegation of all US NPAs from within the Tier 0 (see 4.2.1) or the delegation of country code 1 from Tier 0 (i.e., 1.e164.arpa) into a “skinny Tier 1” (see 4.2.2). It does not imply any implementation alternatives for other countries in the NANP. Registrars have only to interface with the single US Tier 1 Registry, independent of the sub-alternative chosen in this option.

4.2.1 Delegation of US NPAs from within Tier 0

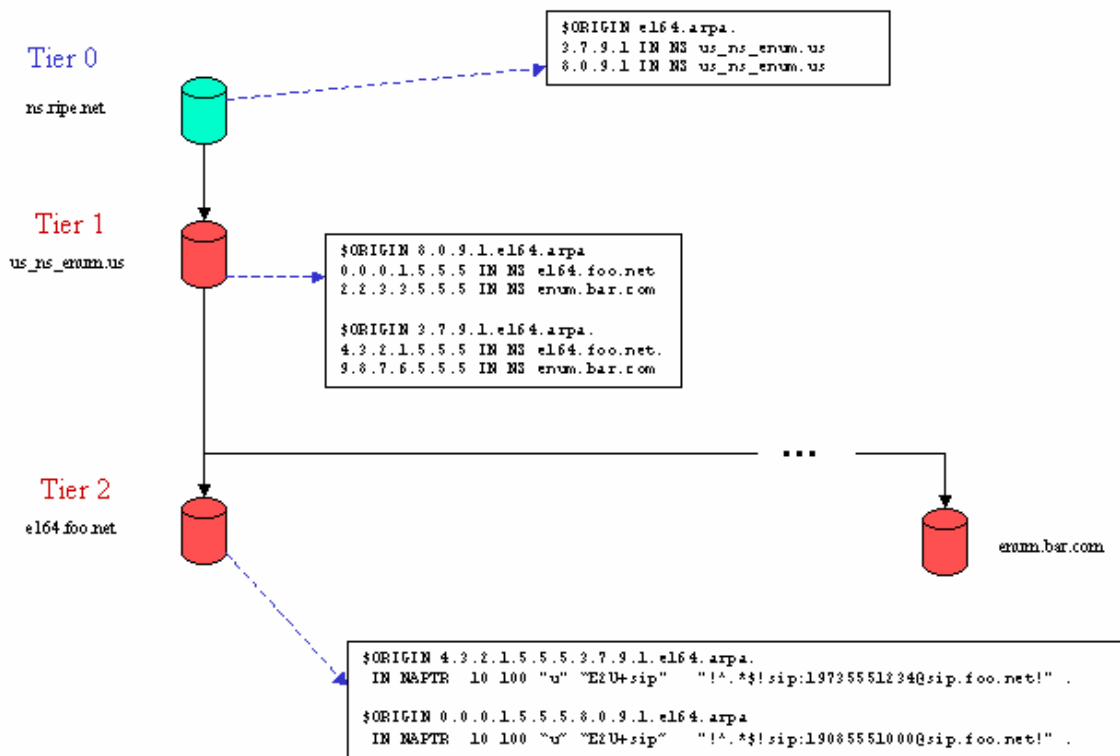


Figure 2 - Single Tier 1 Entity for the USA

Pros	Cons
No distribution of US NPAs needed between multiple Tier 1 entities	Restricts the business opportunity to a single entity at the Tier 1 level.
USA can opt into global ENUM without needing agreement from other NANP	NPAs for the USA have to be entered into Tier 0.

members. No negotiation needed with other NANP members on loading the USA NPAs into Tier 0.	Creates potential risk of relying upon a single business entity Does not resolve issues regarding the inclusion of non-geographic numbers in ENUM
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4.2.2 Delegation of the single US Tier 1 from within a Skinny Tier 1

In past discussions of the Tier 0/Tier 1 interface, it has been an assumption that delegation of US numbering resources would occur at the NPA level. Specifically, the underlying assumption was that Tier 0 would include a set of NS records for a domain name of, for example, “3.7.9.1.e164.arpa”. Because this would result in a larger number of records in the Tier 0 for the inclusion of the US area codes, an assumption of this sub-alternative is that Tier 0 would delegate country code 1 (i.e., “1.e164.arpa”) to a single entity and that the delegation of the NPAs would have to be managed separately. This separate registry of NPA delegations has been called a “skinny Tier 1.” This skinny Tier 1 would require that all 19 countries of the NANP reach agreement on, or at least acquiesce in, the selection of some entity to manage this Registry. The entity responsible for the skinny Tier 1 *may* be different than the entity responsible for the single US Tier 1.

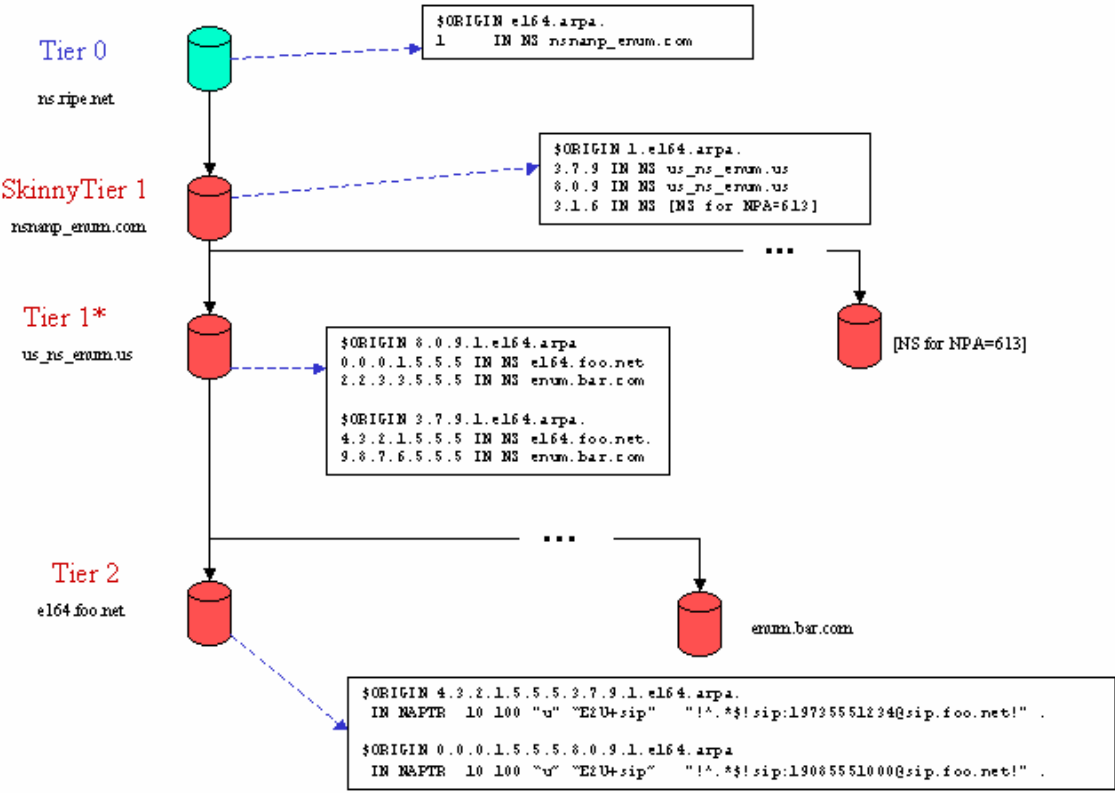


Figure 3- Skinny Tier 1 handled within NANP for Single US Tier 1

Pros	Cons
<p>No distribution of US NPAs needed between multiple Tier 1 entities</p> <p>Only country code 1 has to be loaded into Tier 0</p> <p>Only one representative from the NANP countries needs to deal with the Tier 0 Registry.</p> <p>The individual NANP countries deal with a single Tier 1 provider.</p> <p>May simplify the inclusion of non-geographic numbers in ENUM if 10-digit non-geographic numbers are included in the skinny Tier 1</p>	<p>Restricts the business opportunity to a single entity at the skinny Tier 1 and the US Tier 1 levels.</p> <p>Creates potential risk of relying upon single business entities at both the skinny Tier 1 and at the US Tier 1</p> <p>Does not resolve issues regarding the inclusion of non-geographic numbers in ENUM</p> <p>All 19 countries in the NANP have to agree/acquiesce to have a single entity operate a skinny Tier 1.</p> <p>All 19 countries in the NANP have to agree/acquiesce on the method of selecting and the selection of that entity.</p>

4.3 Multiple Tier-1 Operators in the US

This alternative divides the US NPAs among multiple Tier 1 Registries. It relies upon either the delegation of all US NPAs from within the Tier 0 (see 4.3.1) or the delegation of country code 1 from Tier 0 (i.e., 1.e164.arpa) into a “skinny Tier 1” (see 4.3.2). It does not imply any implementation alternatives for other countries in the NANP.

4.3.1 Delegation of US NPAs from within Tier 0

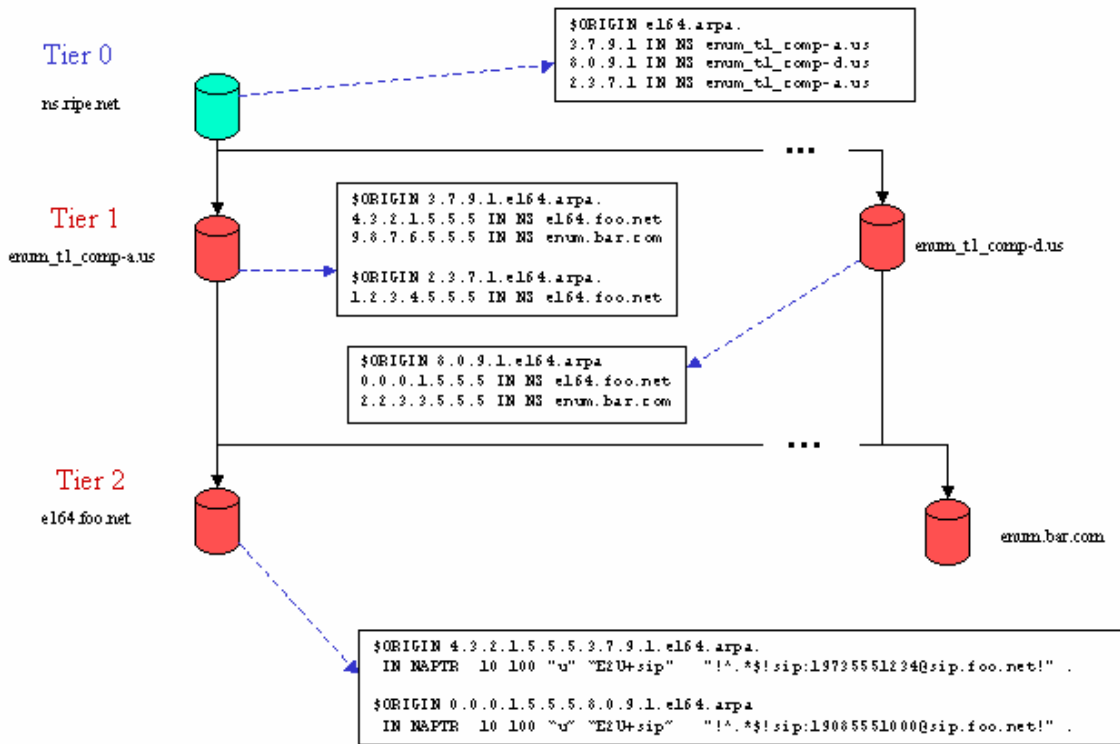


Figure 4 - Multiple Tier 1 Entities for NPAs in the USA

Pros	Cons
Promotes multiple business opportunities in the Tier 1 registry	NPAs need to be distributed among Tier 1 providers.
US can opt into global ENUM without needing agreement from other NANP members.	NPAs for the USA would have to be entered into Tier 0.
No negotiation is needed with other NANP members on loading the US NPAs into Tier 0.	Introduces additional operational and administrative interfaces for Registrars and Tier 2 operators
Reduces potential risk of relying upon a single business entity for Tier 1, including proprietary interfaces	Does not resolve issues regarding the inclusion of non-geographic numbers in ENUM

4.3.2 Delegation of multiple US Tier 1s from within a Skinny Tier 1

In past discussions of the Tier 0/Tier 1 interface, it has been an assumption that delegation of US numbering resources would occur at the NPA level. Specifically, the

underlying assumption was that Tier 0 would include a set of NS records for a domain name of, for example, “3.7.9.1.e164.arpa”. Because this would result in a larger number of records in the Tier 0 for the inclusion of the US area codes, an assumption of this sub-alternative is that Tier 0 would delegate country code 1 (i.e., “1.e164.arpa”) to a single entity and that the delegation of the NPAs would have to be managed separately. This separate registry of NPA delegations has been called a “skinny Tier 1.” This skinny Tier 1 would require that all 19 countries of the NANP reach agreement on, or at least acquiesce in, the selection of some entity to manage this Registry. The entity responsible for the skinny Tier 1 *may* be different than the entity responsible for any US Tier 1.

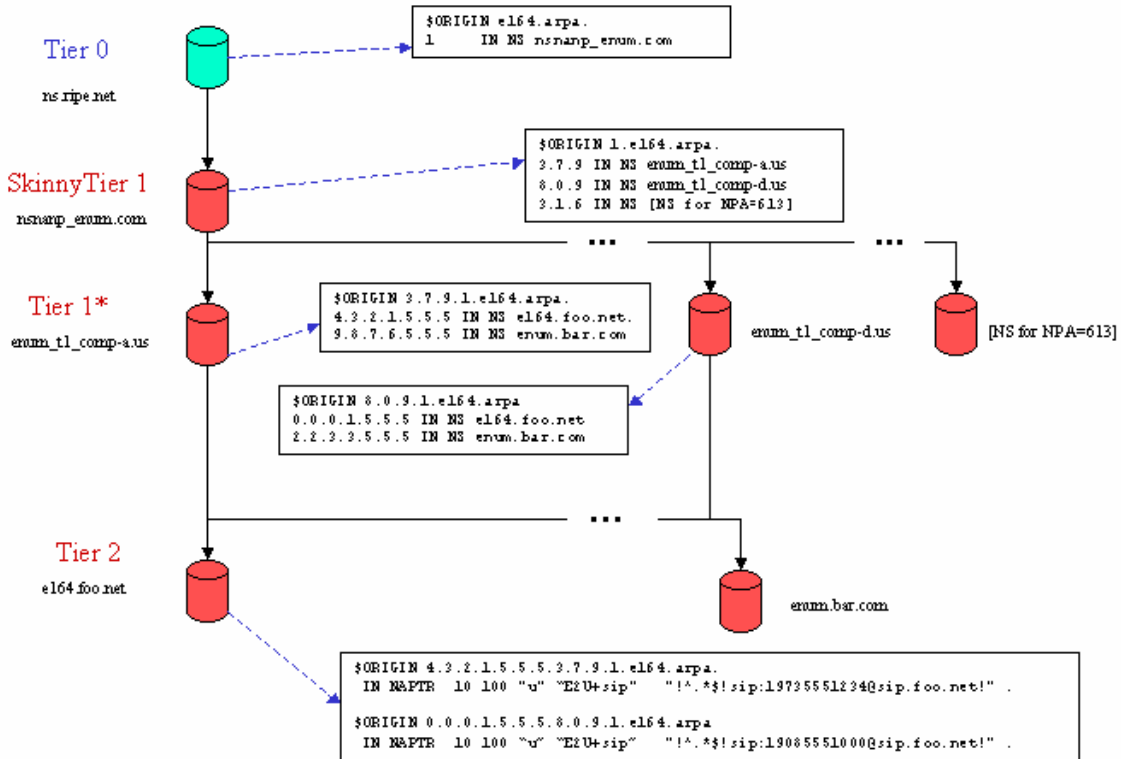


Figure 5 - Skinny Tier 1 handled within NANP for Multiple US Tier 1s

Pros	Cons
<p>Only country code 1 has to be loaded into Tier 0</p> <p>Only one representative from the NANP members needs to deal with the Tier 0 Registry. The individual NANP countries deal with a single skinny Tier 1 provider.</p> <p>May simplify the inclusion of non-geographic numbers in ENUM if 10-digit non-geographic number is included in skinny Tier 1</p> <p>Promotes multiple business opportunities in the Tier 1 registry</p>	<p>NPAs need to be distributed among Tier 1 providers.</p> <p>Restricts the business opportunity to a single entity at the skinny Tier 1 level.</p> <p>Creates potential risk of relying upon single business entity at the skinny Tier 1</p> <p>Does not resolve issues regarding the inclusion of non-geographic numbers in ENUM</p> <p>All 19 NANP members have to agree/acquiesce to have a single entity operate skinny Tier 1.</p> <p>All 19 NANP members have to agree/acquiesce on the method of selecting and the selection of that entity.</p> <p>Introduces additional operational and administrative interfaces for Registrars and Tier 2 operators</p>

5 Considerations

Although individual participants within the ENUM Forum have been proponents for each of the various alternatives described in this document, the member companies could not reach consensus on any particular architectural alternative.

However, the ENUM Forum endorses the US Government's support for an industry-based solution, such as an LLC, given the August 13th letter to the ENUM Forum and Forum discussions as documented in section 3.

The following statements summarize the ENUM Forum's considerations of the architectural alternatives:

- While a technically feasible and simple delegation of country code 1 is represented in 4.1, it relies upon multinational agreements that are outside the scope agreed upon by the Forum participants.
- Any alternative that involves the delegation of country code 1 by itself from Tier 0 involves the agreement, or at least the acquiescence, of all 19 members of the NANP. The selection of any of these alternatives (4.1, 4.2.2, 4.3.2) *may* involve delays in the implementation of ENUM for US resources. These delays, if any, will be caused by the need to reach some kind of agreement/acquiescence with the other NANP countries.

- On the other hand, selection of the remaining alternatives (4.2.1, 4.3.1) *may* involve additional negotiations with the Tier 0 Registry. This is due to the fact that the US NPAs must be entered into the Tier 0 Registry.
- One of the issues that need to be considered is the question of how many registries should operate for those NPAs within the US. Should a single registry be implemented that would contain the telephone number delegations for all NPAs or should several registries be created that would manage the telephone number delegations for given subsets of the US NPAs? The latter raises the issues of what a reasonable number of registries is and how the NPAs should be distributed between the Tier 1s. It is recommended that, if the multiple US Tier 1 Registry alternative is chosen, some reasonable number of Tier 1 Registries should be selected by the contracting entity.

The ENUM Forum recommends and looks forward to continued interaction with each of the involved government agencies. Assuming the creation of an LLC, the LLC will require similar government agency interaction to ensure the fair and equitable implementation of ENUM in the US.

The ENUM Forum participants agree and recommend that a formal relationship between the LLC and the ENUM Forum be established to support implementation and operational activities.

6 Glossary

6.1 Acronyms

CFR	Code of Federal Regulations
DOS	Department of State
ENUM	Telephone Number Mapping
FAR	Federal Acquisition Regulations
FCC	Federal Communications Commission
LLC	Limited Liability Corporation
LNP	Local Number Portability
NANP	North America Numbering Plan
NIST	National Institute of Standards and Technology
NPA	Numbering Plan Area
NS	Name server
NTIA	National Telecommunications and Information Administration
RFP	Request for Proposal
RFQ	Request for Quote
SOW	Statement of Work
USG	United States Government

6.2 Definitions

ENUM Tier 0 Registry	An entity responsible for providing ENUM Tier 0 Registry services; ENUM Tier 0 Registry services include management of pointers to ENUM Tier 1 Registry nameservers.
ENUM Tier 1 Registry	An entity responsible for providing ENUM Tier 1 Registry services; ENUM Tier 1 Registry services include management of pointers to ENUM Tier 2 Provider nameservers.
Skinny Tier-1	A registry that contains delegations of all NPAs for Country Code 1 as ENUM Tier 1 Registries. This registry is delegated from the ENUM Tier 0 Registry through the domain name 1.e164.arpa.
ENUM Registrar	A person or entity that, via contract with assignees of E.164 numbers and an ENUM Tier 1 Registry, provides registration services to ENUM Registrants.