Framework Document for a US/CC1 ENUM Trials Program

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Abstract: This document describes a framework for an ENUM trials program within
               the US/CC1. It gives a picture of how such trials might be conducted
               using a trial CC1 infrastructure, which is one of some of the possible
               architectures for implementing US/CC1 trials.

               The document also identifies some issues that would need resolution
               before trials could begin. This document is not intended to proscribe
               anything about trials that might be conducted by other CC1 countries.

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CONTEXT

1   Introduction - Rationale for Conducting Trials

There is a desire within the industry to get ENUM working for numbers within Country Code 1 (CC1). The industry created a formal Limited Liability Company (LLC) to procure and oversee the official Tier 1A function for numbers within Country Code 1 and Tier 1B functions for numbers within the United States; the CC1 ENUM LLC was established on September 29, 2004. The LLC's procurement process is expected to take some time. Accordingly, in order to enable CC1 nations to be ready to provide ENUM service as soon as the LLC Tier 1 is complete, the potential for conducting ENUM-related trials via a test bed implementation, one of several possible architectures, is proposed here[1].

This document describes a concept to provide early Tier 1 service for trials. It is designed to help industry test ENUM services, to trial the registration process, and to get hands-on experience for the LLC working on the RFP for the official Tier 1 vehicle. In particular, trials involving limited call/service setup and completion, e.g., an ENUM-enabled application service could be performed.

A test bed platform, one of several possible architectures, could also support a variety of scenarios in response to suggestions from industry and government. This could include experiments with Tier 1 architectures, non-geographic numbering, and registry-registrar interactions.

2   Scope

This document is intended for any party who has an interest in ENUM trials within Country Code 1, and specially within the United States. It may include parties who wish to actively participate in deploying trial facilities and platforms, those who may wish to utilize those facilities and platforms, and those interested in the direction and results of any trials that take place. It would be expected that the principal participants would be those directly involved in the telecommunication and Internet industries.

The scope of these trials must include definitive start and sunset dates. These trials are intended to take place during the gap between current time and the point at which the formal Tier 1 functions of the US/CC1 ENUM LLC's procurement begin operations.

The domain for these trials shall be the Country Code 1 delegation from e164.arpa. The trials may be country code 1 specific or even further limited to only US NPAs from within country code 1.

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[1] See GEN0095R0, GEN0097R0 and ad hoc Contribution from AG Design, LLC and Seiri, Inc. dated 23 March 2004

3   Terms and Definitions

Terms of 6000_1_0 are incorporated by reference. Beyond that, the following terms and definitions are used within this document:

Testbed   A collection of hardware and software systems that have been assembled for the purpose of satisfying the requirements and objectives of an ENUM trial.

Trial   The activities that, when performed in some logical order, satisfy the requirements and objectives described in this document.

4   Objectives and Principles

The overall object of this document is to describe a framework for a US/CC1 ENUM trials program. The trials program has the following objectives:

- To decouple policy and technological goals to allow for concurrent progress of both, and in particular, to allow for a faster timeline for ENUM trials;

- To conduct tests of zone architectures using designated US/CC1 telephone numbers mapped into the e164.arpa domain;

- To test the Query/Response mechanism of the ENUM DNS protocol using NANP numbers in e164.arpa and test resource records in various domains;

- To perform tests of call setup and completion for test user agents/service providers of ENUM-enabled services;

- To test registration and operational procedures and interfaces that could apply between the roles involved in ENUM implementation: US/CC1 Tier 1, US Tier 2, Registrar, Application Service Provider, etc.; and

- To evaluate potential DNS security mechanisms

The key principles of the trial are:

- The trials should have a specific sunset, which could be up until the time when the official contracted Tier 1 function is ready for service

- The trials should preserve national sovereignty, which is the continued right of each country sharing Country Code 1 to determine if and how it chooses to participate in ENUM

- The trials should be operated in an open, neutral and transparent fashion. A report of the trial results will be made publicly available except for those portions of individual participant's results that involve proprietary information

- There should be no competitive advantage conferred to potential bidders in the Tier 1 procurement process It is envisaged that all volunteer(s) for the role of a Tier 1B Registry would be accommodated in the trial

- The costs of participating in the trial should be borne by the individual participants, with the possibility of support from other interested parties

- The trial is limited to non-commercial activities. Commercial and retail end-users will not be a part of the trial. Any registrations in the Tier 1B Registry(ies) will not survive the trial

- The trials should not automatically preclude any particular technical activities that participants wish to conduct. The administrator of the trial must approve activities that affect the principal architecture or the primary interfaces between the identified roles. Technical activities that only affect the ENUM-enabled applications that a participant or group of participants wish(es) to run may be conducted without any prior permission

FRAMEWORK

5   Architecture to be Implemented for the Trials

5.1   Functional Architecture

The functional architecture for ENUM in the US has several layers. In the first figure in this section, the functional entities are shown in three layers:

- International, which consists of the DNS root and the Tier 0 for ENUM. Tier 0 has the domain name "e164.arpa" and contains the delegations for country codes

- Country Code 1, which holds the Tier 1A (skinny Tier 1) for Country Code 1. Its domain name is "1.e164.arpa" and it will contain delegations for NPAs from countries that choose to participate in the trial

- Individual E.164 Zones for NPAs, which is comprised of the Tier 1B Registry(ies), Registrars, and Registrants. It also includes the Authentication and Verification Entities. Below these are the Tier 2 Providers and the Application Service Providers

In the second figure in this section, the functional components for a Trials Platform (one of several possible architectures) are shown. The component groups are:

- Trial Tier 1A for Country Code 1,

- Trial Tier 1B for the US, and

- Test and Development Systems

The elements of those components are described later in this section.

The third figure is in the next subsection. It is a conceptual diagram of a Tier 1 Platform and includes a schematic illustration of Internet connectivity.

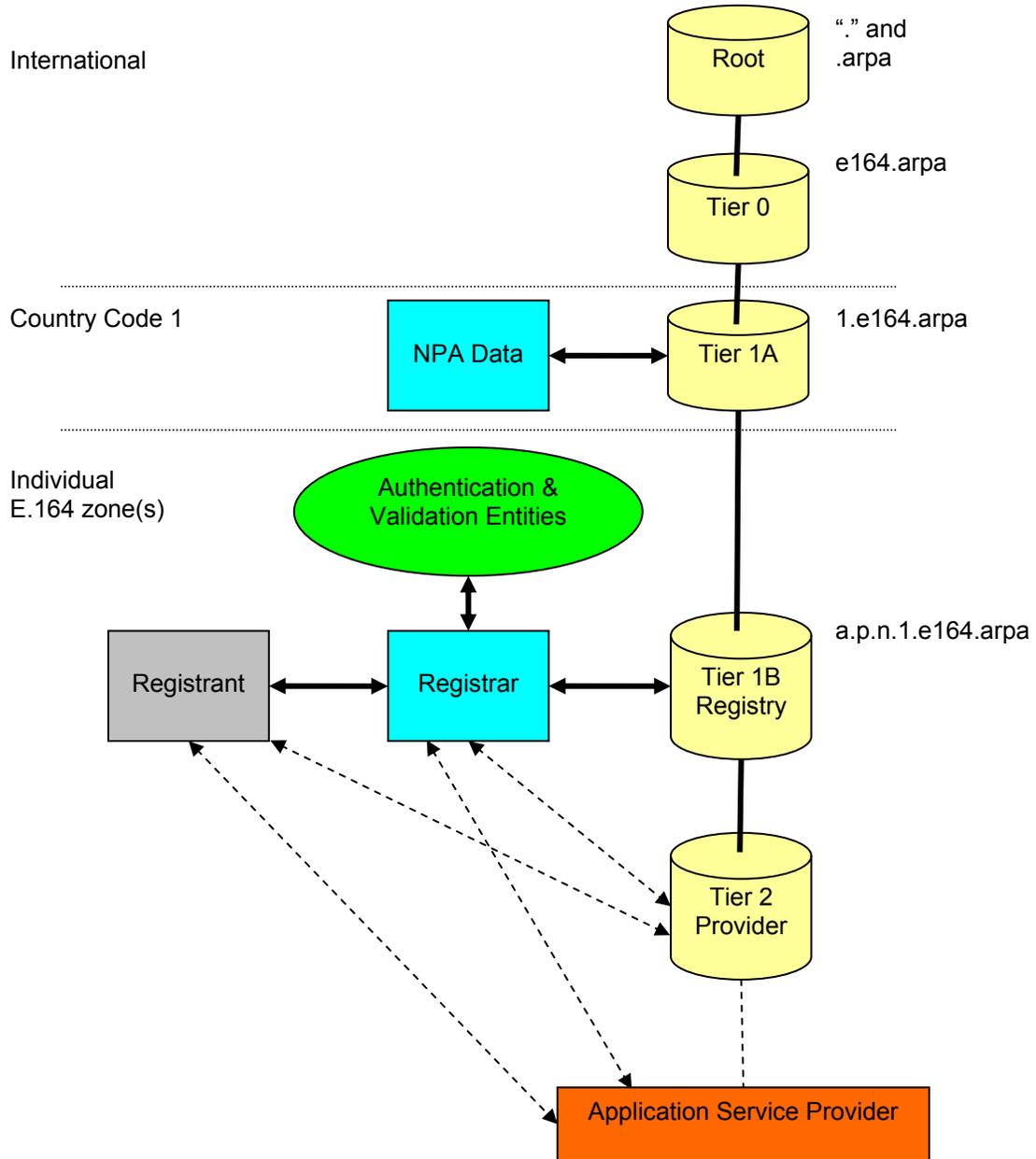The diagram for the overall functional architecture is as follows:

Figure 1 - ENUM Functional Architecture

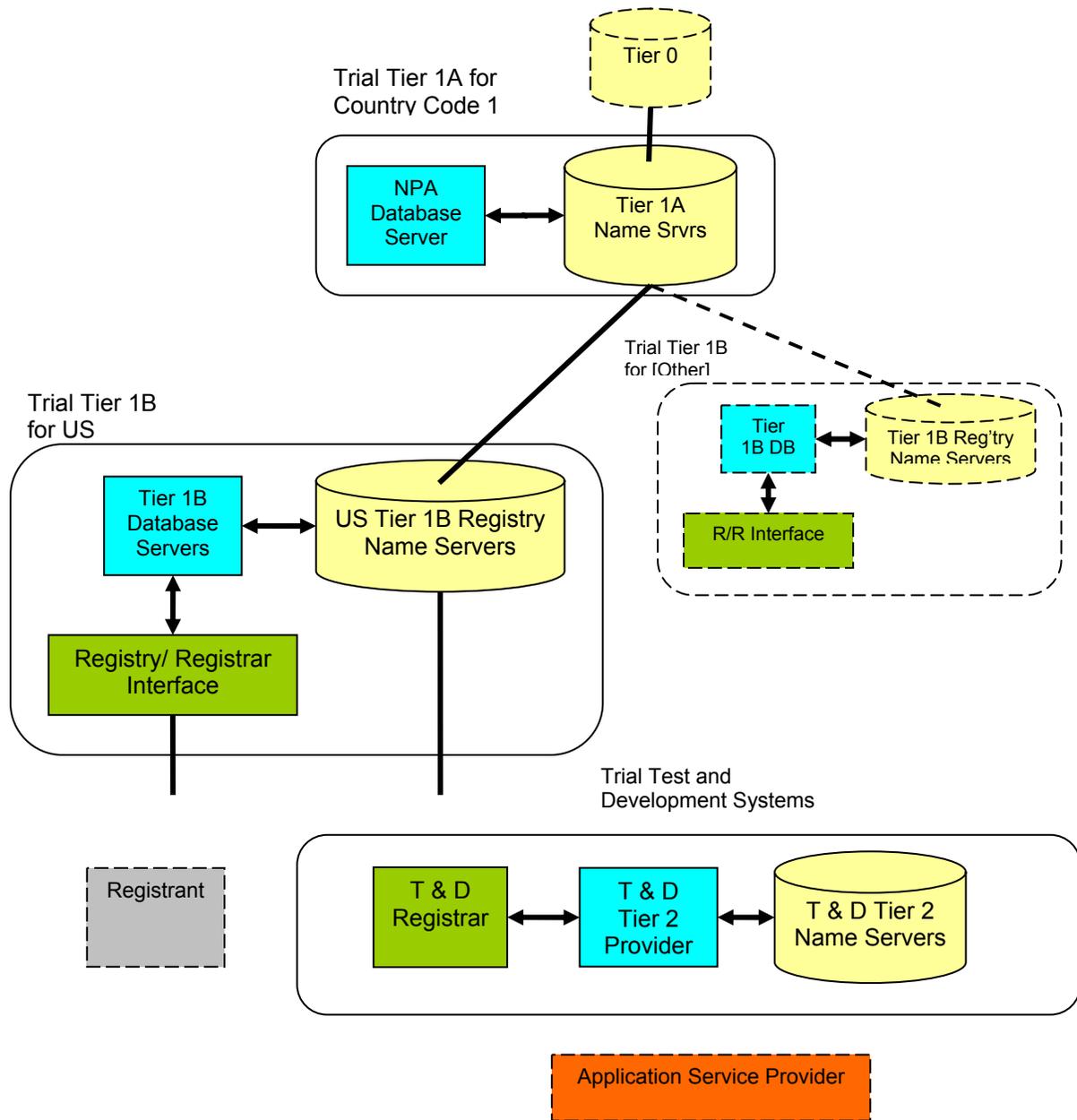The diagram showing three sets of components for a Trial Platform is as follows:

Figure 2 - Components of a Platform for ENUM Trials

More information on these components is contained in the next subsection.

5.2   Physical Architecture

There are several different physical architectures that could be used to implement a test bed for ENUM trials. This subsection describes a modest approach for implementing a Tier 1 platform.

There are three sets of components proposed for the trial Platform.

- Trial Tier 1A (Skinny Tier 1) for Country Code 1

  The trial Tier 1A consists of Name Servers for the zone 1.e164.arpa and the database server for generating the zone files for 1.e164.arpa. This zone contains the delegations for the NPAs delegated to the trial Tier 1B Registries.

- Trial Tier 1B(s) for the US

  The US Tier 1B(s) consist of Name Servers for the ENUM zones of each NPA used in the trials program, the database server used for generating the zone files for each such zone, and a test Registry/Registrar Interface (RRI) plus the Registry side of the RRI. In this document the domain name for an NPA's zone is written as a.p.n.1.e164.arpa.

  Note that this setup can also handle trial Tier 1B functions for the NPAs used by other NANP countries that might choose to participate in the trials program.

- Trial Test and Development Systems

  Additional systems are needed for a variety of things. There is a need to implement test Trial Tier 2 Providers to respond to test ENUM queries.

  Also test systems need to be able to generate ENUM queries, to host ENUM-enabled client applications, to host test server-based applications, and to test the Registrar side of the test Registry/Registrar Interface.

These components will need Internet connectivity, and should be able to support functions for systems operations, administration, and management, including security, backups, and reporting.

The trial platform would be delegated the zone for Country Code 1. In turn it would create a (skinny) Tier 1A, in which zones for each NPA would only be populated or delegated at the request of the relevant country. Individual NANP countries could have their own ENUM Tier 1B name servers to acknowledge national sovereignty for those countries. Any trial activity should be coordinated directly or through the US Department of State. The US Department of State needs to be involved due to the fact that they are the authorized entity that, with the other NANP countries, would request the ITU-T to delegate Country Code 1. For the purposes of this trial, limited non-geographic numbers could be registered based on subsequent specifications and agreements.

For certain NPAs, DNS zones would be populated with numbers. For example, for NPA = 203, there could be DNS resource records for domain names like [0.9.8.7.6.5.4.3.0.2.1.]e164.arpa (for the phone number [1-203-456-7890]). Those resource records would point to the nameservers of Tier 2 providers, which contain records for applications associated with that number.

5.3   Policy Architecture

Participation in the ENUM trials is voluntary, open and should minimally consist of ENUM Registry(ies), ENUM Tier 2 Providers, and Registrars. Application Service Providers are also encouraged to participate. A list of proposed NPAs for each CC1 nation's trial will be generated by their trial participants. Each CC1 nation will then designate and authorize the NPAs that will be officially used in the trial. These NPAs will then be entered into the ENUM Tier 1A registry(ies) in preparation for the commencement of the trial.

Prior to the start of the trial each of the participating entities will sign a MoU agreeing to the criteria and terms and conditions of the trial. Additional agreements between trial partners and or sub-contractors shall be the responsibility of the partners themselves.

The ENUM Tier 1B registry(ies) will work together with the Tier 2 providers and Registrars on the basis of a trust agreement, which indicates that applications submitted by registrars for the delegation of an ENUM domain will be regarded as valid. The Registrars will incur costs for each trial participant and therefore Registrars are not expected to accommodate an unlimited number of participants in the trial, but are encouraged to accommodate as many participants as possible. Residential unlisted numbers shall not be part of the ENUM trials.

The ENUM Tier 1B Registry(ies) will make its services available to interested ENUM Tier 2 Providers and Registrars on the same terms and conditions during the duration of the trial. However, the Tier 1B Registry(ies) will be obligated to make its services available only to those ENUM Tier 2 Service Providers and Registrars participating in the trial.

The participation of multiple Tier 2 Providers is encouraged.

The trial participants accept all liability relative to their national trials. All participants must realize that the trial is conducted on a best-effort basis using non-production services.

There will be no external funding available for the trial. Therefore, each participant must assume all costs associated with the trial. In addition, participation in the trial does not imply or guarantee similar roles when commercial introduction of ENUM is implemented.

The results of the trial will be made public, however proprietary activities of individual participants need not be included.

5.4   Schedule

The following schedule is based on the date on which the members of the ENUM Forum approve this document, and is expressed in incremental weeks from that date. It also assumes that the delegation of CC1 has already taken place.

The trial schedule is as follows:

	Date
Participants identified	+2 weeks
MoU Signed	+4 weeks
Trial Begins	+6 weeks
Trial Ends	+32 weeks
Report generation	+36 weeks

After this date all of the functions (mailing list, web site, ENUM Tier 1B Registry, TSP validation) will cease to exist.

6   Roles

Some of these entities will directly interface with the Tier 1A/Tier 1B; others will interface with intermediaries rather than directly with the Tier 1A/1B. One of the main trial objectives is to test the architectural, technical, and operational aspects for 1.e164.arpa related to the provision of ENUM capabilities as defined in IETF RFC 3761.

6.1   Tier 1A Registry

The Tier 1A Registry must establish an interface that is available for all Tier 1B Registries to use. The common protocol may be used between the Tier 1A and the Tier 1B, should separate roles be adopted by trial participants.
The Tier 1A Registry should ensure that they meet the following requirements:

- "The Tier 1A Registry must demonstrate relevant registry experience
- "The Tier 1A Registry must commit suitably experienced staff resources for the trial
- "The Tier 1A registry must commit to providing sufficient trial technical resources

6.2   Tier 1B Registry

The Tier 1B Registry is the entity responsible for providing ENUM Registry services for US telephone numbers in full E.164 format, including management of pointers to Tier 2 Provider nameservers. The Tier 1B Registry does not handle NAPTR records but points at Tier 2 Providers where NAPTR records associated with E.164 numbers are stored.

According to ENUM Forum Document 6000, Tier 1 Registry has interactions with DNS Providers and Registrars. This is the role that the Tier 1B will play for the US, however for the purposes of this trial the Tier 1A may also play the role of a Tier 1B. The Tier 1B Registry must establish an interface which is available for all Registrars to use. The common protocol may be EPP, but this should not preclude other protocols being used between the Registry and Registrars subject to the prior agreement of those trial participants. The protocols to be used on the interface between Tier 1B Registry and Registrars must be agreed between those parties.

The Tier 1B Registry should ensure that they meet the following requirements:

- The Tier 1B Registry must demonstrate relevant registry (e.g. nameserver operations) experience
- The Tier 1B Registry must commit suitably experienced staff resources for the trial
- The Tier 1B registry must commit to providing sufficient trial technical resources
- The Tier 1B Registry must maintain a listing of all registered testing numbers

6.3   Registrar

The Registrar is an entity that provides registration services to Registrants. Registrars also are the operational contact with Registrants and they interface between the Registrant, the Tier 1B Registry and Tier 2 Providers. A Registrar may also be a Tier 2 Provider or may interface with other independent Tier 2 Providers.

Registrars should ensure that they meet the following requirements:

- Registrars must commit to the provision of sufficient staff and technical resources for the trial
- Registrars must commit to strictly complying with all Data Protection statutes and relevant guidelines
- Any nameservers operated by the Registrar must comply with DNS requirements
- Registrars must be capable of carrying out their role in accordance with ENUM Forum 6000_1_0, Section 11, Registrar Requirements
- Registrars must be prepared to disclose relevant information gathered during the trial and participate in trial reporting
- Registrars must commit to providing resources appropriate to satisfactory completion of the trial
- Registrars must establish an interface with a Tier 1B Registry and Tier 2 Providers. The common protocol should be EPP, but this does not preclude other protocols being used between the Registry and Registrars subject to the prior agreement of those trial participants. The protocols to be used at the interface between Tier 1B Registry and Registrars are executed bilaterally
- For the purpose of this trial, Registrars will not charge for services

- Registrars may provide an interface to allow end users to manipulate their NAPTR records. The Registrar may provide guidance to the end user on the recommended structure or content of NAPTR records
- Registrars should provide a means by which the end user can be validated to enable record manipulation. This may require the Registrar to establish an 'on-line' relationship with an Authentication Agency so that validation (e.g., via a digital certificate, username & password) can be validated in real time

6.4   Authentication Agency

Authentication Agencies are responsible for providing information that may be used by the Registrar in validating the assignment of ENUM end user E.164 numbers. An Authentication Agency can be a Telephony Service Provider or National Number Plan Administrator or any entity capable of providing the registrar with the data needed for authentication, such as a national hub provider or data clearinghouse. National hub providers and data clearinghouses have access to multiple data sources from telephony service providers and various other sources. The role of an Authentication Agency will be to provide information that may confirm to the Registrar that the Registrant is the rightful assignee of the E.164 telephone number that they wish to enter into the DNS.

The Authentication Agency should ensure that they meet the following requirements:

- An Authentication Agency must be prepared to discuss any relevant findings gathered during the course of the trial

- An Authentication Agency must commit to providing resources appropriate to satisfactory completion of the trial and may only charge for such services where tariffs have been established

6.5   Tier 2 Provider

The Tier 2 Provider manages the ENUM fully qualified domain name associated with an E.164 number and acts as the Registrant's NAPTR records hosting company. The Tier 2 Provider maintains the actual NAPTR records that contain information for specific communication services.

The Tier 2 Provider should ensure that they meet the relevant requirements specified in the ENUM Forum 6000_1_0 Document in the context of the trial. For the purpose of this trial the Tier 2 Provider will not charge for services.

6.6   Application Service Provider

The Application Service Provider (ASP) will provide the applications directly to the ENUM end users in the context of the trial. The role of the ASP is to provide applications to the end user. The ASP is an entity which runs application servers that facilitate

operation of the various data uploading and maintenance aspects of ENUM and/or the query/response/usage side of ENUM NAPTR records. For example, fully automated querying of a telephone number could be triggered by clicking the "Send" button of an end user device client in which the telephone number is entered as the address.

ASPs should ensure that they meet the following requirements:

- Application Service Providers must commit to providing sufficient staff and technical resources for the trial. Application Service Providers will commit to providing resources appropriate to satisfactory completion of the trial
- The end user will determine and control the content of the NAPTR records. However, since the application will be using this data in order to provide the service, ASPs may provide end user guidance on recommended content or structure of the NAPTR records
- Application Service Providers must be prepared to disclose the relevant information gathered during the course of the trial
- For the purpose of this trial, ASPs should not generally charge for services

TRIALS

7   Activities

Start of the trial is dependent on the approval of CC1 delegation by the Governmental Agencies of countries within the NANP area. This delegation is also dependent on the parameters specified by the ITU-T Study Group 2 Interim Procedures.

It is assumed that the trial would be of a specific duration, in this case 6 months. This timeframe is expected to allow the trial to complete prior to any commercial implementation as defined by the CC1 ENUM LLC. If necessary, the trial could be extended with the consensus of the trial participants and the trial sponsor as well as the approval of the appropriate Governmental Agencies.

Each Phase should generate a report of the results with suggestions for the CC1 ENUM LLC. The phases may overlap.

7.1   Phase 1 - Registry Infrastructure

Roles Involved: Skinny Tier 1A, Tier 1Bs, Tier 2 Providers, Application Service Providers

Duration: 1 month

Activities: The first activity is to implement the delegation of Country Code 1 from the Tier 0 Registry (RIPE-NCC) to the designated Skinny Tier 1A. Once the primary name server is established, any secondary name servers should also be identified within the Tier 0 Registry. The secondary Tier 1A name servers may be operated by a different organization than the Primary and from a different country within the NANP area.

The Tier 1A should ensure that:

- all records in the Tier 0 are correct and are transferred to the secondary name servers in a reasonable timeframe;

- queries for a domain name of "1.e164.arpa" are resolvable to all of the Tier 1A name servers

The second activity is to delegate one or more NPAs to each of the various Tier 1B Registries. The Skinny Tier 1A should implement and test a procedure to ensure the integrity of the national opt-in/opt-out process. If there is to be more than one Tier 1B Registry from any specific country, each may be delegated a different NPA for the trial. NPAs to be used in the trial will be determined by the participants based on the locations of the termination points[2]. The transfer of information between the primary Tier 1A and any secondaries must be tested, as well as between any primary and secondary name servers at the Tier 1B levels.

The Tier 1B(s) should ensure that:

- all records in the Tier 1A are correct and are transferred to the secondary name servers in a reasonable timeframe;

- queries for a domain name of "<NPA>.1.e164.arpa" are resolvable to all of the appropriate Tier 1B primary and secondary name servers

The third activity is to delegate telephone numbers from each Tier 1B Registry to Tier 2 name server providers such that every Tier 2 name server will contain test data. Once the test numbers have been delegated, the Tier 2 will load 1 or more NAPTR records for each test number based on the needs of the various Application Service Providers that are participating in the trials.

Tier 2 Providers should ensure that:

- all records in the Tier 1B are correct and are transferred to the secondary name servers in a reasonable timeframe;

- queries for the domain name "<tel. No.>.<NPA>.1.e164.arpa" are resolvable to all appropriate Tier 2 primary and secondary name servers;

- the data in the Tier 2 name servers could be retrieved successfully (e.g., via a utility such as DIG)

The fourth activity is to allow ENUM-enabled ASPs to test query/response activities against the NAPTR records in the Tier 2 name servers. This activity can overlap into Phase 2 with an increased number of telephone numbers being registered.

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[2] For example, if a participant in the Morristown, NJ area wanted to use a telephone number of one of its employees from that area, the NPA 973 should be included in the list of NPAs to be used in the trial.

7.2   Phase 2 - Registry/Registrar Interface

Roles
Involved: Tier 1Bs, Tier 2 Providers, Registrars, Application Service Providers

Duration: 3 months

Activities: The principal activity in this phase is to test the Registry/Registrar interfaces. A first part of this activity is to test establish manual interfaces between the two roles for bootstrap purposes. The manual interface may consist of facsimile or e-mail transmission methods. The amount of data processed via these manual methods should be limited to a reasonable amount (TBD) of transactions. The second and main part of the activity is to implement and test an automated interface using EPP[3] or other interfaces as may be standardized in the future, subject to the prior agreement of those trial participants.

The following scenarios should be tested using the EPP interface between the Registrar and the Tier 1B as well as the Tier 2, as appropriate:

1. add new registration

2. transfer existing registration to new Registrar

3. delete existing registration

4. add new NAPTR records to existing registration
   a.   add different ENUMService types
   b.   add same ENUMService types

5. modify existing registration service data

6. delete some NAPTR records from existing registration

During this phase, participating Registrars should be encouraged to study various procedures for validation and authentication during registration. This should continue into phase 3. Registrars should be encouraged to make use of both external and internal sources to determine which work best and in what specific circumstances (e.g., is the Registrar also an Application Service Provider, does the Registrant already have a relationship with the Registrar).

A second activity is to develop the necessary ContactInfo infrastructure at the appropriate Tiers. This information may be important during the trial process to resolve any issues that arise.

A third activity is to conduct extended call/service setup and completion using ENUM-enabled applications. Termination of communications in this phase should be limited to controlled environments such as within labs. A directory of test numbers should be published and available to trial participants only. ASPs should work with Registrars to include realistic test data and to ensure that all ASPs are given non-discriminatory access

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[3] Using http://www.ietf.org/internet-drafts/draft-ietf-enum-epp-e164-08.txt or the current version as appropriate.

to the registration and update processes. This activity can overlap into Phase 3 where increased complexity in the service environment can be tested.

7.3   Phase 3 - Application Testing

<u>Roles Involved</u>:   Tier 1Bs, Tier 2 Providers, Registrars, Application Service Providers

<u>Duration</u>:   2 months

<u>Activities</u>:   In this phase, service providers can test against the trial ENUM infrastructure in order to validate their service architectures. These activities should be conducted on a non-commercial basis. Call completion between endpoints of different service providers should be encouraged.

Alternative approaches to distinguish "carrier" information that would coexist with user-originated NAPTR records should be studied. Some approaches that could be studied *might* include, but need not be limited to, the use of txt or Hinfo to specify a Carrier SPID, the use of non-terminal NAPTRs, experimental ENUMService subtypes (e.g., "E2U+SIP:X-CXRAOR"), and the use of different order values. As part of the study, participants should determine the impact of carrier information on U.S. Government ENUM policy directives and regulatory issues.

In addition, interested parties could test other delegation schemes and registry procedures. Registrars could test automated interfaces (such as via web pages) that would allow Registrants to add new ENUMService data, modify certain existing ENUMService data, and delete certain existing ENUMService data.

8   Issues for Immediate Resolution

The Country Code 1 ENUM LLC will be responsible for selecting a Tier 1A Registry operator and managing that relationship for the trial. This is necessary to enable individual national trials to take place by NANP nations. While not within the scope of the ENUM Forum or the US ENUM Trial, it is recommended that the trial Tier 1A not be permitted to bid on the permanent Tier 1A Registry. This is not an issue with the Tier 1B Registries since all volunteers for that role will be accommodated within the trial framework.

Acceptance of the trials' program will be demonstrated by three events:

- the approval of this document by the membership of the ENUM Forum

- the agreement of at least two CC1 countries to request the temporary delegation of CC1

- the fulfillment of all trial roles by volunteer companies

9 Other/For Further Work

9.1 Zone Architecture

The concept of a zone is based on delegation of the domain name for the zone. The "root" zone for ENUM is e164.arpa, and RIPE NCC acts as the current Tier 0 to administer the DNS records for the164.arpa zone. Tier 0 can then delegate zones for country codes. For example, +46 is the E.164 country code for Sweden, and the zone 6.4.e164.arpa is delegated for Sweden to administer.

The case for country code 1 is different. CC1 is an integrated numbering plan shared by "Canada, the US and its territories, and the Caribbean." There have been many discussions about alternatives for delegating ENUM resources under CC1.

Two principles should apply to whatever architecture is used for ENUM for CC1:

- The domain 1.e164.arpa should be managed as a DNS zone, and
- The domain for each NPA should also be managed as a DNS zone

In other words, there should be DNS delegations (zone cuts) at 1.e164.arpa for CC1 (in the Tier 1A) and at each z.y.x.1.e164.arpa for each NPA +1+xyz (in the Tier 1B).

It is important to note that this approach does not preclude any of the alternatives for DNS delegation. A delegated zone could be administered on the same nameservers as the parent zone, or it could be administered on different name servers. Depending on the specific software implementation used for a specific DNS nameserver, there may be a single "zone file" that contains the data for all the zones hosted by that nameserver.

9.2 Sharing Trial CC1 Administration of 1.e164.arpa

The administration of the CC1 Tier 1A is complicated because more than one country is involved. It is a challenge to find arrangements that are both technically and politically satisfactory. However, there may be ways to share the administration of the CC1 Tier 1A zone by separating and distributing some of the functions. The following approach is suggested as a strawman for discussion.

It is possible for separate parties to

- administer zone data and create the master zone files,
- operate the primary name servers that load the master zone files, and
- operate the secondary name servers that have replicas of the master zone files

Note that "primary/master" and "secondary/slave" refer to the source of zone data files.

- "Primary/master" name servers load their zone files from authoritative offline sources, e.g., authoritative database servers

- "Secondary/slave" name servers load their zone files from other authoritative name servers, e.g., other primary (or secondary) name servers

For example, either the US or Canada could operate a database server that is the authoritative source of zone data, while either Canada or the US could operate the primary nameservers. Such arrangements could help resolve some open issues during the trial period.

In addition, it is possible for there to be different parties that have administrative responsibility for different sets of 1+NPA zones. For example, within CC1, each participating national administration would be responsible for its own ENUM zone(s), irrespective of the physical architecture of Tier 1.

9.3   DNS Security Mechanisms

One of the most important aspects of the ENUM infrastructure and its provisioning process is security. Data needs to be transfered between various parties in a secure manner. ENUM clients also need to know that responses to ENUM queries are authentic. Various security mechanisms are necessary to make this possible. Some of those mechanisms, however, have yet to be fully implemented and tested in commercial applications. While it is important that the trial be used to evaluate the effectiveness of the various security mechanisms, it may be difficult to fully achieve that objective because of the lack of availability of implementations in applications such as DNS resolvers.

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