VeriSign®

The Domain Name Industry Brief

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The VeriSign Domain Name Primer

As the leading global domain name registry, VeriSign closely monitors the state of the domain name market through a variety of analytical and statistical research. This brief provides a primer on the Domain Name System (DNS), domain names and the key players in the industry.

+ Executive Summary

With over 1.3 billion users globally, the Internet is the fastest growing technology of the past decade or any other decade before. According to Business Week, it took radio 30 years to reach 60 million people and television 15 years; the Internet has grown to almost 20 times this size in a much shorter period of time.[1]

A domain name is key to doing just about anything on the Internet, from setting up a Web site to sending and receiving email to building an online store. Today there are over 153 million registered domain names. The Domain Name System (DNS), which supports these domain names, is the engine that makes the Internet simple and accessible for users around the world. The DNS is not just important to the smooth running of the Internet but it also plays a very important part in everyday life. Visits to the ATM machine, paying for groceries with your credit card, placing a long-distance telephone call, would not be possible if the DNS was not functioning. These activities rely on the Internet or Internet technology, and the DNS is a fundamental part of the Internet: without DNS, the Internet doesn't work.

And yet, for too many people, the DNS belongs in the confusing realm of the technical experts. This primer provides an overview of how the Domain Name System works and why it is so important for the continued operation of the Internet.

+ The Domain Name System

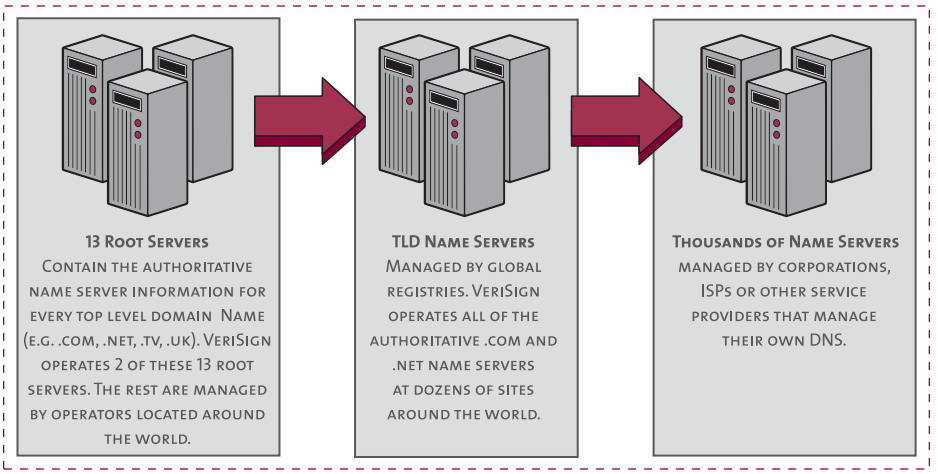
The Domain Name System performs the simple, straightforward function of mapping names to Internet Protocol (IP) addresses and back. Every server on the Internet has an IP address, represented as a series of numbers and letters, for example 123.45.67.254 or 2001:503:A83:0:0:2:30. But, like telephone numbers, these long series of numbers and letters can be difficult to remember. The DNS allows people to use names, instead of random numbers and letters, to reach Web sites and send email messages.

The rightmost label in a domain name (such as .com or .net) is referred to as the top-level domain or TLD. There are many TLDs available. The DNS forms a hierarchy: each TLD has one or more second-level domain names (abc.com); each second-level domain can have many third-level domain names (corporate.abc.com) and so forth. Domain names can use characters from many different scripts, such as Kanji and Arabic, and not just the familiar Latin alphabet.

After a user enters a domain name into a Web browser, a behind-the-scenes process called resolution uses a global network of name servers to look up the IP address corresponding to a service associated with the domain name, such as a Web site or email service. Web browsers and other applications need IP addresses to contact the appropriate Web server and retrieve an associated Web page, if any. The technology, servers, guidelines and processes that make up these name servers form the backbone of the DNS. The DNS is the low-level protocol that enables communications over the Internet for applications like credit card processing, bank transactions and telephony as well as Web browsing and email.

1 http://www.businessweek.com/1998/25/itspec98.htm. "The Click Here Economy," *Business Week*, June 22, 1998.

Domain Name System



Domain Name System

Source: VeriSign

+ Registration of Domain Names

Name servers for TLDs, such as .com and .net, route requests to lower-level name servers for ultimate resolution. For example, the .com name servers refer queries about the verisign.com domain name to VeriSign's name servers. Second-level domains, such as versign.com, must be registered with the TLD operator. Domain names can be registered through one of the hundreds of registrars or thousands of resellers. With multiple channels available to register domain names, it is simple for users to find the right combination of product, price and complementary services to meet their needs. For example, many registrars offer the ability for users to register names with different top-level domains. They also provide email services and even assist with building a Web site.

+ The Top-Level Domain Names

There are over 270 top-level domain names of varying types:

- Two-letter TLDs (.uk, .de, .jp, etc) correspond to the official two-letter abbreviations of over 250 countries and territories. These domains are called country-code TLDs or ccTLDs for short. Each has a designated registry that operates the ccTLD according to local policies (for example, to register a name in some TLDs you must be a local resident).
- Sponsored generic TLDs (gTLDs) include .edu, .gov, .mil, .aero, .coop,.museum, .jobs, .mobi, .travel, .tel, .cat, and .asia . A sponsored TLD is a specialized domain with a sponsor representing the community that the TLD serves.
- Unsponsored generic TLDs (gTLDs) are .com, .net, .org, .int, .arpa, .biz, .info, .name and .pro. Unsponsored TLDs operate without any sponsoring organization and often have fewer restrictions for registrations than sponsored TLDs.

+ Internationalized Domain Names

Since 2000, the Internet community has been trying to make it easier for non-English speakers to navigate the Internet in their own language through the use of Internationalized Domain Names (IDNs). IDNs are domain names represented by local language characters. The local language domain name is followed by a TLD like .com or .net, for example: ベリサイン.com They utilize non-ASCII characters and are generally used in places where English is not the primary language. IDNs are available to be registered in all character sets or scripts identified in Unicode 3.1 which means that registrants can register IDNs in scripts that represent more than 350 languages.[2]

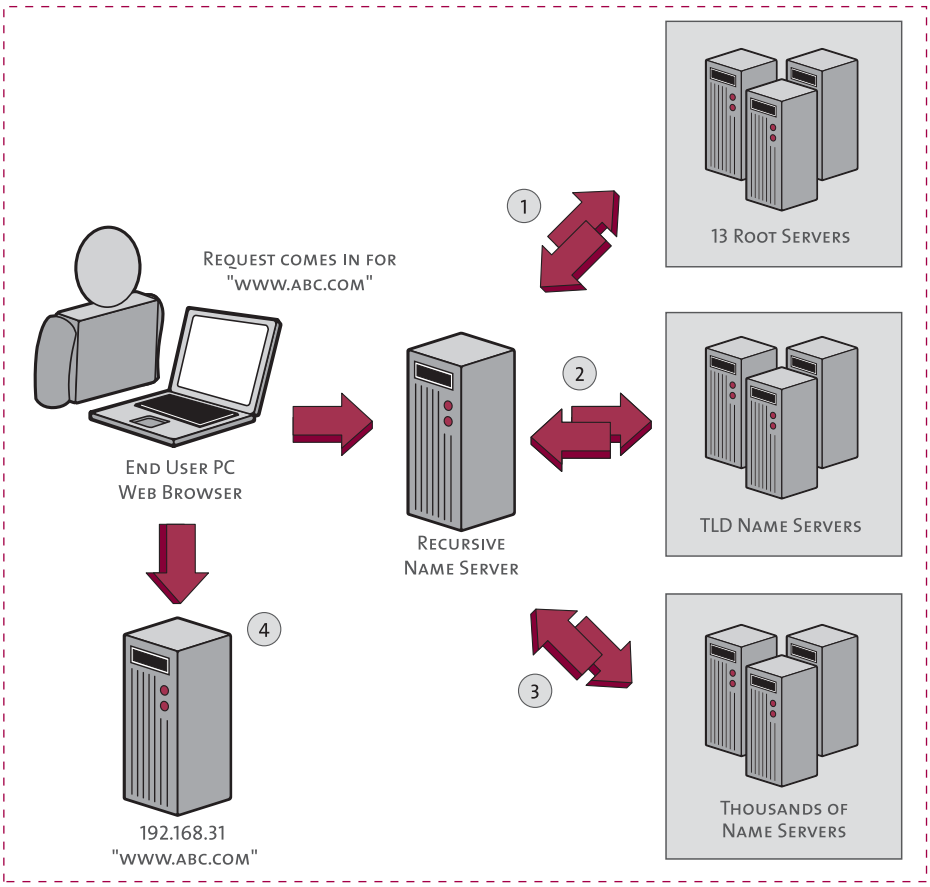
2 ASCII (American Standard Code for Information Interchange) characters include 0-9, A-Z and the hyphen. Currently the standards are for Unicode 3.1, but future changes will accommodate additional versions of Unicode up to and including 5.0.

IDNs have evolved from their early development in various test beds into viable domain names that resolve just like full ASCII domain names. The Internet Engineering Task Force (IETF) published the global standards for IDNs to assure their proper functioning within the DNS in 2003. The IDN Standards standardized the way that non-ASCII characters are to be represented within and handled by the DNS. One of the standards established by the IETF specifies that software and Internet applications translate the IDN into the form in which the DNS can handle an IDN. For example, the Microsoft Internet Explorer 7.0 browser supports IDNs.

+ How Registration Works

A user wanting to register a domain name contacts a registrar. (Registrars are companies that register domain names for end users - there are currently over 850 registrars, located all over the world, who register .com and .net domain names). Upon receiving a user's requested domain name, the registrar first verifies that the domain name is available by checking with the registry that manages the corresponding TLD. If the domain name is available, the registrar registers the domain name with the registry, which adds the domain name to its database. Then, no one else can register that domain name during the term of the registration.

How Resolution Works



How Resolution Works

Source: VeriSign

DOMAIN NAME TIMELINE

1983: Name server developed at University of Wisconsin, no longer requiring users to know the exact path to other systems

1984: Domain Name System (DNS) introduced; Number of hosts exceeds 1,000

1985: ISI at USC assumes responsibility for DNS root management; Symbolics.com becomes the first registered domain name on 15 March

Other firsts:
cmu.edu, purdue.edu, rice.edu, berkeley.edu, ucla.edu, rutgers.edu, bbn.com, mit.edu, think.com, css.gov, mitre.org

1987: Number of hosts exceeds 10,000

1989: Number of hosts exceeds 100,000

1990: First commercial provider of Internet dial-up access (world.std.com)

1992: Internet Society (ISOC) is chartered (January); Number of hosts exceeds 1,000,000; Term "surfing the Internet" coined

1993: InterNIC created by National Science Foundation; Network Solutions, Inc. awarded cooperative agreement for registration services

1995: $50 annual fee instated for domain names registration

1996: Domain name tv.com sold to CNET for US$15,000 in the secondary market

1997: Domain name business.com sold for US$150,000 in the secondary market; 101,803 name servers in Whois database

+ How Resolution Works

Everyday, millions of users surf the Web and send email using domain names instead of unfriendly and hard-to-remember IP addresses. Between the time a user types a domain name into a browser and when the associated Web page loads, a critical, time-sensitive process called resolution occurs behind the scenes. For each request, the computer checks first with the local name server to see if it recognizes the domain name; if it doesn't, the local name server will check a root name server, a TLD name server and finally the name server for the domain name itself. The entire process generally happens in a few tenths of a second and is transparent to the end user.

With explosive growth in domain name registrations, Web site resolutions and email usage, assuring the continued stability and security of the DNS infrastructure is critical to anyone with an interest in the Internet. (See the VeriSign Domain Report at www.verisign.com/domainbrief for statistics on the growth in the domain name industry).

+ A Bit of History

The Internet owes its roots to an ambitious 1973 research program of the U.S. Defense Advanced Research Projects Agency (DARPA) to develop communication protocols that would allow networked computers to communicate transparently across multiple linked packet networks. With significant success and rapid growth, by the 1980's the population of users expanded to include commercial enterprises and organizations outside the U.S., in addition to government facilities.

In 1984, the Domain Name System was introduced. Some of the earliest domain names in the system were symbolics.com, mit.edu, think.com, css.gov and mitre.org. The U.S. Department of Defense oversaw the domain name system until 1993, when the non-military component of the system was privatized through a cooperative agreement between the National Science Foundation and Network Solutions, Inc., among others.

Today the Internet functions as collaboration among many cooperating parties. The Internet Corporation for Assigned Names and Numbers (ICANN), a nonprofit, private-sector corporation, was established in 1998 by the U.S. Department of Commerce as the technical coordination body for aspects of the Domain Name System.

+ Keeping the DNS Safe and Sound

With peak loads of over 33 billion transactions a day, making sure that the DNS works accurately, quickly and securely is a key factor in maintaining the integrity of the Internet. VeriSign has a long history of leadership with the DNS. To provide redundancy and speed, VeriSign operates 13 large .com and .net resolution sites around the world at important Internet hubs in North America, Europe and Asia. In addition to these large resolution sites, VeriSign also operates dozens of smaller Regional Internet Resolution Sites (RIRS) throughout the world that provide high-speed resolution to traditionally under-served countries.

This "constellation" of name servers is maintained, monitored and managed by VeriSign's team of DNS experts. Each site in the constellation is well connected with high bandwidth and tight security controls. To meet the exceptional requirements of serving .com and .net, VeriSign developed its own proprietary name server called ATLAS (Advanced Transaction Lookup and Signaling System), which handles DNS traffic faster and more efficiently than any commercially available option. For the past decade, VeriSign's DNS constellation has achieved a 100% uptime record and resolved every DNS query with 100% accuracy.

1998: Network Solutions registers its 2 millionth domain name on 4 May; Internet Corporation for Assigned Names and Numbers (ICANN) established to transition DNS technical coordination from government to private sector

1999: First testbed registrars announced for competitive Shared Registry System; Register.com is first registrar to come online; business.com is sold for US$7.5million in the secondary market

2000: Testbed allowing registration of domain names in Chinese, Japanese and Korean begins; ICANN selects new TLDs: .aero, .biz, .coop, .info, .museum, .name, .pro

2001: : EDUCAUSE takes over management of .edu TLD; .biz, .info and .aero registrations begin

2003: Public Interest Registry (PIR) takes over management of .org TLD

2005: ICANN announces second round of sponsored gTLDs including: .mobi, .travel, .jobs, .cat

2008: IPv6 addresses for root servers added to the root zone.

Sources: Hobbes' Internet Timeline, Copyright 2004 Robert H. Zakon, www.zakon.org/robert/internet/timeline/; VeriSign

+ The Future

VeriSign is also a leader in DNS research and development. The ATLAS name server platform can answer millions of queries per second and allows changes to quickly propagate throughout the DNS constellation within minutes. VeriSign was a key contributor to the DNS security extensions, known as DNSSEC, developed by the Internet Engineering Task Force (IETF). (DNSSEC uses cryptography and digital signatures to eliminate spoofing and increase security.) Finally, VeriSign is at the forefront of leveraging our DNS expertise for new and interesting uses. For example, VeriSign runs the Object Naming Service (ONS), the root directory of electronic product codes (EPC) used by radio frequency identification (RFID) tags. This new lookup system uses established DNS technology: EPC codes are translated to domain names and the ONS is based on the DNS protocol.

+ Learn More

To subscribe or to access the archives for the Domain Name Industry Briefs, please go to www.verisign.com/domainbrief. Email your comments or questions to domainbrief@verisign.com.

+ About VeriSign

VeriSign, Inc. (Nasdaq: VRSN), operates Internet infrastructure services that enable and protect billions of interactions every day across the world's voice and data networks.

DEFINITIONS

TLD: Top Level Domain (rightmost label in a domain name)

Domain Name: using words instead of numbers to represent an Internet address

Root Server: database with comprehensive name listings of Top Level Domains

Whois: look-up directory to determine who registered which domain names

Constellation: network of distributed name servers

Resolution: process that returns a Web page after a name is entered into a browser or sends/receives an email after a name is entered in an email address