

GLOBAL ENUM SERVICES

INTRODUCTION AND OVERVIEW

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INTRODUCTION

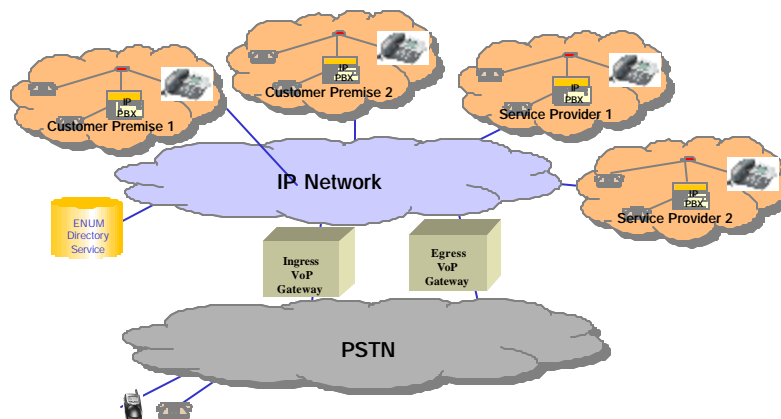
The telecommunications industry is moving at remarkable speed to embrace the new world of Internet Protocol (IP) technology. Underlying economics and the growing demand for new services dictate that data networks like the Internet, corporate intranets, and managed extranets will be the converged telecommunications networks of the future. These high-speed data networks built upon vast fiber optic pipes are accelerating the migration toward an IP based packet infrastructure for all forms of communication. IDC a leading industry research firm forecast that IP based voice communications revenue will grow from \$300 million at the end of 2000 to more than \$15 billion in 2004

As the convergence of telephone networks and the Internet has advanced, a well-defined addressing challenge has emerged. Telephone services like real-time voice, voicemail and fax are based on using standard telephone numbers for addressing. Unfortunately, Internet based communications services like SIP, H323, SMTP, IPP, etc. use a completely different addressing format. In order for the convergence of telephone services and the Internet to continue, a mechanism needs to exist to translate standard telephone numbers into Internet addresses.

ENUM – A Standards Based Solution

In response to this addressing challenge, the Internet Engineering Task Force (IETF) launched a working group called ENUM to define a technical standard for translating telephone numbers into Internet addresses. The result of this effort, RFC 2916, is called ENUM, short for Electronic NUMBER. ENUM services are a core piece of Internet infrastructure that convert telephone numbers into the IP based address information required to support all forms of IP-enabled communications services including real-time voice, voicemail, fax, remote-printing, unified-messaging and many other types of enhanced services.

The network diagram shown below provides a visual representation of how an ENUM directory service fits into a converged global network. When an end-user in Enterprise #1 picks up an IP-phone and dials a telephone number, the enterprise IP-PBX does an ENUM query to "discover" the list of Internet communications services registered for the destination party. If an Internet telephony service address has been registered for the telephone number then the call can be completed as a pure end-to-end IP call. If no address is registered the call is handed off to the PSTN for termination. Thanks to ENUM, a telephone number can function as a common address for both PSTN services and IP-based communications services.



NETNUMBER? ENUM SERVICE

NetNumber's global ENUM service is the first commercially available ENUM service offering a full suite of ENUM capabilities including Registration, Provisioning, Validation, and Resolution services. The NetNumber ENUM Service is the outgrowth of a three-year technology development, intellectual property and standards body effort launched by the NetNumber team in early 1997. NetNumber retains a strong intellectual property position in the ENUM space that includes three patent applications and over 150 claims covering the NetNumber directory methodology for use in all IP-communications applications on all types of IP-networks. The US Patent Office recently granted the team's first patent.

NetNumber has been working with industry standards bodies including the IETF and the ITU and with various government agencies since early 1998 to develop consensus regarding various aspects of the IP communications directory space.

The Netnumber service suite is comprised on the following main components

- ENUM client Software Development Toolkit (SDK)
- Global ENUM DNS Infrastructure
- Registration
- Validation
- Security
- Private ENUM Services

ENUM Client SDK

The NetNumber ENUM Client Software Development Kit (SDK) is a collection of software components, documentation and example code designed to IP communications applications and platforms to rapidly incorporate standard ENUM technology into their solutions. Included in the ENUM Client SDK is an Application Programming Interface (API) that provides secure query and update capabilities. The API is fully documented and illustrated using a variety of example application programs.

The ENUM Client SDK supports the Java and C/C++ development environments and C/C++ API implementation is available on Solaris, Windows, and Linux. The ENUM client SDK is incorporated into devices such as

- IP-PBX
- VoIP Gateways
- SIP Proxy Servers
- H.323 Gatekeepers
- Softswitches
- 3GPPP Wireless Devices
- VoIP User Agents

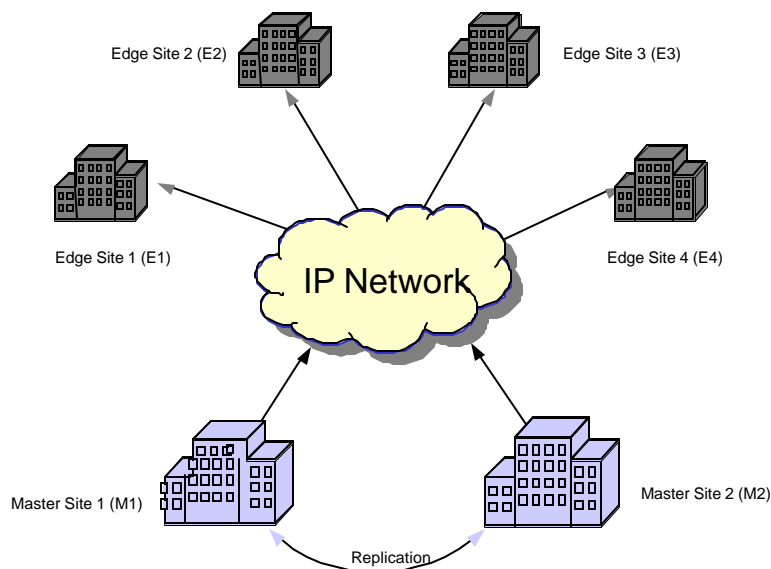
The core functionality of the SDK implementation is ENUM resolution and update. In addition, the ENUM Client addresses a broad range of security concerns by implementing DNS Security (DNSSEC) Secret Key Transaction Authentication for DNS (TSIG) [RFC2845] and Secret Key Establishment for DNS (TKEY) [RFC2930].

The ENUM Client provides the network transport and query processing mechanism required for translating a telephone number into a set of ENUM records. For more information, see NetNumber's "*ENUM Client SDK Overview*" document under the Services section on the NetNumber website at www.netnumber.com.

Global ENUM DNS Infrastructure

NetNumber's global ENUM DNS infrastructure provides the carrier-class reliability, scalability and performance required to support worldwide deployment of ENUM-based communications solutions. The NetNumber ENUM service utilizes best-in-class facilities that are dispersed geographically, and support the most comprehensive physical and network security capabilities in the industry.

NetNumber's ENUM infrastructure is deployed across multiple Network Data Centers (NDC's) utilizing a distributed edge site and redundant master site configuration as shown below. Specific functional characteristics of the DNS infrastructure are as follows:



- High availability servers that have been optimized for ENUM translation. No single point of failure due to fully redundant software and hardware configurations
- Multiple network edge sites located at strategic IP peering intersections and housed in fault tolerant data centers. Supports low latency connections provided over multiple backbones with high availability
- Master site configuration to provide geographical redundancy and centralized delivery of DNS information as well as back end administration support

- Rapid delivery of DNS updates using dynamic DNS
- Service level agreements (SLA) with established query times
- 24x7 operational support

For more detailed information on ENUM infrastructure see NetNumber's "*ENUM Operations Overview*" document which can be found under the "Services" section on the NetNumber web site at www.netnumber.com.

Registration

The NetNumber registration system provides a highly flexible environment for Service Providers, Enterprise customers, and IP-communications application vendors to gain access to, and integrate with, every aspect of the NetNumber service offering. Specific functionality includes:

Account administration: Web based tools for the creation and administration of ENUM customer accounts. Support for both global ENUM and private ENUM services is provided under a common customer account structure. Key functionality within this system includes:

- Account creation
- Administrator management
- Sub-account administration

ENUM record administration: Addition, modification and deletion of ENUM records within a given ENUM customer account. NetNumber provides both interactive and programmatic tools for administering ENUM records within a given account. Key functionality with this system includes:

- Private domain administration
- Number block pre-validation
- Communications platform "key" management
- ENUM record management and look-up
- Network availability "pulse"

For more information see NetNumber's "*Registration Services – Account and ENUM Record Administration*" document under the Services section on the NetNumber website.

Validation

Every ENUM record provisioned into the NetNumber ENUM service is validated for accuracy. The objective of the NetNumber validation process is to confirm that the subscriber with day-to-day control over each telephone number being registered has approved the registration. The validation process addresses two distinct issues:

- Number Validation: Confirms that an authorized representative of the Subscriber that has been assigned control over the telephone number being registered has approved an ENUM registration.

- Service Validation: Service validation confirms that the Subscriber has approved the registration of an Internet service in the ENUM record for a specific telephone number.

NetNumber supports validation of Telephone Number provider (TNP), Individual subscriber and enterprise subscriber registrations. A specific and detailed validation process has been established for each type of subscriber registration to insure that accurate validation is completed in a timely manner.

For more information see NetNumber's "*ENUM Validation Services Overview*" document under the Services section on the NetNumber website at www.netnumber.com

Security

NetNumber's security policies and procedures have been designed to address two high-level aspects of ENUM security that apply to both shared global ENUM services and fully outsourced private ENUM services:

- (1) Access Security: Protecting every Registrant's ENUM records against inappropriate use by external entities. For example: protection against farming of ENUM data for the purpose of spamming.
- (2) Update Security: Protecting every Registrant's ENUM records against unauthorized modification by external entities. For example: protection against malicious redirection of IP calls through modification of ENUM records in the directory itself or through spoofing the directory during the query process.

In responding to the two high-level security issues defined above, NetNumber has implemented security policies to address the following areas of risk:

- Data Tampering
- Impersonation
- Eavesdropping
- Malicious Redirection
- Farming

NetNumber uses state-of-the-art Network Data Center facilities that offer the widest range of physical security features, including modern smoke detection and fire suppression systems, motion sensors, and 24x7 secured access, video camera surveillance, security breach alarms and secured equipment cabinets.

Network security at the NetNumber hosted edge and master sites is provided through the following mechanisms, Load Balancing, Hardened Unix operating systems and Password Rotation. NetNumber uses standard DNS Security (DNSSEC) to protect unauthorized query and updates to the ENUM directory using Secret Key Transaction Authentication (TSIG).

For more information see NetNumber's "*ENUM Security – Policies and Procedures Overview*" document under the Services section on the NetNumber website at www.netnumber.com

APPLICATIONS

The fundamental value proposition of an ENUM directory is the efficient "discovery" of the list of "Internet communications services" registered for an individual using a standard telephone number as a common address. As such, one of NetNumber's primary roles as a leading provider of global ENUM services is to enable multiple Internet communications services to be registered for a single telephone number. Examples include:

Primary IP-Communications Services

Dozens of service providers around the world such as WCOM, Qwest, Webley, TalkingNets and many others are beginning to provide IP-based communications services that replace a user's PSTN telephone service. Similarly, dozens of technology vendors including Cisco, 3Com, Alcatel, and others are selling IP-PBX systems to enterprise customers to replace aging legacy PBX systems. NetNumber's global ENUM service enables IP-based service providers and IP-based enterprise customers to "discover" each other by translating a telephone number into either a SIP or H323 address.

Example: Telephone # → sip:user@serviceprovider.com.

Desktop IP-Communications Services

The PC is quickly becoming a world-class communications platform that can support multiples types of applications including real-time voice, video, instant messaging and more. Upcoming releases of the Windows operating system will enable a rich set of communications services based on a built-in SIP client. Enterprise and consumer users will have the option to register their desktop as another communications service that can be "discovered" through the NetNumber ENUM service.

Example: Telephone # → sip:user@sip.proxy.enterprise.com

Unified Messaging Services

E-mail systems are quickly becoming unified messaging systems that allow users to link e-mail messages, voicemail messages and fax messages into a single "unified" in-box. Dozens of service providers around the world are experimenting with or have already deployed fully outsourced unified messaging service offerings. NetNumber's ENUM service provides a mechanism for Unified Messaging systems to register a user's e-mail address to enable simple but powerful services like "spoken e-mail".

Example: Telephone # → <mailto:user@company.com>

Remote Printing Services

Network based printing services that are ENUM enabled provide subscribers with the ability to re-direct standard fax communications to remote printing facilities while using the same telephone number as a common address for both types of services.

Example: Telephone # → ipp:printer-10@print.company.com

SUMMARY

"Market leadership in both global and private ENUM services"

With the rapid pace of change in today's communications industry, it is crucial to partner with best in class providers. Netnumber has built a leadership position in the ENUM space by being first to market with a commercial service that meets the flexibility and reliability needs of service provider and enterprise customers alike.

ENUM's role in the IP-communications industry is the "discovery" of a list of Internet communications services registered for a specific individual, using a telephone number as a common address. Within this vision, NetNumber has built all of the tools necessary for technology vendors and service providers to quickly and efficiently integrate ENUM into their underlying infrastructure.

Contact us today to learn more about how ENUM can help extend the scope and utility of your Internet communications service offerings.

For integration with the NetNumber ENUM service join the developers program at www.netnumber.com.

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