US End-user ENUM Trial

Final Report, 2007

1) Introduction

This is a report of the trial of End-user ENUM in the United States sponsored by the Country Code 1 ENUM Limited Liability Company ("the LLC") and executed by participating entities ("Participants"). ENUM, as set forth in Internet Engineering Task Force (IETF) RFC 3761, specifies a protocol for use of the Domain Name System (DNS) for identifying services associated with an E.164 telephone number. Public, or End-user, ENUM is designed to support end-user control of ENUM records for his or her telephone number so as to associate various services from his or her chosen service providers with that number.

The purpose of conducting a U.S. Trial was to test the architectural, technical, operational, and user aspects related to the provision of ENUM capabilities for the U.S. under Country Code 1. It was anticipated that the U.S. Trial could provide valuable experience, data and information concerning the implementation of the ENUM protocol. This report provides results from the U.S. Trial to relevant authorities and to the public in order to assist parties interested in learning about ENUM, including commercial implementation of ENUM capabilities.

The technology of End-user ENUM can be made to work. During the first phase of this trial, the necessary DNS infrastructure was established to support the trial. The administrative procedures established for the delegation of approved NPAs allowed for appropriate policy controls over registry actions at the Tier 1A level. Additional controls need to be implemented at the national level to ensure that similar policies are reflected throughout the provisioning process. While the concept of registrant authentication and validation was tested during the second and third phases of the trial, there are recommendations for improving this key component that must be realized before commercial implementation can take place. Finally, if the industry wishes to pursue End-user ENUM, it will need to make ENUM-enabled applications available in the marketplace.

This report is divided into four sections. The first deals with the legal-regulatory and administrative arrangements for the trial and the effects of these arrangements on the trial. The second section deals with the goals of the trial, as such, and the third section deals with the actions of the participants to achieve those goals. The fourth section deals with issues arising from the trial, points of interest, and recommendations for the future.

2) *Chronology of Events External to the Trial*

The US End-user ENUM trial was conducted between March 2006 and June 2007 under the direction of the LLC. The purpose of the trial was to work out a set of procedures related to implementing End-user, or Public ENUM.

The use of telephone numbers is strictly regulated by treaty and law. At the top end lies the International Telecommunication Union[1], to which nation-states adhere by treaty. The ITU defines the international telephone numbering system in Recommendation E.164. E.164 is the scheme by which telephone numbers are made to work internationally. In a system of global routing of telephone calls, control must be exercised over the telephone numbering system so that any telephone can reach any other in the world. To maintain the integrity of the numbering system when numbers are converted to domain names through ENUM, the IETF and ITU agreed that End-user ENUM would be implemented under a specific apex (e164.arpa) in the domain name system and that delegations under e164.arpa would be controlled by the appropriate national regulatory authorities responsible for given country codes under the E.164 Recommendation.[2] In the case of Country Code 1, the delegation is made more complicated by the fact that the United States, Canada, and many Caribbean countries share the "1" prefix.[3]

In response to a request from the LLC to conduct a trial of End-user ENUM, the United States Government (USG) issued a letter on September 5, 2005 encouraging the LLC to proceed subject to certain conditions. The letter and these conditions may be found at the LLC's website.[4]

Delegation of the ENUM domain for Country Code 1 (1.e164.arpa) to the LLC for the trial was sought by the USG by a letter from Ambassador David Goss (U.S. Coordinator for International Communications and Information Policy) to Hulin Zhao, Director of the Telecommunication Standardization Bureau on December 5, 2005 and obtained from the ITU on February 13, 2006. The Canadian government supported the application of the USG for authority to conduct an ENUM trial.[5] The Jamaican government also supported the application.

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[1] www.itu.int
[2] http://www.itu.int/ITU-T/inr/enum/procedures.html
[3] Country Code 1 includes the United States, Canada and a number of Caribbean states, and US overseas dependencies. See http://en.wikipedia.org/wiki/List_of_country_calling_codes
[4] http://www.enumllc.com/USGDelLetter.pdf
[5] Letter of support from Michael Binder, Assistant Deputy Minister, Department of Industry, to Hulin Zhao, of December 14, 2005

Earlier in 2005, the LLC had signed an agreement[6] with the Canadian Internet Registration Authority (CIRA)[7] for the latter to act as the trial Tier 1A registry, the entity that would manage the country code "1" delegation for the LLC. CIRA would stand between the Réseaux IP Européens Network Coordination Centre (RIPE-NCC), which was the root, or Tier 0, for ENUM look-ups, and the two Tier 1B registries (operated by NeuStar and VeriSign) in the United States that participated in the trial. The purpose of the Tier 1A was in part to allow other countries in the North American Numbering Plan (NANP[8]) to join in the trial on terms set by their respective governments. CIRA's contract with the LLC obliged it to allow connection only with those registries authorized by the respective national administrations to participate in the trial, with the LLC as the only interlocutor between the United States Government and CIRA.

The LLC devised a Memorandum of Understanding (MoU) to which trial participants were required to agree.[9] This was completed in March 2006. It mirrors the conditions that the USG imposed upon the LLC in its letter of September 5, 2005. Trial Participants signed the MoU as a precondition to participating in the trial, and this rule was strictly enforced throughout. No entity was allowed to participate in meetings of the Trial Participants Advisory Committee (TPAC) without having signed the MoU, and the determination of who had signed was a matter for the LLC, which communicated the names and representatives of the authorized participants to the project executive (engaged by the LLC).

One of the most important terms set by the USG was that the LLC would have to apply to the Federal Communications Commission for permission to use numbers from the NANP in the trial, for which purpose a waiver would be granted by the FCC under its numbering rules.[10] The LLC accordingly submitted a waiver petition to the FCC on March 15, 2006.[11]

Efforts to obtain waivered numbers continued until August 2006, when the trial participants and the LLC concluded that alternate arrangements would be required. The interaction of the LLC with the FCC is set out in a letter from counsel for the LLC to the Secretary of the FCC of June 15, 2006, found on the LLC's website.[12] While the failure to obtain waivered numbers did not

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[6] http://www.enumorg.ca/pdfs/CIRA%20MOU.pdf
[7] on February 9, 2005.
[8] http://www.nanpa.com/
[9] http://enumllc.com/MoU2.pdf
[10] http://www.enumorg.ca/docs/UStrials/WaiverRequestNumbersFCC.DOC
[11] http://fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6518332172
[12] http://enumllc.com/061506FCCExParte.pdf

ultimately prevent technical verification of ENUM, the delay from June to September 2006 probably caused some participants to drop out of the trial.

In the absence of action by the FCC to provide numbering resources under the terms and conditions for the trial outlined by the USG, the LLC decided to execute an alternate trial plan in order to move forward under these circumstances. These terms effectively eliminated the need for telephone numbers issued under special conditions of government approval, while retaining all the others that had been imposed by the USG. The plan may be found on the LLC's website.[13] The decision was taken to make enumtrial.us the root of the delegation rather than e164.arpa. By taking this decision, the LLC obviated the need for approvals from various departments of the USG, from other Country Code 1 governments, and the ITU. For trial participants, it meant that they could contribute numbers to the trial which they had already been assigned in the normal course of business.

3) *Chronology of Events within the Trial Participants' Advisory Committee*

3.1 *Methods and procedure*

The basic terms of the public ENUM trial were established in two documents. One was the ENUM Forum Document 6003_1_0, *Framework Document for a US/CC1 ENUM Trials Program*, of May 3, 2005[14] and the other was the Memorandum of Understanding between the trial participants and the LLC.

The *Framework Document* set forth the proposed architecture, purposes and roles for the trial (discussed below). As mentioned above, MoU between the LLC and trial participants governed their participation in the trial. Signing the MoU was a precondition to participating in the trial. The TPAC created and conducted test procedures. The individual participants met occasionally in physical meetings but for the most part conducted their work in weekly conference calls under the chairmanship of the Project Executive, a person engaged by the LLC for that purpose.

The Trial Participants followed the three phases that were set out for the trial in the *Framework Document* of 2005. The document outlined the phases as follows:

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[13] http://www.enumllc.com/AltPlan.pdf
[14] www.enumf.org

"Phase 1 - Registry Infrastructure, which was designed to consist of the delegation of Country Code 1, the North American telephone number prefix, from the Tier 0 Registry (RIPE-NCC[15]) to the designated Tier 1A registry, which, for the purposes of this trial, was the Canadian Internet Registration Authority, CIRA.[16] The second portion of Phase 1 was to delegate area codes, known in the trade as Numbering Plan Areas (NPAs) from the Tier 1A to the appropriate Tier 1B registries. The *Framework Document* called for the Tier 1A to implement and test a procedure to ensure the integrity of the national opt-in/opt-out process. If there was to be more than one Tier 1B Registry from any specific country, each might be delegated a different NPA for the trial.

"Phase 2 - 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 Extensible Provisioning Protocol (EPP) 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 Naming Authority Pointer (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

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[15] From Réseau Internet Protocol Européen – Network Control Centre, an organization in the Netherlands delegated authority by the ITU to handle the look-ups necessary to make ENUM work.
[16] www.cira.ca

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.

"Phase 3 - Activities: 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. [….]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."

These were the desired outcomes laid down in the *Trial Framework* document. The trial participants proceeded to devise tests cases for each phase of the trial, and once the decision was made to proceed with the root *enumtrial.us* and with telephone numbers contributed by the trial participants themselves, the TPAC could begin to complete some of the missions proposed for the trial.

3.2 Roles of the trial Participants

The Participants assumed roles corresponding to the architecture of the trial, which is set out below in Figure 1.[17]

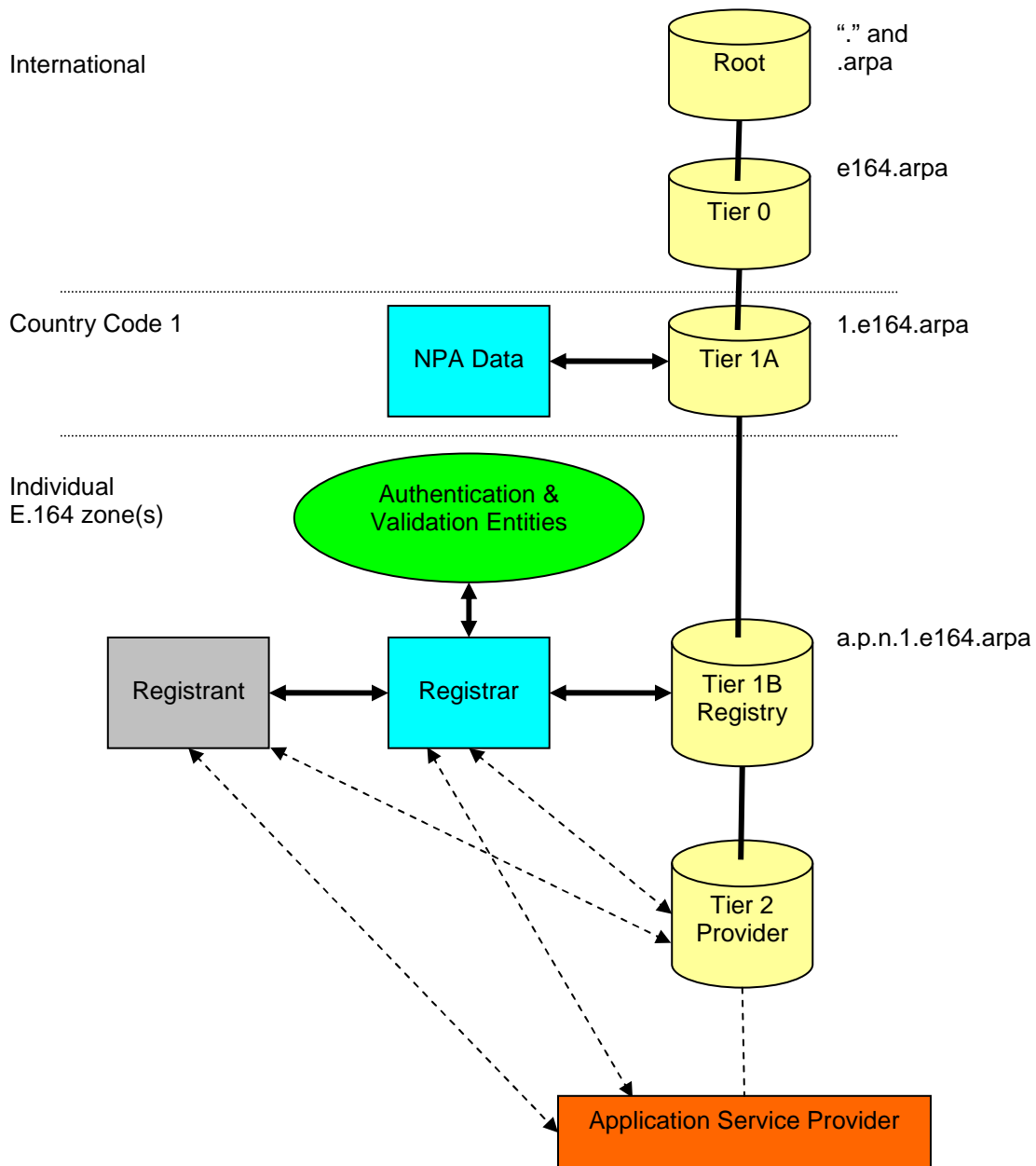**Figure 1. Components of a Platform for an ENUM Trial**

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[17] Figure 1 shows the original architecture for the trial using the apex e164.arpa. For the alternate trial plan using enumtrial.us, CIRA took on the roles of both Tier 0 and Tier 1A.

Company	Registrar	T1B	T2	Auth	TSP[18]	ASP	End-User
AG Design							✔
AT&T (was BellSouth)				✔			
Calleveryone.com[19]							✔
DelTel[20]	✔		✔	✔	✔	✔	✔
Encirca	✔						
EnumDNS[21]	✔						
Evolving Systems[22]	✔	✔					
GoDaddy[23]	✔		✔			✔	✔
InCharge Systems				✔			✔
Instra	✔		✔	✔			✔
NeuStar		✔	✔				✔
Qwest[24]			✔		✔		✔
Seiri			✔		✔	✔	✔
VeriSign		✔	✔	✔			✔
Verizon							✔

Figure 2: Participation and Trial Roles

✔ – Company agreed to fulfill that role in their MoU

3.3   Test Case Development and Trials

The development of test cases proceeded within the TPAC based on Participant input. Test cases were designed to elicit information which the *Framework Document* had proposed should be developed in each phase of the trial.

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[18] The Telecommunications Service Provider (TSP) role was not required with the alternate trial plan

[19] Calleveryone.com left the trial in early 2007

[20] DelTel trial participation was suspended in late 2006

[21] EnumDNS joined the trial during the testing phase

[22] Evolving Systems trial participation was suspended in late 2006

[23] GoDaddy left the trial in early 2007

[24] Qwest left the trial in early 2007

Phase 1: Registry Infrastructure and delegation of NPAs to Tier 1Bs

The first part of Phase 1 consisted of setting up relations between CIRA, the Tier 1A registry, and the two Tier 1Bs, NeuStar and VeriSign, and populating the registries with numbers assigned to the trial.

Phase 1 tests were devised by Scott Hollenbeck of VeriSign, approved by Richard Shockey of NeuStar, accepted by the TPAC in June 2006 and actually tested in the months of October and November 2006. The delay was occasioned by the consequence of not receiving approval from the FCC to use "waivered" numbers from the Pooling Administrator. The Phase 1 tests themselves are set out in Appendix 1. They presented no difficulty for the parties involved – CIRA and the to Tier 1B registries - and were completed successfully.

To ensure that only properly authorized NPAs were placed into the Tier 1A registry and delegated to the proper national Tier 1B registries, the LLC defined a process where it would act as a third-party gatekeeper between the registries at the two tiers. This process was:

> 1. The ENUM LLC would provide, in writing, to CIRA (Tier 1A) a list of the Tier 1B Registries and a list of the NPAs assigned to each. The LLC would attach a copy of the waiver as proof of USG opt-in to the trial. Instead, under the alternate trial plan, the TPAC needed to provide a list of the telephone numbers to be included in the trial and an indication as to which Tier 1B registry a particular NPA was assigned. Once the LLC approved that list, it would provide that information to CIRA.

> 2. Each Tier 1B would contact CIRA to provide the necessary technical details for the delegation of one or more specific NPAs. The CIRA-LLC MoU had provided a framework for such exchange of information, The Tier 1B also needed to copy (in some fashion) the LLC with the technical information.

> 3. CIRA would validate that each request from a Tier 1B registry was on the authorized list provided by the LLC. That validation needed to include not only that the NPA was authorized to be delegated, but that it was assigned to the requesting Tier 1B registry.

Essentially the tests in Phase 1 involved the manual placement of data into the DNS, and the appropriate delegations between Tier 1A and Tier 1Bs. "Delegations" in this context refer to the process whereby:

1) the respective companies declare who shall be their authorized representatives, and their order of precedence,

2) CIRA then accepts from the LLC the NPAs of telephone numbers contributed to the trial, and

3) CIRA delegates the NPAs to the two Tier 1B registries according to an equitable split agreed upon by the TPAC.

Note that not all numbers contributed were used in the trial nor were they registered with either of the Tier 1B registries.

Figure 6: Area Codes initially allocated to Tier 1B Registries on September 29, 2006

NeuStar	VeriSign
469/ 319/ 972/ 480/ 571/949	518/ 515/ 301/ 630/ 816/ 703

Figure 7: Numbers Contributed to the Trial, Numbers registered in CIRA and assigned to Tier 1B registries as of May 16, 2007

NPA	TPAC Tier 1B	CIRA Tier 1B	NPA	TPAC requested	NeuStar registered	VeriSign registered	Company
202	N		202	2	0		EuroDNS
203	N		203	3	0		AT&T
205	N		205	4	1		AT&T
212	N		212	2	1		EuroDNS
214	N		214	2	1		AT&T
256	N		256	1	0		AT&T
301	V	V	301	1		3	AG Design
303	V		303	0			?
310	N		310	2	0		AT&T
314	N		314	1	0		AT&T
319		N	319		2		GoDaddy
323	N		323	2	0		EuroDNS
469		N	469		1		Instra
480		N	480		3		GoDaddy
515	V	V	515	2		0	InCharge
517	N		517	2	0		AT&T
518	V	V	518	6		0	Seiri
571	N	N	571	1000	5		NeuStar
616	V		616	3			AT&T
619	V		619	1			AT&T
630	V	V	630	2		0	InCharge
703	V	V	703	35		24	VeriSign
714	V		714	1			AT&T
816	V	V	816	2		0	InCharge
818	V		818	1			AT&T
860	V		860	2			AT&T
954	N		954	2	0		EuroDNS
972	N	N	972	12	2		Verizon

As it happened, as the work of the TPAC progressed, some participants contributed additional numbers to the trial and the communication of these additional NPAs for the contributed numbers from the TPAC to the Tier 1A through the LLC was never fully completed. The result was that the NPAs of these numbers were not delegated to the appropriate Tier 1B Registry. Some contributed numbers did not resolve as a consequence even though some data was provisioned in the Tier 2 name server. This suggests that, even though the NPA authentication/delegation process was adequate, in a production environment, care would need to be taken to manage delegations in a systematic way such that data would not be provisioned into a Tier 2 name server without the provisioning process successfully completing at the tier above.

The following Table sets out what was conceived would be achieved at the beginning of the trial. The Tables date from May 2006 and were not subsequently discussed in the TPAC. The Results column indicates the Project Executive's assessment of whether it was achieved.

These tables were created at the beginning of the trial but were not used to facilitate the trial. They are being used in the reporting phase to measure what we did against what we expected to accomplish at the beginning of the trial.

Table 1: Phase 1 Table of Expectations and Results

Day 1 Requirement	Responsible Party	Comments	Results
Tier 1B Name Servers	Registry Operator	Entities acting at Registries will have available at least 2 geographically separated name servers capable of answering requests on the full NANP 10 digit range. NS Records only	achieved
Tier 1B Web Interface for NS registrations.	Registry Operator	A manual interface would be put in place during Phase 1. Web and email support to be offered. Instructions offered on Web Site. Thick Registry Assumed Data to be collected attached.	achieved

Day 1 Requirement	Responsible Party	Comments	Results
Tier 2 Servers (Optional)	Registry Operator	Registry Operator may offer Tier 2 Services on physically separate servers	Not attempted
Tier 2 Interface	Registry Operator	Registries may offer Tier 2 services via separate WEB interface. Web interface will permit NAPTR registrations	The Tier 2 operator offered services, and entered data based on emailed input.
Phase 1 Validation – Phone Blocks	CC1 LLC	LLC must provide to T1B registries list of all Pooled Blocks approved by FCC and Pooling Administrator	Permission to issue numbers never came from the FCC
Delegation of NPA .1.e164.arpa blocks from T1A	CC1 LLC	Upon approval from the Pooling Administrator. LLC Delegation of US NPA's to from T1A to T1B's via SOA records.	Permission to issue numbers never came from the FCC
Phase 1 Validation - Registrars	CC1 LLC	LLC must provide to T1B registries list of all entities approved as Registrars	achieved
Contact Info Infrastructure	Registry Operator	All entities recording data must collect Contact Info Data as Required. Contact Info Server (IRIS) not required at Phase 1	achieved
ENUM-enabled Applications	Registrants	Presumably someone has an application they want to test such as SIP	ENUM-enabled applications were found

3.3.2 Phase 2: Registration of Numbers with registrars, manually and through EPP

The second phase of the trial tested the registry-registrar interfaces through the Extensible Provisioning Protocol (EPP). This US trial was the first to test an implementation of RFC 4114. As there was, at the time, only one registrar in the trial, this phase tested relations between NeuStar and VeriSign, the Tier1B registries, and EnCirca, the registrar. Phase 2 tests are set out in Appendix 2.

By late January 2007 VeriSign and NeuStar had servers capable of EPP available for the trial. VeriSign reported that it adapted a standard implementation for new generic top level domains for the trial. EnCirca reported that there were no problems with conforming to the interfaces established by the Tier 1B Registries. The obstacle of getting through the firewalls of both Tier 1B registries was a minor irritant which was overcome. Firewalls are normal parts of registry security with which registrars deal regularly.

The following steps describe the steps that were taken in an interface between Registrars and Authentication Agents in Phase 2 of the End-user ENUM Trial to register a phone number for ENUM services:

1) Registrar will collect the registrant information.
   a. Data will include: Name, Address, City, State, Zip, Phone number (to be registered), email address, and payment method.
2) Registrar will present the registrant with an email that contains the domain ID in the form of a parameter to a URI link that will be an Authentication Agent web site.
3) The registrant will then access the Authentication Agent web site and begin the authentication process
   a. If this process is not complete with in 5 days, the registration is cancelled.
4) Once the registrant has either passed or failed the authentication definitively, Authentication Agent will provide back to Registrar the Domain ID along with the status of the authentication in the form of a Boolean pass/fail.

At this time, there will be no failure reason stated – this would be up for change review at the time of a production release.

The authentication process introduced by InCharge Systems for the trial required users to go to InCharge Systems via the web and enter in their registrant identity information. The process then required users to call InCharge Systems and enter a specific code into an IVRU. Once that process was complete, a call back was made to the registrant from the IVRU that again asked them to enter in some piece of data that only InCharge and the registrant knew. For future fully operational systems, InCharge Systems may use, in addition to the systems mentioned above, other factors and sources of authentication, such as using a Line Information Database (LIDB) dip to obtain additional information about the registrant and the phone number

This process was designed to limit the opportunity for party to obtain the ENUM registration for a number that is not theirs.

In short, Phase 2 did not occasion any particular difficulties for the Participants. Part of the reason can be attributed to the fact that for such organizations, establishing registry-registrar interfaces is the normal course of business for both registrars and registries.

Table 2: Phase 2 Table of Expectations and Results

Day 1 Requirement	Comments	Results
Tier 1B EPP Registrar Interface.	It has been contemplated that the first part of this phase would be to establish a manual interface. However, recent discussions have indicated that a manual interface would be put in place during Phase 1. During Phase 1 Participants in Registrar and Tier 1B Registry roles should also collaborate on implementing an EPP interface based on RFC 3730, and 3731 as appropriate. The EPP interface would be available on day 1 of Phase 2. The EPP interface would support check, create, delete, and update.	EPP was used in Phase 2. An EPP interface was developed for the trial in the January-February 2007 period. This was achieved..
Tier 2 EPP Registrar	During Phase 1, Participants in	This collaboration

Day 1 Requirement	Comments	Results
Interface	Registrar and Tier 2 roles would collaborate on implementing an EPP interface based on RFC 4114, 3730, and 3731 as appropriate. The EPP interface would be available on day 1 of Phase 2. The EPP interface on day 1 would support check, create, delete, and update.	occurred. These capabilities were supported.
Registrar/Validation Interfaces	During Phase 1 Participants in the Validation role would collaborate with those in Registrar roles on the details and availability of validation interface(s). The goal of those in the Validation roles should be to have an interface available on day 1 of Phase 2.	Accomplished in March 2007 between EnCirca and InCharge DNS. An automated interface was established.
ContactInfo Infrastructure	Current understanding is that this infrastructure would be developed during Phase 2. If that instead should occur during Phase 1, additional Registry/Registrar Interface functionality may be required to be in place on day 1 of Phase 2.	Not applicable at this stage, was achieved in Phase 2
ENUM-enabled Applications	Using ENUM-enabled apps to conduct extended call/service setup and completion is a necessary aspect of the trial during Phase 2. Those in ASP roles should be preparing now and during Phase 1 in order to begin running designated test cases as soon after day 1 of Phase 2 as possible.	ENUM-enabled applications were not tested until Phase 3 in February-March-April of 2007

3.3.3: Phase 3 Tests

In Phase 3, the basic architecture was tested by end-users, and the Tier 2 service provider, who held the NAPTRs for the telephone numbers, was engaged for the first time. It was apparent that there is a scarcity of applications that were/are capable of using ENUM. The second observation was that Phase 3 involved significantly more complex operations among a number of players.

There were a couple of ENUM call completion tests using ENUM-enabled software. End-users were required to obtain a SIP client, download X-lite software to enable a call, as well as register a number with the registrar and create a NAPTR in the Tier 2.

Examples of issues dealt with in Phase 3 are captured in the following extracts from the May, 2007 meeting notes:

May 10, 2007

AG Design observed that he had registered a number with EnCirca, had it populated with VeriSign, but that its validation with InCharge Systems (ICS) had subsequently failed.

This raised the question whether a number should be validated before it was populated. The alternative in the real world environment might well be a host of false registrations if this were not stopped.

AG Design then registered a telephone number that was not on the list of numbers previously presented to the ENUMLLC. He expressed concern that in a production environment he could load a Tier 1B with numbers that point to non-existent servers. Registration should not go ahead without the Tier 2 nameserver (validating?), he said.

Seiri pointed out that whoever operates the Tier 1B should have the tools to identify lame delegations[25] and tools to remove them.

May 17, 2007

Seiri had attempted to register a number with EnCirca, without success. Firewall issues between EnCirca and VeriSign had prevented this. This was described by VeriSign as a production "blip" which had since been fixed.

CIRA was in the process if restoring one of its two servers dedicated to the trial, which had been knocked out by a power failure in the building.

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[25]A Lame Delegation is a zone delegations to any name server that is not authoritative for that zone

During this week's test session it was discovered that some numbers volunteered for the trial had not been delegated to the Tier 1A in a formal communication from the ENUMLLC. AG Design subsequently created a tally of area codes delegated to NeuStar and VeriSign.

This information allowed the project executive to send to the ENUMLLC a tally of the numbers contributed to the trial as of March 29th, 2007 contrasted with the numbers entered into the servers of CIRA acting as Tier 1A and NeuStar and VeriSign, the Tier 1B registries. The document is with the ENUMLLC at the time of writing. CIRA stated that it would enter whatever numbers it was requested to enter by the ENUMLLC.

Verizon pointed out that there several more issues arising from the test session than the DNS configuration issue mentioned above, such as the number of registrants with registered numbers in the Tier 2, availability of ENUM-enabled software, filling in the NAPTRs with Uniform Resource Indicators (URIs) pointing to ENUM-enabled services, and so forth. He observed that there were 11 NPAs delegated to CIRA but only a couple of numbers had been registered in the Tier 2 Registry.

Seiri observed that EnCirca had not been sending registration requests automatically to the Tier 2, and that he had to register information manually in the Tier 2. He stated that there were communication problems between EnCirca and the Tier 1As and between EnCirca and the Tier 2.

In response to a comment of AG Design, VeriSign noted that it was impractical to ask for more capability in the trial than exists today in a production environment. AG Design noted that the job of the trial is to provide information for the Request For Proposal (RFP) process which is expected to follow the trial.

VeriSign offered to create a diagram of the call-flow of an ENUM-enabled look up, noting that it would allow is in our discussions, identify problems and see what we need to fix. It was noted that the call-flow diagram does not need to go into the actual operations of a SIP call – the DNS look-up of the URI being the main feature.

In the event, the TPAC did engage in a couple of testing sessions at which various SIP-enabled, ENUM-facilitated calls and exchanges took place.

Test cases for Phase 3 are found in Appendix 3.

Test results for Phase 3 are found in Appendix 4.

The following steps were required for Phase 3 tests to take place:

Table 3: Phase 3 Day 1 Requirements and test case outlines

Day 1 Requirement	Responsible Party	Comments	Results
Identify applications for use in testing	Registrants	While there is no need to limit the applications used in testing, we do want to make sure that we at least have somewhat of a representative sample of potential applications. During Phase 2, each Participant that wants to participate in the trial as an ASP should provide some overview information about their application and the test-cases they can participate in. Ideally, we get at least one application in each of the following three categories: Telephone Call, Instant/Text Messaging, and Email.	Applications involved placing voice calls using SIP. Seiri provided voice conferencing and voice messaging through ENUM-enabled applications
Identify application-related test cases	All Participants	Prior to commencing Phase 3, we need to identify the specific test cases that we intend to test. This list will be created during Phase 1 and 2 after the list of applications is determined. This is a different list of tests than those created for Phase 1 and 2 and will not concentrate on the registration interface or registry reliability. It will, however, include extensive testing of NAPTR parsing.	A generic test case for phase 3 was developed by AG Design. SIP calls through ENUM relied on working relations among end-users, the Tier 2 (NAPTR) record holder and the registrar.
Determine how to handle calls from non-ENUM enabled devices	CC1 LLC, TSPs, and ASPs	The ASPs need to work with the LLC to determine the handling of standard PSTN calls from non-ENUM enabled devices during the trial. Ideally, at least some of the Pooled Blocks that are allocated to the LLC for the trial would be turned-up on the PSTN. The LLC would then work with the TSPs and ASPs to determine how to transport those calls to the ASPs using traditional methods. This allows the testing of various failure scenarios (NAPTR records unavailable or incorrect). It also allows the testing of potential applications that could take calls from the PSTN and forward them using NAPTR records.	Not done. No TSPs eventually participated in the trial, nor were they necessary once the trail used *enumtrial.us* as the root

Day 1 Requirement	Responsible Party	Comments	Results
		Since this could require interconnects between TSPs and ASPs, this process needs to start as soon as possible – definitely during Phase 1.	
Prepare applications	ASPs	Before the start of Phase 3, the ASPs need to make sure their applications are ready to look-up and understand NAPTR records and complete calls (or messages, or whatever else is being transported) using ENUM data.	Achieved
Provide software and/or accounts to Participants	ASPs	Ideally, all of the Participants that are ASPs will either provide a trial copy of their software or a trial of their service to all Participants that want to stand-in as end-users (which, assumedly, is all the Participants). This will allow all Participants to test the entire process – from registration to call delivery. This should be accomplished during the beginning of Phase 3, as soon as the ASPs complete any required internal testing.	While no ASP applications were offered, Participants used both soft-clients and SIP-enabled hardware phones.
Integrate one or more applications with registration process	ASPs, Registrars	In addition to testing NAPTR lookup and call-completion, one or more applications may be able to provide the "end-user" with a fully integrated experience where the end-user signs up for a service and the ASP automatically registers the end-users number and inserts the initial NAPTR records into the Tier-2. While this doesn't test anything that hasn't been tested elsewhere in the trial, it would be a good end-to-end test.	Such functionality was not available during the test.

4. Observations and Conclusion

4.1 Authentication

The authentication agent used for the trial a proof of concept system that embodied a single method for authenticating a number as detailed in Section 3.3.2. The system was not intended to reflect what a fully operational system would embody and worked as expected. For the purposes of a fully operational ENUM system, the following design features should be addressed by operational systems and procedures:

- Once the authentication process starts, the user should be able to interrupt or cancel it
- During the authentication process, the user should be given a point of contact
- The user should get information about time limits, e.g., a user must make a callback attempt within 24 hours of receiving authentication instructions
- A user should be able to query for the authentication status of a number
- If an authentication attempt fails, the user should be given information about what happened and alternatives for how to proceed
- Failure paths within the authentication agent need to be further developed. The effect of failed authentications among and between the various entities (registrant, authentication agent, T1B, and registrar) also need to be further developed
- Alternative methods must be available to authenticate legitimate numbers that fail the usual authentication process, such as a distinctive ringing number for an existing line. Alternative methods, such as a query of the LIDB, are available and would be used in a production environment

4.2 DNS Configuration

Some ENUM domains resolved to the Telephone Number (TN) level, but trying to resolve intermediate domains for CC and NPA gave inconsistent results. A variety of digs were performed, including queries targeted to specific nameservers. Other web-based diagnostic tools indicated problems with configurations and resolution.
In the trial, a number of anomalies surfaced.

- The same entity had to function as both Tier 0 and Tier 1A because the trial took place in an alternate domain and not in e164.arpa
- Tier 1A did not contain a CC level delegation, only 1+NPA delegations

- The Tier 1A delegations did not completely match the documented NPAs
- One nameserver was out of service for some time
- The NPA and numbering documentation contained some anomalies
- Tier 1A NPA delegations and NPA zones in Tier 1Bs did not always match.
- One Tier 1B contained both CC and 1+NPA delegations
- One online tool indicated loops in resolution and multiple resolution failures

The operational systems and operators should satisfy a number of requirements.

- Industry standards for operating TLD nameservers[26]
- Coordination and periodic review of NPA configurations between Tier 1A and Tier 1B (s)

4.3 Coordination among Registries of Numbers Contributed to the Trial

Attempts to register different kinds of numbers revealed some anomalies during the trial. It should be noted that registration systems and procedures in the trial were not necessarily operational, and were even proof of concept in some instances. There are some possible lessons learned that could apply to the operational systems and procedures.

In the trial, some anomalies surfaced. While a set of numbers was identified for trial use, the trial systems and procedures did not take these into account. In one case, it was possible to register a number that was not a number listed for the trial[27]

The operational systems and operator procedures should address how to deal with situations like those that arose in the trial. For ranges of numbers that are identified as potentially not eligible for registration, the operational systems and procedures should check for this.

4.4 Coupling of Registration and Authentication

One registrar sent delegation information to a Tier 1B without checking for authentication. In particular, one number failed authentication but still was registered into Tier 1B. In addition, one number that was not listed for use in the trial was registered. These issues should be addressed by operational systems and procedures.

---

[26] The requirements for end user ENUM developed by the LLC's Technical Advisory Committee (TAC) already address this issue.

[27] Although the number was "registered" in the sense of being accepted by the Registrar, numbers in NPAs not identified to the Tier 1A (CIRA in the trial) could not be resolved since there was no corresponding record in the Tier 1. This represents one of the protections against registrations of excluded numbers built into the ENUM system.

Also, the registration process is complex, and not all parts were explained or coordinated. For a subscriber to start with a number and end up with at least one retrievable NAPTR, there are several stages and relationships that need to be clarified at the registrar at a minimum. These include the following.

- The user needs to have a number that can be authenticated. Some capability to determine the potential eligibility of a number for use in End-user ENUM, should be part of the registrar's function.

- Is it a valid assumption that a registration must include a delegation from T1B to a T2? If so, then the user needs to identify a T2, or else the registrar must somehow ensure that a T2 can be provided. If not, then this type of non-delegational registration needs to be defined and clarified.

- Is it a valid assumption that a registration must include at least one NAPTR? If so, then a user needs to identify a URI for an Enumservice, and such a URI means that the user must have an ASP supporting that URI. If not, then the minimum requirements for contents of a T2 zone need to be defined and clarified.

- Is it a valid assumption that each T2 should, or could have a standard record whether there are user NAPTRs or not? If so, what should such a record be?

- Is it a valid assumption that a user should be able to verify easily that a number has been registered? For a while, one registrar provided an interesting approach that displayed a web page for a registered number. Is there an user friendly method that is feasible, i.e., doesn't require the user to use dig?

- Is it required that a T2 exist before a delegation from T1B is made? If so, then this should be part of operational procedures and systems. Note that this avoids lame delegations. If not, then this needs to be reviewed for consistency with industry practice in running TLD-like domains.

- How should registrars, along with T1Bs and Authentication Agents, handle failure paths in registration and/or verification? If a number fails in the process of verification, the processes whereby the various parties deal with the failure need to be worked out. As this was a trial, and not a commercial implementation, it was not found necessary to work out all of the business process issues of a production environment.

4.5 Conclusion

Technically, End-user ENUM works. As this trial was technical in nature, there remain issues of business processes related to End-user-ENUM that need to be worked out prior to deployment of a production environment.

5. Related Online Documents

USG Terms and Conditions for the US ENUM Trial

Waiver Request by the ENUM LLC to the FCC

FCC Public Notice regarding ENUM LLC FCC Waiver

MoU Governing Participants in the End-User ENUM trial

Alternate Trial Plan for End-User ENUM

Meeting of the ENUM LLC with the Secretary of the FCC

Appendix 1: Phase 1 Test Cases

Summary of test cases:
1. Initial ENUM Registration (register domain name)
2. ENUM client-registry data sharing and change
    a. Check (view status)
    b. Info (view extended information)
    c. Delete (remove registration)
    d. Update (change registration)
3. Tier 1B reporting (see section 10 of CC1 ENUM LLC Tier 1B requirements)

Tier 1A-Tier 1B Validation

1) The ENUM LLC shall provide, in writing, to CIRA (Tier 1A) a list of:
    a) the Tier 1B Registries,
    b) 3 authorized contacts, and
    c) a list of the NPAs assigned to each.
   The LLC shall attach a copy of the waiver as proof of USG opt-in to the trial.

2) An authorized contact from each Tier 1B shall contact CIRA to provide the necessary technical details for the delegation of one or more specific NPAs.

3) Tier 1A (CIRA) shall

    (a) cross-check the contact and involved NPA against the most recent NPA/Tier 1B list
    (b) notify the ENUM LLC by email of the pending change (only required if ENUM LLC was not copied on the request from Tier 1B)
    (c) check the request for sanity (eg, typos, existence)
    (d) If all is in order then execute the request and notify Tier 1B contact and the ENUM LLC contact by email
    (e) If rejected then notify 1B contact and the ENUM LLC contact that the request was rejected

4) ENUM LLC may request changes to any NPA without Tier 1B approval.   Tier 1B contact will be informed of any such changes.

5) The ENUM LLC may request the re-delegation of an NPA without the approval of the previous Tier 1B holder. The re-delegation shall follow the steps previously described fir delegation in steps

Phase 1 – Test 1

Test Objective:

Initial ENUM Domain Registration

Test History:

Test Date	2006-11-16
Test Iteration Number	2

Test Participants:

Client (registrar)	EnCirca
Server (registry)	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	9.1.9.6.6.7.3.3.0.7.1.enumtrial.us
DNS name server host names	ns1.encirca.net, ns2.encirca.net
ENUM domain name registration period (in years)	1
Authentication, Authorization, and Accounting information	N/A

Test Method:

- Enter required information on registry web form
- Submit request
- Evaluate response

Expected Test Outputs:

- Response to confirm successful registration

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Admin system confirmed registration.
Added zone to EnCirca nameservers with default parking page.

Phase 1 – Test 2a

Test Objective:

Check status of ENUM Domain Registration

Test History:

Test Date	2006-11-16
Test Iteration Number	2

Test Participants:

Client (registrar)	EnCirca
Server (registry)	VeriSign

Test Inputs:

Status request

Test Method:

- Enter required information on registry web form
- Submit request
- Evaluate response

Expected Test Outputs:

Output	Value(s)
ENUM domain name status	Active

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Admin system confirmed registration

Phase 1 – Test 2b

Test Objective:

Get Information on ENUM Domain Registered

Test History:

Test Date	2006-11-16
Test Iteration Number	2

Test Participants:

Client (registrar)	EnCirca
Server (registry)	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	9.1.9.6.6.7.3.3.0.7.1.enumtrial.us
Authentication, Authorization, and Accounting information	N/A

Test Method:

- Enter required information on registry web form
- Submit request
- Evaluate response

Expected Test Outputs:

Response providing detailed information about the ENUM domain.
Detailed information will include all NS registered for that domain.

Output	Value(s)
ENUM domain name status	Active
DNS name server host names	Ns1.encirca.net, ns2.encirca.net

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Admin system confirmed registration.
DIG confirmation and Web Resolving check attached.

Web-based DIG (http://networking.ringofsaturn.com/Tools/dig.php) confirmed registration.

```
; <<>> DiG 9.3.2-P1 <<>> 9.1.9.6.6.7.3.3.0.7.1.enumtrial.us

;; global options:  printcmd

;; Got answer:

;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 56033

;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 2, ADDITIONAL: 2


;; QUESTION SECTION:

;9.1.9.6.6.7.3.3.0.7.1.enumtrial.us. IN          A


;; ANSWER SECTION:

9.1.9.6.6.7.3.3.0.7.1.enumtrial.us. 7200 IN A 69.72.142.98

9.1.9.6.6.7.3.3.0.7.1.enumtrial.us. 7200 IN A 216.98.141.250


;; AUTHORITY SECTION:

9.1.9.6.6.7.3.3.0.7.1.enumtrial.us. 7200 IN NS          ns1.encirca.net.

9.1.9.6.6.7.3.3.0.7.1.enumtrial.us. 7200 IN NS          ns2.encirca.net.


;; ADDITIONAL SECTION:

ns1.encirca.net.          80083     IN          A          216.98.139.169

ns2.encirca.net.          80083     IN          A          72.9.101.84


;; Query time: 57 msec

;; SERVER: 72.64.77.10#53(72.64.77.10)

;; WHEN: Fri Nov 17 06:37:33 2006

;; MSG SIZE  rcvd: 163
```

Confirmation that domain is resolving on web:

Phase 1 – Test 2c

Test Objective:

Delete ENUM Domain Registration

Test History:

Test Date	2006-11-16
Test Iteration Number	2

Test Participants:

Client (registrar)	EnCirca
Server (registry)	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	9.1.9.6.6.7.3.3.0.7.1.enumtrial.us
Authentication, Authorization, and Accounting information	N/A

Test Method:

- Enter required information on registry web form
- Submit request
- Evaluate response
- Test DNS response to ensure ENUM domain deleted

Expected Test Outputs:

- Response to confirm successful deletion of ENUM domain from Registration System
- Response to confirm ENUM domain does not resolve

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Admin system confirmed deletion of both nameservers: ns1.encirca.net and ns2.encirca.net assigned to domain. DIG confirmed deletion.

Phase 1 – Test 2d

Test Objective:

Update ENUM Domain Registration

Test History:

Test Date	2006-11-16
Test Iteration Number	2

Test Participants:

Client (registrar)	EnCirca
Server (registry)	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	9.1.9.6.6.7.3.3.0.7.1.enumtrial.us
DNS Name server host names	ns1.encirca.net
Authentication, Authorization, and Accounting information	N/A

Test Method:

- Enter required information on registry web form
- Submit request
- Evaluate response
- Test DNS response to ensure ENUM domain updated

Expected Test Outputs:

- Response to confirm successful update of ENUM domain in the Registration System
- Response to confirm changes to the ENUM domain reflected in the DNS response

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Deleted one of nameservers
Confirmed update

Appendix 2: Phase 2 test cases

Test: Authentication Agent/Registrar Interface

The following steps describe the steps that were taken in an interface between Registrars and Authentication Agents in Phase II of the ENUM-user ENUM Trial to register a phone number for ENUM services:.

5) Registrar will collect the registrant information.

   a. Data will include: Name, Address, City, State, Zip, Phone number (to be registered), email address, and payment method.

6) Registrar will present the registrant with an email that contains the domain ID in the form of a parameter to a URI link that will be an Authentication Agent web site.

7) The registrant will then access the Authentication Agent web site and begin the authentication process

   a. If this process is not complete with in 5 days, the registration is cancelled.

8) Once the registrant has either passed or failed the authentication definitively, Authentication Agent will provide back to Registrar the Domain ID along with the status of the authentication in the form of a Boolean pass/fail.

At this time, there will be no failure reason stated – this would be up for change review at the time of a production release.

The authentication process introduced by InCharge Systems for the trial required users to go to InCharge Systems via the web and enter in their registrant identity information. The process then required users to call InCharge Systems and enter a specific code into an IVRU. Once that process was complete, a call back was made to the registrant from the IVRU that again asked them to enter in some piece of data that only InCharge and the registrant knew. For future fully operational systems, InCharge Systems may use, in addition to the systems mentioned above, other factors and sources of authentication, such as using a LIDB dip to obtain additional information about the registrant and the phone number

This process was designed to limit the number of possible chances for someone in the cyber world to actively or passively obtain the ENUM registration for a number that is not theirs.

Phase 2, test 1

Test Objective:
Initial ENUM Domain Registration

Test History:

Test Date	5/07/2007
Test Iteration Number	1

Test Participants:

ENUM Applicant	Jorges Marques
Registrar	EnumDNS
Tier 2 Provider	EnumDNS
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	9.6.9.3.9.5.8.1.0.3.1.enumtrial.us
DNS name server host names	ns1.eurodns.com, ns2.eurodns.com
ENUM domain name registration period (in years)	1
Registrant information and technical, contact, and billing information	EDS-1170017, EDS-t170017, EDS-a170017, EDS-b170017
Authentication, Authorization, and Accounting information	thepassword, testgreg

Test Method:
- Collect data from ENUM applicant
- Validate ENUM applicant identity
- Submit request via EPP
- Evaluate response
- Initiate dispute resolution process if the there is an existing ENUM registration
- Report result to ENUM applicant

Expected Test Outputs:
Response to confirm registration status

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Test Objective:

Initial ENUM Domain Registration

Test History:

Test Date	4/17/2007
Test Iteration Number	1

Test Participants:

ENUM Applicant	enum2 (Userid created for VeriSign)
Registrar	Encirca
Tier 2 Provider	
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	2.3.2.3.3.1.4.3.0.7.1.enumtrial.us
DNS name server host names	ns1.encirca.net, ns2.encirca.net
ENUM domain name registration period (in years)	1 year
Registrant information and technical, contact, and billing information	Billing Contact : ENCIRCA Technical Contact : ENCIRCA Registrant Handle: ENCIRCA-17266 Admin Contact: ENCIRCA
Authentication, Authorization, and Accounting information	Registrar logon name: registrar1 password :enumtrial

Test Method:
- Collect data from ENUM applicant
- Validate ENUM applicant identity
- Submit request via EPP
- Evaluate response
- Initiate dispute resolution process if the there is an existing ENUM registration
- Report result to ENUM applicant

Expected Test Outputs:

Response to confirm registration status

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Phase 2 test 2A

Test Objective:

ENUM Registrant-Registrar Status Check

Test History:

Test Date	2007/07/05
Test Iteration Number	3

Test Participants:

ENUM Applicant	Marques Jorges
Registrar	EnumDNS
Tier 2 Provider	EnumDNS
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
Authentication/Authorization information (login/password)	Test / test
ENUM domain name	6.6.9.3.9.5.8.1.0.3.1.enumtrial.us

Test Method:

- Collect authentication/authorization information from ENUM registrant
- Validate login/password
- Identify ENUM domain name

Expected Test Outputs:

Response confirms domain name availability

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Test Objective:

ENUM Registrant-Registrar Status Check

Test History:

Test Date	4/27/2007
Test Iteration Number	1

Test Participants:

ENUM Applicant	enum1 (Userid created for VeriSign)
Registrar	Encirca
Tier 2 Provider	
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
Authentication/Authorization information (login/password)	registrar1/enumtrial
ENUM domain name	1.3.2.3.3.1.4.3.0.7.1.enumtrial.us

Test Method:

- Collect authentication/authorization information from ENUM registrant.
- Validate login/password.
- Identify ENUM domain name

Expected Test Outputs:

Response confirms domain name availability

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

A domain check command was run.

Phase 2 test 2B

Test Objective:

ENUM Registrant-Registrar Extended Info

Test History:

Test Date	2007/07/05
Test Iteration Number	2

Test Participants:

ENUM Applicant	Marques Jorges
Registrar	EnumDNS
Tier 2 Provider	EnumDNS
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
Authentication/Authorization information (login/password)	test / test
Request Status	
Request technical, contact, and billing info	
Request name server host names	ns1.eurodns.com, ns2.eurodns.com
Request expiration date	2008-07-05

Test Method:

- Collect authentication/authorization information from ENUM registrant
- Return registrant information
- Report result to registrant

Expected Test Outputs:

Response confirms extended information to registrant

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Test Objective:

ENUM Registrant-Registrar Extended Info

Test History:

Test Date	4/17/2007
Test Iteration Number	1

Test Participants:

ENUM Applicant	enum2 (Userid created for VeriSign)
Registrar	Encirca
Tier 2 Provider	
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
Authentication/Authorization information (login/password)	registrar1/enumtrial
Request Status	Unlocked
Request technical, contact, and billing info	Technical Contacts: ENCIRCA, Billing Contacts: ENCIRCA, Admin Contacts: ENCIRCA
Request name server host names	ns1.encirca.net, ns2.encirca.net
Request expiration date	Sat Apr 12 23:57:12 UTC 2008

Test Method:

- Collect authentication/authorization information from ENUM registrant
- Return registrant information
- Report result to registrant

Expected Test Outputs:

Response confirms extended information to registrant

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Domain name is 3.2.3.2.3.1.4.3.0.7.1.enumtrial.us

Phase 2, Test 2c

Test Objective:
ENUM Registrant-Registrar Data Change—Add

Test History:

Test Date	2007/07/05
Test Iteration Number	2

Test Participants:

ENUM Applicant	Jorges Marques
Registrar	EnumDNS
Tier 2 Provider	EnumDNS
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
Authentication/Authorization information (login/password)	test / test
Request Add	
New nameserver	ns3.eurodns.com
Additional technical, admin, and billing information	Xavier Buck
Additional contact information	Xavier Buck
Authorization for Tier 2 provider access	200

Test Method:
- Collect authentication/authorization information from ENUM registrant
- Validate login/password
- Return registrant information
- Receive Add information from registrant
- Report result to registrant
- Registrar submits add to Tier 1B

Expected Test Outputs:
Response confirms Add to registrant

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Test Objective:

ENUM Registrant-Registrar Data Change—Add

Test History:

Test Date	4/17/2007
Test Iteration Number	1

Test Participants:

ENUM Applicant	enum2 (Userid created for VeriSign)
Registrar	Encirca
Tier 2 Provider	
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
Authentication/Authorization information (login/password)	registrar1/enumtrial
Request Add	Added a nameserver, deleted an existing contact and added a new one
New nameserver	Added ns1.verisign.com
Additional technical, admin, and billing information	Technical Contact: ENCIRCA, Billing Contact: VERISIGNCONTACT, Admin Contact: ENCIRCA
Additional contact information	
Authorization for Tier 2 provider access	

Test Method:

- Collect authentication/authorization information from ENUM registrant
- Validate login/password
- Return registrant information
- Receive Add information from registrant
- Report result to registrar
- Registrar submits add to Tier 1B

Expected Test Outputs:

Response confirms Add to registrant

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Domain name is 3.2.3.2.3.1.4.3.0.7.1.enumtrial.us

Phase 2, Test 2d

Test Objective:

View information associated with a registered ENUM domain

Test History:

Test Date	2007/07/05
Test Iteration Number	2

Test Participants:

ENUM Applicant	Jorges Marques
Registrar	EnumDNS
Tier 2 Provider	EnumDNS
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	6.6.9.3.9.5.8.1.0.3.1.enumtrial.us
Domain contact identifiers	EDS-A170017
Authentication, Authorization, and Accounting information	

Test Method:
- Identify ENUM domain name
- Identify domain authorization information, if applicable
- Submit EPP domain <info> command
- Evaluate response
- Identify domain contacts
- Submit EPP contact <info> command
- Evaluate response

Expected Test Outputs:
- Command execution without error
- Domain registrant contact information
- Registration expiration date
- Creation, modification, and/or transfer dates
- Domain status
- Registrar contact information
- Name server information
- Organizational information
- Authentication, Authorization, and Accounting information

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Test Objective:

ENUM Registrant-Registrar Data Change—Delete

Test History:

Test Date	4/17/2007
Test Iteration Number	1

Test Participants:

ENUM Applicant	enum2 (Userid created for VeriSign)
Registrar	ENCIRCA
Tier 2 Provider	
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
Authentication/Authorization information (login/password)	registrar1/enumtrial
Request Delete	Deleted a billing contact and added a new one. Deleted a nameserver.
Delete nameserver	Deleted nameserver ns2.encirca.net
Delete technical, admin, and billing information	Deleted contact VERISIGNCONTACT
Delete contact information	Deleted contact VERISIGNCONTACT
Remove authorization for Tier 2 provider access	

Test Method:

- Collect authentication/authorization information from ENUM registrant
- Validate login/password
- Return registrant information
- Receive Delete updates from registrant
- Report result to registrant
- Registrar submits Delete to Tier 1B

Expected Test Outputs:

Response confirms Delete to registrant

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Domain name is 3.2.3.2.3.1.4.3.0.7.1.enumtrial.us

Phase 2, test 2e

Test Objective:
ENUM Registrant-Registrar Data Change—Modify/Change

Test History:

Test Date	4/17/2007
Test Iteration Number	1

Test Participants:

ENUM Applicant	enum1 (Userid created for VeriSign)
Registrar	Encirca
Tier 2 Provider	
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
Authentication/Authorization information (login/password)	registrar1/enumtrial . Authinfo used is : cjsxzu6e
Request Modify/Change	Modify
Change User ID (if permitted)	
Change Password	
Change technical, admin, and billing info	
Change contact information	Tried to change contact information for VERISIGNCONTACT. Changed the address information to City: Ashburn and Zip code: 20147.
Modify Tier 2 access/contact information	
Modify TSP information (in case of porting)	

Test Method:
- Collect authentication/authorization information from ENUM registrant
- Validate login/password
- Return registrant information
- Receive modify/change updates from registrant
- Report result to registrant
- Registrar submits modify/change to Tier 1B

Expected Test Outputs:
Response confirms Modify/Change to registrant

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Phase 2, test 3a

Test Objective:
Determine if ENUM domain name is available for registration

Test History:

Test Date	2007/07/05
Test Iteration Number	1

Test Participants:

ENUM Applicant	Jorges Marques
Registrar	EnumDNS
Tier 2 Provider	EnumDNS
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	6.6.9.3.9.5.8.1.0.3.1.enumtrial.us

Test Method:
Identify ENUM domain name.
Submit EPP <check> command.
Evaluate response.

Expected Test Outputs:
Response to confirm domain name availability. A domain name that has not been registered should be available. A domain name that has been registered should not be available.

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Test Objective:

Determine if ENUM domain name is available for registration

Test History:

Test Date	4/17/2007
Test Iteration Number	1

Test Participants:

ENUM Applicant	enum2 (Userid created for VeriSign)
Registrar	ENCIRCA
Tier 2 Provider	
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	3.2.3.2.3.1.4.3.0.7.1.enumtrial.us

Test Method:

- Identify ENUM domain name
- Submit EPP <check> command
- Evaluate response

Expected Test Outputs:

Response to confirm domain name availability. A domain name that has not been registered should be available. A domain name that has been registered should not be available.

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

An availability check was done for this domain. It was available before it was registered and unavailable thereafter.

Phase 2, test 3b

Test Objective:

View information associated with a registered ENUM domain

Test History:

Test Date	2007/07/05
Test Iteration Number	2

Test Participants:

ENUM Applicant	Jorges Marques
Registrar	EnumDNS
Tier 2 Provider	EnumDNS
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	6.6.9.3.9.5.8.1.0.3.1.enumtrial.us
Domain contact identifiers	EDS-A170017
Authentication, Authorization, and Accounting information	

Test Method:
- Identify ENUM domain name
- Identify domain authorization information, if applicable
- Submit EPP domain <info> command
- Evaluate response
- Identify domain contacts
- Submit EPP contact <info> command
- Evaluate response

Expected Test Outputs:
- Command execution without error
- Domain registrant contact information
- Registration expiration date
- Creation, modification, and/or transfer dates
- Domain status
- Registrar contact information
- Name server information
- Organizational information
- Authentication, Authorization, and Accounting information

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Test Objective:

View information associated with a registered ENUM domain

Test History:

Test Date	04/27/2007
Test Iteration Number	1

Test Participants:

ENUM Applicant	enum2 (Userid created for VeriSign)
Registrar	Encirca
Tier 2 Provider	
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	3.2.3.2.3.1.4.3.0.7.1.enumtrial.us
Domain contact identifiers	Billing Contact: VERISIGNCONTACT1 Technical Contact: ENCIRCA Admin Contact: ENCIRCA
Authentication, Authorization, and Accounting information	registrar1/enumtrial

Test Method:

- Identify ENUM domain name
- Identify domain authorization information, if applicable
- Submit EPP domain <info> command
- Evaluate response
- Identify domain contacts
- Submit EPP contact <info> command
- Evaluate response

Expected Test Outputs:

• Command execution without error	• Registrar contact information
• Domain registrant contact information	• Name server information
• Registration expiration date	• Organizational information
• Creation, modification, and/or transfer dates	• Authentication, Authorization, and Accounting information
• Domain status	

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Phase 2, test 3c

Test Objective:

ENUM Registrar-Registry Add - Add information to the already registered enum domain name

Test History:

Test Date	2007/07/05
Test Iteration Number	4

Test Participants:

ENUM Applicant	Jorges Marques
Registrar	EnumDNS
Tier 2 Provider	EnumDNS
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	6.6.9.3.9.5.8.1.0.3.1.enumtrial.us
Name Servers	ns1.infotechnique.com, ns2.infotechnique.com
Domain registrant contact information	EDS-A170017 (street updated)
Domain status	clientTransferProhibited
Authentication, Authorization, and Accounting information	

Test Method:

- Identify ENUM domain name
- Identify domain authorization information
- Submit EPP domain <update> command
- Evaluate response

Expected Test Outputs:

Command execution without error

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Test Objective:

ENUM Registrar-Registry Add - Add information to the already registered enum domain name

Test History:

Test Date	4/17/2007
Test Iteration Number	1

Test Participants:

ENUM Applicant	enum2 (Userid created for VeriSign)
Registrar	ENCIRCA
Tier 2 Provider	
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	3.2.3.2.3.1.4.3.0.7.1.enumtrial.us
Name Servers	ns1.encirca.net, ns1.verisign.com
Domain registrant contact information	Admin Contacts: ENCIRCA, Billing Contacts: VERISIGNCONTACT, Technical Contacts: ENCIRCA
Domain status	Removed the status 'Locked' (client transfer prohibited) for the domain
Authentication, Authorization, and Accounting information	registrar1/enumtrial

Test Method:
- Identify ENUM domain name
- Identify domain authorization information
- Submit EPP domain <update> command
- Evaluate response

Expected Test Outputs:

Command execution without error

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Phase 2, test 3d

Test Objective:

ENUM Registrar-Registry Update - Update information to the already registered enum domain name

Test History:

Test Date	2007/07/05
Test Iteration Number	4

Test Participants:

ENUM Applicant	Jorges Marques
Registrar	EnumDNS
Tier 2 Provider	EnumDNS
Tier 1B Registry	Versign

Test Inputs:

Input	Value(s)
ENUM domain name	6.6.9.3.9.5.8.1.0.3.1.enumtrial.us
Domain registrant contact information	
Authentication, Authorization, and Accounting information	

Test Method:
- Identify ENUM domain name
- Identify domain authorization information
- Submit EPP domain <update> command
- Evaluate response

Expected Test Outputs:

Command execution without error

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Test Objective:

ENUM Registrar-Registry Delete - Delete information to the already registered enum domain name

Test History:

Test Date	4/17/2007
Test Iteration Number	1

Test Participants:

ENUM Applicant	enum2 (Userid created for VeriSign)
Registrar	Encirca
Tier 2 Provider	
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	3.2.3.2.3.1.4.3.0.7.1.enumtrial.us
Name Servers	Deleted ns1.verisign.com
Domain status	Unlocked
Domain registrant contact information	Admin Contacts: ENCIRCA, Billing Contacts: VERISIGNCONTACT, Technical Contacts: ENCIRCA
Authentication, Authorization, and Accounting information	registrar1/enumtrial

Test Method:

- Identify ENUM domain name
- Identify domain authorization information
- Submit EPP domain <update> command
- Evaluate response

Expected Test Outputs:

Command execution without error

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Phase 2, test 3e

Test Objective:
ENUM Registrar-Registry Update - Update information to the already registered enum domain name

Test History:

Test Date	4/17/2007
Test Iteration Number	1

Test Participants:

ENUM Applicant	enum2 (Userid created for VeriSign)
Registrar	Encirca
Tier 2 Provider	
Tier 1B Registry	VeriSign

Test Inputs:

Input	Value(s)
ENUM domain name	3.2.3.2.3.1.4.3.0.7.1.enumtrial.us
Domain registrant contact information	Removed the Billing Contact VERISIGNCONTACT and added VERISIGNCONTACT1 instead.
Authentication, Authorization, and Accounting information	registrar1/enumtrial

Test Method:
- Identify ENUM domain name
- Identify domain authorization information
- Submit EPP domain <update> command
- Evaluate response

Expected Test Outputs:
Command execution without error

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Phase 2, test 4

Test Objective:
Transfer a registered ENUM domain from one registrar to an alternate registrar

Test History:

Test Date	NOT EXECUTED
Test Iteration Number	<Enter test iteration/run number, starting at 1 for the first run>

Test Participants:

ENUM Applicant	<Enter company and/or individual name>
Registrar	<Enter company and individual name>
Tier 2 Provider	<Enter company and individual name>
Tier 1B Registry	<Enter company name>
Authenticataion Agent	<Enter company name>

Test Inputs:

Input	Value(s)
ENUM domain name	
Domain contact identifiers	
Authentication, Authorization, and Accounting information	
Financial information required by Registar	

Test Method:
- Identify ENUM domain name
- Identify domain authorization information, if applicable
- Validate domain authorization information, verify that user has the rights to make the change requested
- Submit EPP Domain <info> command to gather current status of the domain
- Evaluate Response to determine domain status
- Submit EPP transform <transfer> command to Tier 1B (this will place the domain in pending transfer status)
- Tier 1B awaits acknowledgement, once received the domain will be transfer complete status (Active with new registrar)
- Tier 1B notifies Registrar of change
- If not successful, the registrar informs user of reason for failure and possible remedies
- If successful the New Registrar completes the registration process with the registrant (financial transaction complete)

Expected Test Outputs:
Tier 1 B will update records to reflect new registrar

Test Evaluation:

Pass	☐
Fail	☐

Test Comments:
Multiple registrars required to conduct a transfer test, so execution not possible in this trial

Phase 2, test 5

Test Objective:
Renew a registration with the same registrar during the active period for the registration.

Test History:

Test Date	2007/07/05
Test Iteration Number	2

Test Participants:

ENUM Applicant	Jorges Marques
Registrar	EnumDNS
Tier 2 Provider	EnumDNS
Tier 1B Registry	<Enter company name>
Authenticataion Agent	<Enter company name>

Test Inputs:

Input	Value(s)
ENUM domain name	9.6.9.3.9.5.8.1.0.3.1.enumtrial.us
Authentication, Authorization, and Accounting information	
Financial information required by Registar	
Renewal Period	1 year (new exp: 2009-07-05)

Test Method:
- Identify ENUM domain name
- Identify domain authorization information, if applicable
- Validate domain authorization information, verify that user has rights to make requested change
- Submit EPP Domain <info> command to gather current status of the domain
- Evaluate Response to determine domain status
- Submit EPP transform <renew> command to Tier1 B
- Upon success, Tier 1 B notifies registrar of success and new expiration date
- Upon completion, the registrar informs the registrant of status
- If successful, financial transaction is completed and local data stores are updated
- If not successful, reason for failure communicated to the registrant and no data store updates performed

Expected Test Outputs:
- Tier1 B will update records to reflect new expiration date
- Registrar will update local data stores to reflect expiration date

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Test Objective:

Renew a registration with the same registrar during the active period for the registration

Test History:

Test Date	5/2/2007
Test Iteration Number	1

Test Participants:

ENUM Applicant	enum2 (Userid created for VeriSign)
Registrar	Encirca
Tier 2 Provider	
Tier 1B Registry	VeriSign
Authenticataion Agent	

Test Inputs:

Input	Value(s)
ENUM domain name	3.2.3.2.3.1.4.3.0.7.1.enumtrial.us
Authentication, Authorization, and Accounting information	registrar1/enumtrial
Financial information required by Registar	The costs for now are set to 0.
Renewal Period	1 year

Test Method:

- Identify ENUM domain name
- Identify domain authorization information, if applicable
- Validate domain authorization information, verify that user has rights to make requested change
- Submit EPP Domain <info> command to gather current status of the domain
- Evaluate Response to determine domain status
- Submit EPP transform <renew> command to Tier1 B
- Upon success, Tier 1 B notifies registrar of success and new expiration date
- Upon completion, the registrar informs the registrant of status
- If successful, financial transaction is completed and local data stores are updated
- If not successful, reason for failure communicated to the registrant and no data store updates performed

Expected Test Outputs:

- Tier1 B will update records to reflect new expiration date
- Registrar will update local data stores to reflect expiration date

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Phase 2 Test 6a

Test Objective:

Terminate a registered ENUM domain while the TN is active.

Test History:

Test Date	2007/07/05
Test Iteration Number	2

Test Participants:

ENUM Applicant	Jorges Marques
Registrar	EnumDNS
Tier 2 Provider	EnumDNS
Tier 1B Registry	Verisgn
Authentication Agent	InCharge Systems

Test Inputs:

Input	Value(s)
ENUM domain name	7.6.9.3.9.5.8.1.0.3.1.enumtrial.us
Authentication, Authorization, and Accounting information	
Financial information required by Registar	
Renewal Period	

Test Method:

- Identify ENUM domain name
- Identify domain authorization information, if applicable
- Validate domain authorization information, verify that user has the rights to make the change requested
- Submit EPP Domain <info> command to gather current status of the domain
- Evaluate Response to determine domain status
- Submit EPP transform <delete> command to Tier1 B
- Upon success, Tier 1 B notifies registrar of success and removes the domain info from the data store and name servers
- Upon completion, the registrar informs the registrant of status
  - o   If successful,
    - ▪   local data stores are updated
    - ▪   Tier 2 providers are notified to terminate service if necessary
  - o   If not successful, reason for failure communicated to the registrant and no data store updates are performed

Expected Test Outputs:

- Tier1 B will delete proper records from local data stores and name servers
- Registrar will delete from records from local data stores and name servers
- Registrar will inform Tier 2 of record deletion

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Test Objective:

Terminate a registered ENUM domain while the TN is active.

Test History:

Test Date	05/02/2007
Test Iteration Number	1

Test Participants:

ENUM Applicant	Enum2 (user created for testing by VeriSign)
Registrar	Encirca
Tier 2 Provider	
Tier 1B Registry	VeriSign
Authentication Agent	

Test Inputs:

Input	Value(s)
ENUM domain name	2.3.2.3.3.1.4.3.0.7.1.enumtrial.us
Authentication, Authorization, and Accounting information	registrar1/enumtrial
Financial information required by Registrar	
Renewal Period	

Test Method:

- Identify ENUM domain name
- Identify domain authorization information, if applicable
- Validate domain authorization information, verify that user has the rights to make the change requested
- Submit EPP Domain <info> command to gather current status of the domain
- Evaluate Response to determine domain status
- Submit EPP transform <delete> command to Tier1 B
- Upon success, Tier 1 B notifies registrar of success and removes the domain info from the data store and name servers
- Upon completion, the registrar informs the registrant of status
    - o   If successful,
        - ▪   local data stores are updated
        - ▪   Tier 2 providers are notified to terminate service if necessary
    - o   If not successful, reason for failure communicated to the registrant and no data store updates are performed

Expected Test Outputs:

- Tier1 B will delete proper records from local data stores and name servers
- Registrar will delete from records from local data stores and name servers
- Registrar will inform Tier 2 of record deletion

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Phase 2, test 6b

Test Objective:

Terminate a registered ENUM domain because TN ownership is no longer valid

Test History:

Test Date	2007/07/05
Test Iteration Number	1

Test Participants:

Registrar	EnumDNS
Tier 2 Provider	EnumDNS
Tier 1B Registry	Verisgn
Authentication Agent	InCharge Systems

Test Inputs:

Input	Value(s)
ENUM domain name	6.6.9.3.9.5.8.1.0.3.1.enumtrial.us
Authentication, Authorization, and Accounting information	
Financial information required by Registar	

Test Method:
- Identify ENUM domain name that is no longer owned by responsible party
- Submit EPP transform <delete> command to Tier1 B
- Upon success, Tier 1 B notifies registrar of success and removes the domain info from the data store and name servers
- Upon completion, the registrar informs the registrant of status
- If successful,
  - Local data stores are updated, technical contacts are contacted with status of the domain
  - Tier 2 providers are notified to terminate service if necessary
- If not successful, the reason for failure is logged

Expected Test Outputs:
- Tier1 B will delete the proper records from the local data store
- Registrar will delete proper records from the local data stores
- Registrar will notify Tier 2 provider or the change

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Test Objective:

Terminate a registered ENUM domain because TN ownership is no longer valid

Test History:

Test Date	02/05/2007
Test Iteration Number	1

Test Participants:

Registrar	Encirca
Tier 2 Provider	
Tier 1B Registry	VeriSign
Authentication Agent	

Test Inputs:

Input	Value(s)
ENUM domain name	Delete submitted for: 5.3.2.3.3.1.4.3.0.7.1.enumtrial.us
Authentication, Authorization, and Accounting information	registrar1/enumtrial
Financial information required by Registar	

Test Method:
- Identify ENUM domain name that is no longer owned by responsible party
- Submit EPP transform <delete> command to Tier1 B
- Upon success, Tier 1 B notifies registrar of success and removes the domain info from the data store and name servers
- Upon completion, the registrar informs the registrant of status
- If successful,
  - Local data stores are updated, technical contacts are contacted with status of the domain
  - Tier 2 providers are notified to terminate service if necessary
- If not successful, the reason for failure is logged

Expected Test Outputs:
- Tier1 B will delete the proper records from the local data store
- Registrar will delete proper records from the local data stores

Registrar will notify Tier 2 provider or the change

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Phase 2, test 6c

Test Objective:

Terminate a registered ENUM domain because business relationship has changed

Test History:

Test Date	2007/07/05
Test Iteration Number	2

Test Participants:

Registrar	EnumDNS
Tier 2 Provider	EnumDNS
Tier 1B Registry	Verisgn
Authentication Agent	InCharge Systems
Enum Applicant	Jorges Marques

Test Inputs:

Input	Value(s)
ENUM domain name	6.6.9.3.9.5.8.1.0.3.1.enumtrial.us
Authentication, Authorization, and Accounting information	

Test Method:
- Identify ENUM domain name that is in default
- Submit EPP transform <delete> command to Tier1 B
- Upon success, Tier 1 B notifies registrar of success and removes the domain info from the data store and name servers
- Upon completion, the registrar informs the registrant of status
- If successful,
  - local data stores are updated, technical contacts are contacted with status of the domain
  - Tier 2 providers are notified to terminate service if necessary
- If not successful, the reason for failure is logged

Expected Test Outputs:
- Tier1 B will delete the proper records from the local data store
- Registrar will delete proper records from the local data stores
- Registrar will notify Tier 2 provider or the change

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Test Objective:

Terminate a registered ENUM domain because business relationship has changed

Test History:

Test Date	05/02/2007
Test Iteration Number	1

Test Participants:

Registrar	Encirca
Tier 2 Provider	
Tier 1B Registry	VeriSign
Authentication Agent	
Enum Applicant	enum2 (a user created for testing by VeriSign)

Test Inputs:

Input	Value(s)
ENUM domain name	7.3.2.3.3.1.4.3.0.7.1.enumtrial.us
Authentication, Authorization, and Accounting information	registrar1/enumtrial

Test Method:

- Identify ENUM domain name that is in default
- Submit EPP transform <delete> command to Tier1 B
- Upon success, Tier 1 B notifies registrar of success and removes the domain info from the data store and name servers
- Upon completion, the registrar informs the registrant of status
- If successful,
    - local data stores are updated, technical contacts are contacted with status of the domain
    - Tier 2 providers are notified to terminate service if necessary
- If not successful, the reason for failure is logged

Expected Test Outputs:

- Tier1 B will delete the proper records from the local data store
- Registrar will delete proper records from the local data stores
- Registrar will notify Tier 2 provider or the change

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Appendix 3: Phase 3 Test Cases

Phase 3, Test 1

Test Objective:

Demonstrate an application using URI(s) retrieved from an ENUM query.
Assumptions:

- Telephone number (TN) ENUM domain exists and contains at least one NAPTR.
- NAPTR contains valid ENUM Service and valid regexp-encoded URI.
- Application causes ENUM query to be made directly or indirectly.
- Application uses resulting URI(s) to invoke service.

Note:

The application may be end-to-end (e.g., SIP call) or user-host-based (e.g.; email)
The ENUM query may be performed by a network element (e.g., SIP server) or by an ENUM-enabled application (e.g., a user-host-based client)
The ENUM user runs the application. The ENUM subscriber has registered the number. The ENUM user queries the TN of the ENUM subscriber.
The Application Service Provider is the provider of the ENUM subscriber's URI.

Test History:

Test Date	<Enter test date>
Test Iteration Number	<Enter test iteration/run number, starting at 1 for the first run>

Test Participants:

ENUM User	<Enter company and/or individual name>
ENUM Subscriber	<Enter company and/or individual name>
Application Service Provider	<Enter company and/or individual name>

Test Inputs:

Input	Value(s)
Telephone Number	
ENUM Service	
Application Scenario Description	<Enter brief description of the application scenario, including how the ENUM query is made and how query results are used>

Test Method:

- ENUM user coordinates test participation, configuration, scenario activities, and readiness
- ENUM user launches application and performs scenario activities, including entering ENUM subscriber's TN
- ENUM user, and other participants as appropriate, observe scenario and capture test results

Expected Test Outputs:

- Description of test results

Test Evaluation:

Pass	☐
Fail	☐

Test Comments:

<Enter comments here.>

Phase 3, Test 2

Test Objective:

Demonstrate an application using URI(s) retrieved from an ENUM query. Assumptions:
- Telephone number (TN) ENUM domain exists and contains at least one NAPTR.
- NAPTR contains valid ENUM Service and valid regexp-encoded URI.
- Application causes ENUM query to be made directly or indirectly.
- Application uses resulting URI(s) to invoke service.

Note: The application is a pair of end-to-end SIP calls to a conference bridge

Note: The ENUM query will be performed by the SIP server.

Note: The ENUM ASP runs the application. The ENUM subscriber has registered the number. The ENUM user queries the TN of the ENUM ASP.

Test History:

Test Date	<Enter test date>
Test Iteration Number	<Enter test iteration/run number, starting at 1 for the first run>

Test Participants:

ENUM User(s)	<Enter company and/or individual name>
ENUM ASP	Seiri
Application Service Provider	Seiri

Test Inputs:

Input	Value(s)
Telephone Number	
ENUM Service	
Application Scenario Description	Two or more end users place a calls with SIP phone to an ENUM listed TN that terminates on a SIP based conference bridge.

Test Method:

- ENUM ASP coordinates test participation, configuration, scenario activities, and readiness
- ENUM users launch call to the conference application using ENUM subscriber's TN
- ENUM users, observe scenario and capture test results

Expected Test Outputs:

- Description of the application architecture and scenario.
- Contents of the ENUM subscriber's ENUM domain.
- Description of test results.
- Logs to substantiate the ENUM query.
- Logs or call records to substantiate the applications use of ENUM query results.

Test Evaluation:

Pass	☐
Fail	☐

Test Comments:

<Enter comments here.>

Phase 3, test 3

Test Objective:
Demonstrate an application using URI(s) retrieved from an ENUM query. Assumptions:
- Telephone number (TN) ENUM domain exists and contains at least one NAPTR.
- NAPTR contains valid ENUM Service and valid regexp-encoded URI.
- Application causes ENUM query to be made directly or indirectly.
- Application uses resulting URI(s) to invoke service.

Note: The application is a SIP call to a voice announcement server.
Note: The ENUM query will be performed by the SIP server.
Note: The ENUM ASP runs the application. The ENUM subscriber has registered the number. The ENUM user queries the TN of the ENUM ASP.

Test History:

Test Date	<Enter test date>
Test Iteration Number	<Enter test iteration/run number, starting at 1 for the first run>

Test Participants:

ENUM User(s)	<Enter company and/or individual name>
ENUM ASP	Seiri
Application Service Provider	Seiri

Test Inputs:

Input	Value(s)
Telephone Number	
ENUM Service	
Application Scenario Description	End users place a calls with SIP phones to an ENUM listed TN that terminates on a voice announcement service. The call detail is recorded on the voice announcement server

Test Method:
- ENUM ASP coordinates test participation, configuration, scenario activities, and readiness
- ENUM users launch call to the announcement application using ENUM subscriber's TN
- ENUM users, observe scenario and capture test results

Expected Test Outputs:
- Description of the application architecture and scenario
- Contents of the ENUM subscriber's ENUM domain
- Description of test results
- Logs to substantiate the ENUM query
- Logs or call records to substantiate the applications use of ENUM query results

Test Evaluation:

Pass	☐
Fail	☐

Test Comments:
<Enter comments here.>

Phase 3, Test 4

Test Objective:

Demonstrate an application using URI(s) retrieved from an ENUM query. Assumptions:
- Telephone number (TN) ENUM domain exists and contains at least one NAPTR
- NAPTR contains valid ENUM Service and valid regexp-encoded URI
- Application causes ENUM query to be made directly or indirectly
- Application uses resulting URI(s) to invoke service

Note: The application is a SIP call to a an echo server which records a short amount of voice from the caller and them plays it back to the caller.

Note: The ENUM query will be performed by the SIP server.

Note: The ENUM ASP runs the application. The ENUM subscriber has registered the number. The ENUM user queries the TN of the ENUM ASP.

Test History:

Test Date	<Enter test date>
Test Iteration Number	<Enter test iteration/run number, starting at 1 for the first run>

Test Participants:

ENUM User(s)	<Enter company and/or individual name>
ENUM ASP	Seiri
Application Service Provider	Seiri

Test Inputs:

Input	Value(s)
Telephone Number	
ENUM Service	
Application Scenario Description	End users place a calls with SIP phones to an ENUM listed TN that terminates on a voice recording/playback service. The call detail is recorded on the server

Test Method:
- ENUM ASP coordinates test participation, configuration, scenario activities, and readiness
- ENUM users launch call to the application using ENUM subscriber's TN
- ENUM users, observe scenario and capture test results

Expected Test Outputs:
- Description of the application architecture and scenario
- Contents of the ENUM subscriber's ENUM domain
- Description of test results
- Logs to substantiate the ENUM query
- Logs or call records to substantiate the applications use of ENUM query results

Test Evaluation:

Pass	☐
Fail	☐

Test Comments:

<Enter comments here.>

Appendix 4, Phase 3 Test Results

Subject: Test Report - TPAC User Applications
From: A. Gallant
Date: 6/27/2007

Overview: This report summarizes some applications testing from the user perspective, principally, the caller.

Notes: A generic test case existed for this testing. The application test is a SIP call to a SIP URI retrieved by an ENUM lookup.

Test Period: April through June 2007.

Participants: Users   AG Design, various
                Subscribers   AG Design, various
                Tier 2   Seiri (for AG Design as the ENUM subscriber)
                ASP   Seiri (for AG Design as calling or called party, respectively)

Test 1:   4/19/2007 11:00 AM

                Config: Calling from second sip account (testag1) on second pc to registered number (1-301-762-4024). T2 has a sip URI for first sip account (testag) on first pc). PCs used X-Lite client.

                1.   From testag1 client, entered +13017624024.
                2.   Answered call on testag client when it rang.
                3.   Tested with voice and dtmf on each machine.

                Result: Success

Test 2:   4/19/2007 11:28 AM

                Config: Reran test 1 to check logging.

                Result: Success

                Sample data from testag log:

                [07-04-19]10:59:47.908 | Debug | RESIP:DUM |
                "ClientSubscription::ClientSubscription from SipReq: SUBSCRIBE
                testag@beowulf.seiri.com tid=e3380169ee3aed10 cseq=SUBSCRIBE
                contact=testag@68.33.203.171:23420 / 1 from(tu)" |
                [...]
                [07-04-19]11:28:35.280 | Debug | RESIP:TRANSACTION | "Matching rule for
                ACK sip:testag@68.33.203.171:23420;rinstance=d1b777002cb0d018 SIP/2.0
                Via: SIP/2.0/UDP 204.130.216.36;branch=0   [...]

Record-Route: <sip:204.130.216.36;ftag=d652c677;lr=on>
Contact: <sip:testag1@68.33.203.171:56946>
To: ""+13017624024""<sip:+13017624024@beowulf.seiri.com>;tag=ee44b900
From: ""testag1""<sip:testag1@beowulf.seiri.com>;tag=d652c677
Call-ID: YWIyMjRmN2Q2ZGNlZWQ5M2I0YzlkM2UwMTc1ZGQ5NDI.
CSeq: 1 ACK

Test 3: 5/15/2007 12:00 PM

Result: Fail

Note: Tried calls to and from other Participants. No successes to report due to a variety of configuration matters:
- One caller to +13017624024 was unable to search in the appropriate tree.
- Some callees/test destinations did not have a T2.
- SIP level calling was checked and worked in cases, but not with ENUM.

Test 4: 6/5/2007 2:00 PM

- 2:40 - successful call to Verizon - 6125 using enum.
- 2:44 - failed call from Verizon - enum lookup problems.
- 2:59 - successful call from Verizon using cisco hard phone and enum.
- 3:01 - successful call to InCharge using enum.

Result: Success (3), Failure (1 - rectified).

Note: There were other testing sessions during the test period from April through June 2007 that failed to produce results worth recording.

Additional Data: Results of dig for Tier 2. There are two NAPTRs - only the SIP one was used.

```
; <<>> DiG 9.2.3 <<>> @ns1.federatedtelephone.com 4.2.0.4.2.6.7.1.0.3.1.enumtrial.us ANY
;; global options: printcmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 47729
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 6, AUTHORITY: 0, ADDITIONAL: 3
;; QUESTION SECTION:
;4.2.0.4.2.6.7.1.0.3.1.enumtrial.us.    IN ANY
;; ANSWER SECTION:
4.2.0.4.2.6.7.1.0.3.1.enumtrial.us.    1200    IN    SOA 4.2.0.4.2.6.7.1.0.3.1.enumtrial.us. hostmaster.seiri.com. 10 4800
                3600 604800 10800
4.2.0.4.2.6.7.1.0.3.1.enumtrial.us.    1200    IN    NS ns2.federatedtelephone.com.
4.2.0.4.2.6.7.1.0.3.1.enumtrial.us.    1200    IN    NS ns1.federatedtelephone.com.
4.2.0.4.2.6.7.1.0.3.1.enumtrial.us.    1200    IN    MX 20 grok.seiri.com.
4.2.0.4.2.6.7.1.0.3.1.enumtrial.us.    60    IN    NAPTR 100 10 "u" "E2U+email"
                "!^.*$!mailto:agenumtest@aol.com!" .
4.2.0.4.2.6.7.1.0.3.1.enumtrial.us.    60    IN    NAPTR 100 10 "u" "E2U+SIP"
                "!^.*$!sip:testag@beowulf.seiri.com!" .
;; ADDITIONAL SECTION:
ns1.federatedtelephone.com. 10800    IN    A 204.130.216.2
ns2.federatedtelephone.com. 10800    IN    A 71.245.156.212
grok.seiri.com.    600    IN    A 204.130.216.64
;; Query time: 153 msec
;; SERVER: 204.130.216.2#53(ns1.federatedtelephone.com)
;; WHEN: Thu Apr 12 16:17:20 2007
;; MSG SIZE rcvd: 357
```

Subject: Test Report - TPAC User Registrations
From: A. Gallant
Date: 6/27/2007

Overview: This report summarizes some registration testing from the user perspective.

Notes: No test case existed for this testing. No existing procedures covered the entire registration process from registrant request to Tier 2 provisioning.

Test Period: April 2007 to June 2007.

Participants: Subscriber   AG Design
               Registrar   EnCirca
               Auth Agent   ICS
               Tier 1B   VeriSign
               Tier 2   Seiri

Config: Tester had a number listed for the trial and a T2 already provisioned.

Test 1:   4/11/2007 9:00 AM

        1.   Signed up for EnCirca account.
        2.   Registered 1-301-762-4024.
        3.   Received email with six verification steps:
          1. Please Call: +1 (412) 894-9598
          2. Provide the following PIN: <2537>
          3. Hang up
          4. You will receive a call shortly, enter the following PIN: <9673>
          5. Hang up
          6. Verification will be completed
        4.   Completed steps above.
        5.   Received positive voice confirmation during step 4 above.

        Result: Success

        Note: This test registered a number at the registrar. It did not check DNS entries in T1B.

Test 2:   4/12/2007 11:00 AM

        1.   Ran a dig of 4.2.0.4.2.6.7.1.0.3.1.enumtrial.us.
        2.   Discovered SOA and NS records at EnCirca as T2.
        3.   Did a direct dig of T2 at Seiri - actual records were there.

        Result: n/a

        Note: Even though it resolved in the global DNS, it wasn't clear how. It turns out there were anomalies in the configurations of the T1A/T1Bs.

Test 3:   4/12/2007 12:15 PM

1. Reran digs to recheck DNS setup.
2. Used EnCirca hint to verify registration there.
3. Used EnCirca site to add T2 NSs and delete EnCirca NSs.
4. Received confirmation from EnCirca.

Result: n/a

Note: Testing stopped. There was no evidence of DNS updates propagating during the time of the test.

Note: The EnCirca method for letting the registrant verify the registration displayed a web page. It was a good idea to let the user check without having to do a dig. The EnCirca method didn't work with a different T2. The LLC should consider this issue.

Test 4:   5/9/2007 8:56 AM

1. Tried to register second number (...5801), expecting failure.
2. Failed at step one - voice response that caller id doesn't match - pls check.

Result: Success/Failure.

Note: This (the verification process) was expected to fail. The number is a second number assigned to an existing line with an existing number (... 4024) for the service of distinctive ring. The verification method is ANI based. During the callback, it presumably detected the first number, rather than the second number. They didn't match, as expected. This failure was a success.

Note: However, the interaction between T1B and registrar did not check for successful authentication. The second number failed verification, yet the NS records were provisioned into T1B. This success was a failure. The LLC should consider these issues.

Note: This number was not listed for trial use. See the note on the next test.

Note: The verification process was an initial implementation for trial purposes. There was no way to cancel the trial. There were no alternative ways to verify a number for authentication. There were no points of contact, and no time frames were given. These and related issues need to be considered by the LLC for the operational systems.

Test 5:   5/9/2007 9:08 AM.

1. Tried to register a third number for the trial.
2. Verification succeeded.

Result: n/a

Note: This third number was not on the list of numbers for the trial. However, verification was performed and the NS records were provisioned into T1B. The LLC should consider this issue for relevant cases facing the operational systems.

Note: Subsequent digs and analysis of resolution using online DNS tools strongly suggested that there were DNS configuration anomalies affecting the alternative Tier 0/Tier1A/Tier 1B configurations.

Phase 3, Test 1

Test Objective:

Demonstrate an application using URI(s) retrieved from an ENUM query.
Assumptions:
- Telephone number (TN) ENUM domain exists and contains at least one NAPTR.
- NAPTR contains valid ENUM Service and valid regexp-encoded URI.
- Application causes ENUM query to be made directly or indirectly.
- Application uses resulting URI(s) to invoke service.

Note:
    The application may be end-to-end (e.g., SIP call) or user-host-based (e.g.; email)
    The ENUM query may be performed by a network element (e.g., SIP server) or by an ENUM-enabled application (e.g., a user-host-based client)
    The ENUM user runs the application. The ENUM subscriber has registered the number. The ENUM user queries the TN of the ENUM subscriber.
    The Application Service Provider is the provider of the ENUM subscriber's URI.

Test History:

Test Date	04/19/07
Test Iteration Number	

Test Participants:

ENUM User	AG Design
ENUM Subscriber	AG Design
Application Service Provider	Seiri

Test Inputs:

Input	Value(s)
Telephone Number	301-762-4024
ENUM Service	SIP
Application Scenario Description	

Test Method:

- ENUM user coordinates test participation, configuration, scenario activities, and readiness
- ENUM user launches application and performs scenario activities, including entering ENUM subscriber's TN
- ENUM user, and other participants as appropriate, observe scenario and capture test results

Expected Test Outputs:

- See test details earlier in this Appendix

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Phase 3, Test 2

Test Objective:

Demonstrate an application using URI(s) retrieved from an ENUM query. Assumptions:
- Telephone number (TN) ENUM domain exists and contains at least one NAPTR.
- NAPTR contains valid ENUM Service and valid regexp-encoded URI.
- Application causes ENUM query to be made directly or indirectly.
- Application uses resulting URI(s) to invoke service.

Note: The application is a pair of end-to-end SIP calls to a conference bridge
Note: The ENUM query will be performed by the SIP server.
Note: The ENUM ASP runs the application. The ENUM subscriber has registered the number. The ENUM user queries the TN of the ENUM ASP.

Test History:

Test Date	06/05/07
Test Iteration Number	

Test Participants:

ENUM User(s)	AG Design/Verizon
ENUM ASP	Seiri
Application Service Provider	Seiri

Test Inputs:

Input	Value(s)
Telephone Number	972-729-6125
ENUM Service	SIP
Application Scenario Description	Two or more end users place calls with SIP phone to an ENUM listed TN that terminates on a SIP based conference bridge.

Test Method:

- ENUM ASP coordinates test participation, configuration, scenario activities, and readiness
- ENUM users launch call to the conference application using ENUM subscriber's TN
- ENUM users, observe scenario and capture test results

Expected Test Outputs:

- See test details earlier in this Appendix

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Phase 3, test 3

Test Objective:

Demonstrate an application using URI(s) retrieved from an ENUM query. Assumptions:
- Telephone number (TN) ENUM domain exists and contains at least one NAPTR.
- NAPTR contains valid ENUM Service and valid regexp-encoded URI.
- Application causes ENUM query to be made directly or indirectly.
- Application uses resulting URI(s) to invoke service.

Note: The application is a SIP call to a voice announcement server.

Note: The ENUM query will be performed by the SIP server.

Note: The ENUM ASP runs the application. The ENUM subscriber has registered the number. The ENUM user queries the TN of the ENUM ASP.

Test History:

Test Date	06/05/07
Test Iteration Number	

Test Participants:

ENUM User(s)	AG Design / Verizon
ENUM ASP	
Application Service Provider	

Test Inputs:

Input	Value(s)
Telephone Number	214-414-0293
ENUM Service	SIP
Application Scenario Description	End users place calls with SIP phones to an ENUM listed TN that terminates on a voice announcement service. The call detail is recorded on the voice announcement server

Test Method:
- See test details earlier in this Appendix

Expected Test Outputs:
- Description of the application architecture and scenario
- Contents of the ENUM subscriber's ENUM domain
- Description of test results
- Logs to substantiate the ENUM query
- Logs or call records to substantiate the applications use of ENUM query results

Test Evaluation:

Pass	✔
Fail	☐

Test Comments:

Phase 3, Test 4

Test Objective:
Demonstrate an application using URI(s) retrieved from an ENUM query. Assumptions:
- Telephone number (TN) ENUM domain exists and contains at least one NAPTR
- NAPTR contains valid ENUM Service and valid regexp-encoded URI
- Application causes ENUM query to be made directly or indirectly
- Application uses resulting URI(s) to invoke service

Note: The application is a SIP call to a an echo server which records a short amount of voice from the caller and them plays it back to the caller.

Note: The ENUM query will be performed by the SIP server.

Note: The ENUM ASP runs the application. The ENUM subscriber has registered the number. The ENUM user queries the TN of the ENUM ASP.

Test History:

Test Date	04/12/07
Test Iteration Number	

Test Participants:

ENUM User(s)	AG Design
ENUM ASP	Seiri
Application Service Provider	Seiri

Test Inputs:

Input	Value(s)
Telephone Number	301-762-4024
ENUM Service	SIP
Application Scenario Description	End users place calls with SIP phones to an ENUM listed TN that terminates on a voice recording/playback service. The call detail is recorded on the server

Test Method:
- ENUM ASP coordinates test participation, configuration, scenario activities, and readiness
- ENUM users launch call to the application using ENUM subscriber's TN
- ENUM users, observe scenario and capture test results

Expected Test Outputs:
- See test details earlier in this Appendix

Test Evaluation:

Pass	✔
Fail	☐

Test Comments: