Name Collision in the DNS

A study of the likelihood and potential consequences of collision between new public gTLD labels and existing private uses of the same strings

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Executive Summary

Names that belong to privately-defined or "local" name spaces often look like DNS names and are used in their local environments in ways that are either identical to or very similar to the way in which globally delegated DNS names are used. Although the semantics of these names are properly defined only within their local domains, they sometimes appear in query names (QNAMEs) at name resolvers outside their scope, in the global Internet DNS.

The context for this study is the potential collision of labels that are used in private or local name spaces with labels that are candidates to be delegated as new gTLDs. The primary purpose of the study is to help ICANN understand the security, stability, and resiliency consequences of these collisions for end users and their applications in both private and public settings.

The potential for name collision with proposed new gTLDs is substantial. Based on the data analyzed for this study, strings that have been proposed as new gTLDs appeared in 3% of the requests received at the root servers in 2013. Among all syntactically valid TLD labels (existing and proposed) in requests to the root in 2013, the proposed TLD string `home` ranked 4th, and the proposed `corp` ranked 21st. DNS traffic to the root for these and other proposed TLDs already exceeds that for well-established and heavily-used existing TLDs.

Several options for mitigating the risks associated with name collision have been identified. For most of the proposed TLDs, collaboration among ICANN, the new gTLD applicant, and potentially affected third parties in the application of one or more of these risk mitigation techniques is likely to substantially reduce the risk of delegation.

The potential for name collision with proposed new gTLDs often arises from well-established policies and practices in private network environments. Many of these were widely adopted industry practices long before ICANN decided to expand the public DNS root; the problem cannot be reduced to "people should have known better."

The delegation of almost any of the applied-for strings as a new TLD label would carry some risk of collision. Of the 1,409 distinct applied-for strings, only 64 never appear in the TLD position in the request stream captured during the 2012 "Day in the Life of the Internet" (DITL) measurement exercise, and only 18 never appear in any position. In the 2013 DITL stream, 42 never appear in the TLD position, and 14 never appear in any position.

The risk associated with delegating a new TLD label arises from the potentially harmful consequences of name collision, not the name collision itself. This study was concerned primarily with the measurement and analysis of the potential for name collision at the DNS root. An additional qualitative analysis of the harms that might ensue from those collisions would be

necessary to definitively establish the risk of delegating any particular string as a new TLD label, and in some cases the consequential harm might be apparent only after a new TLD label had been delegated.

The rank and occurrence of applied-for strings in the root query stream follow a power-law distribution. A relatively small number of proposed TLD strings account for a relatively large fraction of all syntactically valid non-delegated labels observed in the TLD position in queries to the root.

The sources of queries for proposed TLD strings also follow a power-law distribution. For most of the most-queried proposed TLD strings, a relatively small number of distinct sources (as identified by IP address prefixes) account for a relatively large fraction of all queries.

A wide variety of labels appear at the second level in queries when a proposed TLD string is in the TLD position. For most of the most-queried proposed TLD strings, the number of different second-level labels is very large, and does not appear to follow any commonly recognized empirical distribution.

Name collision in general threatens the assumption that an identifier containing a DNS domain name will always point to the same thing. Trust in the DNS (and therefore the Internet as a whole) may erode if Internet users too often get name-resolution results that don't relate to the semantic domain they think they are using. This risk is associated not with the collision of specific names, but with the prevalence of name collision as a phenomenon of the Internet experience.

The opportunity for X.509 public key certificates to be erroneously accepted as valid is an especially troubling consequence of name collision. An application intended to operate securely in a private context with an entity authenticated by a certificate issued by a widely trusted public Certification Authority (CA) could also operate in an apparently secure manner with another equivalently named entity in the public context if the corresponding TLD were delegated at the public DNS root and some party registered an equivalent name and obtained a certificate from a widely trusted CA. The ability to specify wildcard DNS names in certificates potentially amplifies this risk.

The designation of any applied-for string as "high risk" or "low risk" with respect to delegation as a new gTLD depends on both policy and analysis. This study provides quantitative data and analysis that demonstrate the likelihood of name collision for each of the applied-for strings in the current new gTLD application round and qualitative assessments of some of the potential consequences. Whether or not a particular string represents a delegation risk that is "high" or "low" depends on policy decisions that relate those data and assessments to the values and priorities of ICANN and its community; and as Internet behavior and practice change over time, a string that is “high risk” today may be “low risk” next year (or *vice versa*).

For a broad range of potential policy decisions, a cluster of proposed TLDs at either end of the delegation risk spectrum are likely to be recognizable as “high risk” and “low risk.” At the high end, the cluster includes the proposed TLDs that occur with at least order-of-magnitude greater frequency than any others (`corp` and `home`) and those that occur most frequently in internal X.509 public key certificates (`mail` and `exchange` in addition to `corp`). At the low end, the cluster includes all of the proposed TLDs that appear in queries to the root with lower frequency than the least-frequently queried existing TLD; using 2013 data, that would include 1114 of the 1395 proposed TLDs.

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1 Introduction

A name that is properly defined in one domain may (for a variety of reasons) accidentally or maliciously appear in another domain in which it is syntactically valid, where it may be misinterpreted by users, software, or other functions in that domain as if it belonged there. *Name collision* occurs when such a name cannot be distinguished from a syntactically identical name that is properly defined within the other domain.

Anecdotal and some existing empirical data suggest that a large percentage of these new TLD labels have already appeared in queries to the root servers. In 2010 ICANN's Security and Stability Advisory Committee (SSAC), for example, considered "the potential problems that may arise should a new TLD applicant use a string that has been seen with measurable (and meaningful) frequency in a query for resolution by the root system," and in its advisory[1] recommended "that ICANN promote a general awareness of the potential problems that may occur when a query for a TLD string that has historically resulted in a negative response begins to resolve to a new TLD" and "study invalid TLD query data at the root level of the DNS."

This report presents the results of a study of root-level TLD query data that was undertaken to provide empirical information about if, how, and to what extent the delegation of new gTLDs that collide with names that were previously defined in non-public name spaces might affect the security, stability, or resiliency of the Internet. These results are expected to serve as input to the community's discussion of new gTLD delegation policy alternatives.

1.1 Terminology

This report uses the following terms that may not be generally familiar:

Existing TLD: a string that has been delegated as a TLD label in the DNS root maintained by the Internet Assigned Numbers Authority (IANA).

Invalid TLD: a string that could not be a TLD name because it is not a syntactically valid TLD label.[2]

Potential TLD: a string that would be syntactically valid as a TLD label but has not been delegated in the public DNS root.

Proposed TLD: a potential TLD that is among the applied-for strings in the current round of the new gTLD program.[3]

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[1] SAC 045—Invalid Top Level Domain Queries at the Root Level of the Domain Name System (http://www.icann.org/en/groups/ssac/documents/sac-045-en.pdf).

[2] The requirements for a properly constructed TLD label are defined in [19].

Semantic domain: the namespace in which name resolution takes place. The Internet's Domain Name System, anchored at the IANA root, is one semantic domain. Other examples are the multicast DNS namespace [20] and the NetBIOS namespace [21].

Name collision: two names that are represented by syntactically identical strings but belong to different semantic domains are said to "collide" when one of them appears in the other's semantic domain and is (mis)interpreted as if it belonged there.

Request stream: the complete set of request messages received by a DNS server from a DNS client, including those that are of type "query."[4] Because request messages have historically also been called "queries," whether or not they are of type "query," we distinguish the two terms in this report only when the distinction matters. The "query stream at the root" is therefore the complete set of request messages received by the DNS root servers, not just the requests of type "query."

Internal name certificate: public-key certificates issued by widely trusted Certification Authorities with subjectNames or subjectAlternativeNames that are based on domain names that are defined only within a private context in which there is a private DNS service. Typically, such certificates also use at least one DNS name that is properly registered under a valid TLD within the public DNS.

1.2 Scope

The scope of the study as defined by the statement of work covers the following questions:

- What is the scope (size and distribution) of the "name collision" phenomenon (names belonging to non-global name spaces appearing "out of context" in queries to the global DNS)? Put more simply, how often does this happen, and how diverse and numerous are the strings that appear?
- Is the incidence of queries for proposed TLDs that are delivered to root name servers a valid proxy for the overall incidence of local name escape (and thus of collision between local names and DNS names)?

[3] This study relied on the original list of applied-for strings <strings-1200utc-13jun12-en>. A few of those strings were changed during the Initial Evaluation process, and some applications have been withdrawn. The results reported here do not account for any changes that were made after 13 June 2012.

[4] Some of the DNS literature uses the term "query" for messages from a client to a server, and the term "response" for messages from a server to a client. DNS standards also talk about different types of request, where one of the types is "a query" as compared to the type "notify" (about zone file changes) or "update" (with an update request about the zone). The term "request" is therefore often used to refer collectively to all types of messages a client and server might exchange, and "query" for the requests that actually are of type "query."

- How widespread is the use of internal name certificates that either do or could contain names that collide with new gTLD applied-for strings? What are the risks associated with delegating new gTLDs with names that could appear in internal name certificates issued to someone not related to the new gTLD?
- What are the risks associated with delegating new gTLD labels that are syntactically identical to labels that may escape from local contexts and collide with them somewhere in the public DNS (either before or at the root)? Put more simply, what are the bad things that might happen, and who would be harmed (and how) if they did?
- How can the applied-for strings be grouped according to the relative risk that they represent as candidates for delegation as new gTLDs? What risks are associated with each group?
- What risk management options exist?

2 Background and context

2.1 The Domain Name System

The DNS is fundamentally four things:

- a shared name space;
- the servers (name servers) that implement the name space;
- the resolvers (intermediate caching servers) and end systems that send questions (queries) about the name space to the name servers; and
- a protocol that offers interoperable resolution security and defines message delivery.

The root zone defines the apex of the shared name space and the root nameservers are where this name space apex is instantiated for the users of this namespace—*i.e.*, the Internet as we know it.

The billions of computers that form the Internet of today would have to send all of their queries to these root name servers without two other architectural features of the DNS. The first is that it is designed to be hierarchical—parts of the name space can be and are distributed and delegated to other authoritative name servers in the Internet. This DNS feature allows for and has enabled the massive growth and scalability of the Internet in the past 20 years. The second is the use of DNS resolvers that cache responses from authoritative servers as a result of queries sent to them from their client end systems.

2.1.1 DNS zones

The DNS name space is implemented as a hierarchical distributed database, divided for management purposes into pieces, called *zones*. Each zone is served by one or more *name servers*,[5] which are synchronized to contain identical sets of data. The zones are hierarchically organized into a structure that is usually represented graphically as an inverted "tree", and the zones contain DNS information belonging to the corresponding name domains in the tree. The root zone constitutes the top of the inverted tree (level 0). Its name is, strictly speaking, an empty string (not "root"), but it is usually denoted with a single "." (period or "dot").

The DNS data in a zone are usually stored in a file—a *zone file*. The servers serving the same file synchronize by sending the contents of the zone file from the *master* server to *slave* server(s).[6] This is known as a *zone transfer*. Masters and slaves are considered equal from a DNS "quality" or "authority" standpoint; the term *master* simply distinguishes the server at which changes to the zone in question are entered.

[5] Both "name server" and "nameserver" are used, interchangeably, in descriptions of the DNS.
[6] In old literature the terms *primary* and *secondary* are often used instead of *master* and *slave*.

The root zone contains pointers downwards in the DNS hierarchy. It contains the names of the existing domains one level below the root—level 1, or the top level domains (TLDs). This has two consequences:

- a TLD is visible to the public Internet only if it is listed in the root zone, and
- any DNS client (*resolver*) can always start its lookup process for any domain name by asking a server that carries the information in the root zone; the pointers in the root zone will lead the client to issue a series of subsequent queries which will eventually lead to the sought information.

For each TLD there is also a zone, which is served by one or more synchronized servers. The model repeats itself, level by level, down through the hierarchy.

2.1.2 The root name servers

The *root name servers* (or simply *root servers*) are DNS name servers that carry and serve data from the root zone. There are 13 publicly accessible well-known IPv4 addresses (representing hundreds of individual machines) on the Internet from which such service can be obtained. The servers are denoted by the letters A through M, and carry DNS hostnames of the form `<letter>.root-servers.net` (for example, `a.root-servers.net`). Some of them also provide service at IPv6[7] addresses.

The home locations of some of the root servers were originally determined by analysis of network traffic flows and loads, seeking to have at least one server "close" in terms of message communication time to every location on the network. It is important to have root servers distributed so that they provide a sufficient level of service to all users across the network.

Considerations of this type are both complex and important, and have, as the Internet evolved, become increasingly so. Over time, these original locations have become less satisfactory, which has been one of the reasons for the proliferation by some operators of satellite sites at different locations. These satellite sites use a method called *anycast,* which enables servers with the same IP address to be located at different points on the Internet. *Instances* of a root server might therefore be placed at multiple locations around the world. The widespread distribution of anycast instances of the root servers has improved the level of service provided to many previously less well served locations.

2.1.3 DNS resolvers

Throughout the global Internet, systems that need to discover the binding between a domain name and an IP address employ DNS resolvers to send queries ("where is the resource with the

[7] IPv4 and IPv6 are different versions of the Internet Protocol, using different addressing schemes.

domain name `mangelwurzel.example.org`?”) to name servers and receive the responses (“it’s at the IP address 192.168.48.3”).[8] The queries and responses are defined by the DNS protocol, and are usually carried across the Internet in User Datagram Protocol (UDP) packets (although under certain circumstances the queries and/or responses may be carried over Transmission Control Protocol (TCP) connections).

Internet end systems send queries to a DNS resolver. The end system is configured with the IP address of the DNS resolver. The configuration is either static or dynamic (using for example DHCP). The DNS resolver is configured with the IP addresses of the root servers. At startup time, it sends a so called “priming query” to those IP addresses to find out the current set of root servers. After this priming of the cache in the DNS resolver, the DNS resolver is ready to respond to queries from end systems. The DNS resolver when getting a query first looks in its cache, and if the response is not there, it queries the authoritative servers in the world, starting with the root name servers, and places all responses in its cache, caching the responses according to so-called “time to live” information defined by the authoritative servers. In some cases the DNS resolver is configured to not send queries to the authoritative servers, but instead to some other DNS resolver, in which case this second DNS resolver views the first as an end system.

It is these DNS resolvers—also called forwarding servers, caching name servers, or Iterative Mode Resolvers (IMRs)—that send most of the queries from the Internet to the root servers. These systems are the “consumers” of the data in the root zone. As virtually anyone on the Internet can create a DNS resolver at any time, there is no way to precisely determine how many DNS resolvers are “out there,” where they are, what software they are running, or other details of their configuration.

2.2 Name collision

Name collision occurs when name resolution takes place in a semantic domain other than the one that was expected by a user. The cause of this might be that the user, who is expecting a name to be resolved within the Internet’s semantic domain, is using a name resolver that is configured with another Top Level Domain (TLD) namespace that it can query locally, in addition to or perhaps instead of forwarding queries to the root servers configured with the Internet’s IANA root.

End users are often not aware that names might be resolved in different semantic domains, because in many cases names that belong to different semantic domains are syntactically

[8] The operation of the DNS is of course more complicated than this, but for the purposes of this report the simplified description given here suffices.

indistinguishable, and few user interfaces provide any information about the domain in which a name will be resolved.

For example, in a typical home environment a user might type any of the following names into the address bar of a web browser:

- `http://fritz.box`—which is defined within the semantic domain of a particular German brand of home gateways, and identifies the configuration interface of those devices.
- `http://peer.local`—which is defined within the multicast DNS semantic domain, and identifies the web server running on the machine called "peer" within the user's multicast domain.
- `http://www.icann.org`—which is defined within the Internet's semantic domain, the DNS.

If the user's name resolver (perhaps provided as part of her local home or corporate environment, or by her ISP) tries to resolve `http://fritz.box` (for example) in the Internet's DNS domain, the results will (in general) not be the same as they would be if the name resolution took place within the home gateway domain.

3 The name collision study

3.1 Motivation

ICANN has reached the point in its new gTLD program at which applications that have passed Initial Evaluation will begin to proceed to delegation. Questions have been raised [3][4] about the potential collision between newly delegated TLD labels and syntactically identical strings that are already in use as names that are not part of the public DNS but often appear in the same context. ICANN commissioned this study to gather information about the likelihood and potential consequences of these name collisions, and to suggest options for mitigating risks arising from any new gTLD delegation.

3.2 Scope

The scope of this study is defined by the information that can be derived either directly or through analysis from its three principal data sources:

- the DNS request stream at the root servers that participated in the "Day in the Life of the Internet" (DITL) exercises organized by the DNS Operations, Analysis, and Research Center (DNS-OARC)[9] in 2012 and 2013;
- the DNS request stream at servers operated by a global DNS resolver organization that contributed to the 2012 DITL exercise; and
- data concerning the issuance of internal name certificates provided by organizations that operate Certificate (or Certification) Authorities that issue public key digital certificates, many of them members of the Certification Authority/Browser (CA/B) Forum.[10]

This scope is deliberately and necessarily narrow and limited.

3.3 Terms of reference and study timeline

A resolution of the ICANN Board adopted on 18 May 2013[11] noted that "enterprises have local environments that may include strong assumptions about which top-level domains exist at the root level of the public DNS, and/or have introduced local top-level domains that may conflict with names yet to be delegated at the root level of the public DNS" and called for "a study on the use of TLDs that are not currently delegated at the root level of the public DNS in enterprises." The Board resolution called for the study to "consider the potential security impacts of applied-for new-gTLD strings in relation to this usage."

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[9] https://www.dns-oarc.net
[10] https://www.cabforum.org
[11] http://www.icann.org/en/groups/board/documents/resolutions-18may13-en.htm#2.a

On 28 May 2013 ICANN announced[12] that “a study has been commissioned on the potential security impacts of the applied-for new-gTLD strings in relation to namespace collisions with non-delegated TLDs that may be in use in private namespaces including their use in X.509 digital certificates.” Interisle Consulting Group, the contractor selected to perform the study, agreed to complete the study and present its results prior to the ICANN meeting scheduled for 14-18 July 2013.

3.4 Methodology

The study team followed the following process to gather and analyze information about the occurrence and potential consequences of proposed TLD strings appearing as labels in QNAMEs in queries to the root:

- extract statistics concerning existing, potential, and proposed TLD strings from the DITL 2012 and 2013 data supplied by participating root server operators (RSOs), supplemented where possible by additional data from individual RSOs and intermediate resolver operators;
- gather information concerning the issuance and use of internal name certificates from organizations that operate certificate authorities and (as time permits) interviews with people at large organizations that use internal certificates;
- analyze the DITL and resolver data to determine how often proposed TLD strings appear in the query stream to the root, and how those queries are distributed with respect to distinct sources (based on IP address prefix[13]); and
- analyze the CA data to assess the risks and consequences of delegating applied-for strings that match strings used in internal name certificates.

3.4.1 Sources

The study team gathered information from and corroborated elements of its analysis with:

- the pcap[14] data collected during the 2012 and 2013 DITL exercises;
- individual RSOs;
- operators of large DNS resolver services;

[12] http://www.icann.org/en/news/announcements/announcement-28may13-en.htm
[13] An “IP address prefix” is the common high-order part of a block of IP addresses which typically represents the “network” or “subnetwork” within which a number of individual hosts (identified individually by the remaining low-order bits of the address) are located. Because of the way in which Internet routing is (mostly) configured, an IP address prefix is a reasonable aggregate of host IP addresses that collectively represent the same “source” with respect to DNS queries.
[14] A “pcap” file is created by network management systems that capture packet images sent and/or received by a network device; they are essentially low-level network log files. The DITL pcap data consist of packet captures from most of the root servers over a single continuous period of at least 48 hours.

- organizations that operate as widely-trusted certification authorities (*i.e.*, those with root certificates embedded in browsers and OSs); and
- web browser and other software vendors.

3.4.2 Data sources and root server assistance

Preliminary discussions on the practicalities of this study took place during the RIPE66 and DNS-OARC meetings in mid-May 2013 since several of the RSOs were attending. These discussions considered what data would be needed for the study, how to collect and deliver that data, likely timelines/milestones, and what levels of assistance the RSOs could provide.

The consensus was that the main data source for DNS analysis should be DNS-OARC's DITL (Day in the life of the Internet)[15] data sets. Many RSOs already contributed data to that initiative and had begun preparations for the 2013 DITL exercise which would start later that month. Using DITL data for this study had the benefit of not requiring RSOs to commit resources for some other type of data gathering. In addition, access to the DITL data was covered by a single data sharing agreement common to all DNS-OARC members. This meant that the study team would be able to analyze those data almost immediately and avoid the potential delays that might arise from the legal complexities of arranging confidentiality and/or data access agreements with individual root server operators.

3.4.3 DITL data processing

The sheer size of the DITL data sets presented many challenges; managing roughly 8TB of compressed data spread across more than 500,000 files and organizing the workflow around them was a non-trivial exercise. All of this work had to be performed at DNS-OARC under the terms of its data sharing agreement. DITL data could not be copied or moved off-site; they could be accessed only across the local network from DNS-OARC's file servers.

Before any data gathering was carried out, the team made an assessment of the available hardware at DNS-OARC and the potential software that could be used. Some benchmarking was done to assess the hardware or network footprint of these tools and how long particular tools would take to process the data. Pragmatic choices were then made about how best to proceed—which tools would be most suited to the available platforms; what approaches to processing the data would and would not work well; how to arrange the workflows; and estimating how long each run over the data sets would take. Appropriate scripts were then developed and tested. These produced summary results which were submitted for statistical analysis.

[15] https://www.dns-oarc.net/oarc/data/ditl

Processing of the DITL data was carried out in two stages. The first pass over the data just counted TLD labels: how often a string appeared as the right-most label of the QNAME in each DNS request. The second pass extracted information about DNS requests that contained any label matching one of the proposed gTLD strings. This filtering reduced the data sets for analysis from terabytes of compressed data in wire format to gigabytes of plain text. Each pass over a year's DITL data took approximately 1 calendar week. In reality, processing for each data run took 2 CPU-months, since all of the CPUs of an 8-core system were used in parallel.

A custom version of *packetq* was used to produce counts of the TLD labels. The second run over each DITL data set generated plain text which could then be processed by the usual UNIX tools: *awk, sed, perl,* etc. Scripts processed the plain text to produce summary reports on label position and source address prefix counts for each proposed gTLD. Each script run took about 16 hours of elapsed time (approximately 12 CPU-days). The graphs and tables in this report were created from these summaries.

The 2013 DITL exercise took place at the end of May 2013. Delivery of 2013 DITL pcap files was under way while processing of the 2012 DITL data was in progress. The summary reports from the 2012 data set were completed on June 18th. By then the 2013 DITL data had arrived at DNS-OARC. Analysis of this year's data began on June 19th and production of the summary reports from those data runs and scripts was completed on June 26th.

Comparable data runs were carried out on global resolver provider data that were contributed to DITL in 2012. A script was used to count TLD labels instead of using *packetq* because name server log files in plain text had been provided rather than raw packet format pcap files.

Some verification of the summary reports was carried out. A small amount of data sampling was done to check that the summary findings were reasonably accurate and no scripting errors had been introduced. In addition, an independent analysis of the I-root pcap files was carried out at Netnod. This produced results that were broadly in line with those produced by this study across all the RSOs who had contributed to the 2012 and 2013 DITL exercises. Further analysis counted the settings of the opcode field and RA and RD bits in the DNS requests.

3.4.4 Acknowledgements

The study was conducted by Lyman Chapin, Olaf Kolkman, Jim Reid, Colin Strutt, and Chuck Wade. Patrik Fältström served as liaison between the study team and SSAC.

Special thanks are extended to kc claffy for making a CAIDA[16] system installed at DNS-OARC available to the team so that the DITL data could be processed. It would not have been possible

[16] The Cooperative Association for Internet Data Analysis (http://www.caida.org).

to produce our results in time without access to that resource. Dan Anderson at CAIDA provided valuable assistance with system administration and installing/configuring software to support our work. William Sotomayor at DNS-OARC helped with resourcing and arranging access to the DITL data. Netnod's Henrik Levkowetz supplied a custom version of the *packetq* tool and was quick to extend its capabilities as the need arose. He also checked that some of our findings matched his own analysis of the copies of the I-root DITL pcap files that are held in Stockholm. We are grateful to all of these contributors for willingly going far beyond what could reasonably have been expected of them.

4 Name collision potential

The key premise of the current study is that the potential for newly delegated TLD labels to collide with names that are syntactically identical but belong to different semantic domains can be estimated by analyzing the appearance of those name strings in current queries to the DNS root. If a string appears frequently in the request stream today, it is more likely to collide with the same string after it has been delegated as a TLD label in the DNS root.

It is important to recognize, however, that absence of evidence is not evidence of absence. Even proposed new gTLD strings that appear infrequently in requests to the root may be in widespread use on private networks.

4.1 The DITL request stream

The DITL data sets contain a complete copy of every packet received by each participating root server during the measurement period. A key objective of the current study was to analyze the data sets collected in 2012 and 2013 to create summaries of the way in which existing TLDs, proposed TLDs, and potential TLDs appeared in different positions (top level, second level, etc.) in QNAMES in the query stream.

The data captured during the 2012 DITL exercise consisted of full-stream packet captures from the A, C, E, F, H, I, J, K, L, and M root servers. The exercise was conducted during the 3-day period from 17 April to 19 April 2012. The data set amounted to 5.2 TB, comprising 230,000 compressed pcap files which contained a total of 55 billion[17] DNS requests.

The data captured during the 2013 DITL exercise consisted of full-stream packet captures from the A, C, D, E, F, H, I, J, K, L, and M root servers. The exercise was conducted during the 3-day period from 28 May to 30 May 2013. The data set amounted to 1.7 TB, comprising 290,000 compressed pcap files which contained a total of 39 billion DNS requests.[18]

One operator of a global DNS resolver service provided copies of its name server query logs for the period covered by the 2012 DITL exercise. These consisted of 33,000 plain-text files, amounting to 0.9TB of compressed data containing 53 billion DNS requests.

Of the 1,409 distinct applied-for TLD strings, 1,345 appeared at least once in the 2012 DITL data with the string at the TLD position. Another 46 strings did not appear in the TLD position but did appear in some other position.

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[17] In this report we use the "short scale" version of the term "billion" (10**9).

[18] The data sets and query volumes for each year are not aligned because some pcap files contained requests and their responses while others contained only requests. Some 2012 pcaps contained other traffic in addition to DNS packets. Only DNS requests were examined for this study.

Of the 1,409 distinct applied-for TLD strings, 1,367 appeared at least once in the 2013 DITL data with the string at the TLD position. Another 28 strings did not appear in the TLD position but did appear in some other position.

4.1.1 Occurrence of applied-for strings

The 35 strings in the list of proposed TLDs[19] that appear most frequently in the TLD position in the 2012 data set are shown in Table 1.[20]

Rank	String	Count (thousands)
1	home	595,024
2	corp	122,794
3	site	13,013
4	global	10,838
5	ads	7,799
6	iinet	7,668
7	group	6,505
8	box	6,152
9	cisco	5,231
10	hsbc	4,924
11	inc	4,622
12	network	4,417
13	dev	4,344
14	prod	4,107
15	office	3,833
16	host	2,965
17	app	2,573
18	win	2,511
19	ltd	1,962
20	business	1,920
21	ice	1,837
22	link	1,776
23	google	1,644

[19] This study relied on the original list of applied-for strings <strings-1200utc-13jun12-en>. A few of those strings were changed during the Initial Evaluation process, and some applications have been withdrawn. The results reported here do not account for any changes that were made after 13 June 2012.
[20] The complete list is included in Appendix A.

Rank	String	Count (thousands)
24	red	1,603
25	mail	1,505
26	smart	1,475
27	world	1,441
28	casa	1,283
29	med	1,262
30	mnet	1,132
31	star	1,040
32	orange	924
33	web	815
34	youtube	790
35	vip	789

Table 1—Top 35 ranked number of applied-for strings seen in TLD position (2012)

The 35 strings in the list of proposed TLDs[21] that appear most frequently in the TLD position in the 2013 data set are shown in Table 2 (with the 2012 rankings included for comparison):

2013 Rank	2012 Rank	String	Count (thousands)
1	1	home	952,944
2	2	corp	144,507
3	21	ice	19,789
4	4	global	12,352
5	29	med	10,801
6	3	site	10,716
7	5	ads	10,563
8	12	network	8,711
9	7	group	8,580
10	9	cisco	8,284
11	8	box	7,694
12	14	prod	7,004
13	6	iinet	5,427
14	10	hsbc	5,249

[21] The complete list is included in Appendix B.

2013 Rank	2012 Rank	String	Count (thousands)
15	11	inc	5,208
16	18	win	5,199
17	13	dev	5,058
18	15	office	4,006
19	20	business	3,279
20	16	host	3,127
21	31	star	2,435
22	25	mail	2,383
23	19	ltd	1,990
24	23	google	1,859
25	169	sap	1,735
26	17	app	1,720
27	27	world	1,650
28	30	mnet	1,568
29	26	smart	1,331
30	33	web	1,126
31	32	orange	1,072
32	24	red	1,043
33	43	msd	956
34	37	school	872
35	39	bank	780

Table 2—Top 35 ranked number of applied-for strings seen in TLD position (2013)

Table 3 shows the top 100 most frequently occurring TLD strings in the DITL 2013 data[22] for all categories except "invalid," with occurrence counts (in thousands) separated out (and lines colored) by existing TLDs, proposed TLDs, and potential TLDs.[23]

[22] Because of the way in which the extremely large DITL data sets were processed to produce these summaries, the occurrence counts in Tables 2 and 3 differ slightly. The differences are negligible and have no effect on the analysis or results of the study.

[23] `local`, `localhost`, and `invalid` are syntactically valid domain name labels but are disallowed as TLD labels by [15] (`localhost` and `invalid`) and [19] (`local`). Comments in this report about the rank of a proposed or existing TLD relative to all syntactically valid TLDs omit these "potential" TLDs.

Rank	TLD	Existing TLD	Proposed TLD	Potential TLD
1	com	8,555,898		
2	net	5,037,688		
3	local			2,501,349
4	org	1,099,675		
5	home		1,018,998	
6	arpa	845,996		
7	localdomain			596,069
8	internal			508,937
9	ru	426,826		
10	localhost			414,286
11	cn	392,168		
12	belkin			388,979
13	lan			362,914
14	uk	308,134		
15	de	289,210		
16	domain			275,608
17	jp	269,032		
18	br	245,572		
19	info	245,228		
20	edu	235,602		
21	au	157,392		
22	pl	153,050		
23	corp		153,012	
24	nl	145,164		
25	router			140,124
26	tw	137,992		
27	us	134,186		
28	dlink			126,378
29	tv	111,549		
30	eu	109,104		
31	fr	107,905		
32	kr	103,877		
33	at	96,909		
34	ca	96,103		
35	in	94,882		
36	gov	94,124		
37	it	93,373		
38	biz	91,982		
39	me	87,557		

Rank	TLD	Existing TLD	Proposed TLD	Potential TLD
40	cc	86,001		
41	ua	82,335		
42	es	80,213		
43	tr	69,257		
44	invalid			66,675
45	co	65,951		
46	se	64,724		
47	id	62,117		
48	novalocal			60,370
49	cz	58,249		
50	ro	54,482		
51	vn	53,066		
52	homestation			52,258
53	null			50,080
54	gr	48,422		
55	kg	48,403		
56	loc			48,205
57	private			47,384
58	arris			46,763
59	ch	45,822		
60	mx	45,453		
61	ar	45,360		
62	hk	43,821		
63	notinuse			43,121
64	intra			42,085
65	za	41,839		
66	bind			41,699
67	be	38,607		
68	gprs			38,113
69	nz	35,987		
70	dk	35,620		
71	dom			35,102
72	il	34,826		
73	sg	32,674		
74	pt	29,863		
75	no	29,444		
76	hu	28,975		
77	cl	28,900		
78	mil	28,766		

Rank	TLD	Existing TLD	Proposed TLD	Potential TLD
79	html			28,478
80	sys			27,724
81	my	25,482		
82	sk	25,063		
83	th	24,497		
84	fi	24,366		
85	tendaap			24,171
86	gateway			23,917
87	none			23,213
88	ws	22,178		
89	ph	21,451		
90	actdsltmp			21,152
91	server			20,674
92	pri			20,624
93	su	19,963		
94	intranet			19,907
95	ice		19,825	
96	pvt			19,633
97	lt	19,482		
98	la	19,226		
99	minihub			19,187
100	asus			18,873

Table 3—Number of existing, proposed, and potential TLD strings in TLD position (2013)

This list includes 3 proposed TLDs.

Figure 1 shows the relative distribution of existing, proposed, potential, and invalid TLD strings in the root query stream in 2013:

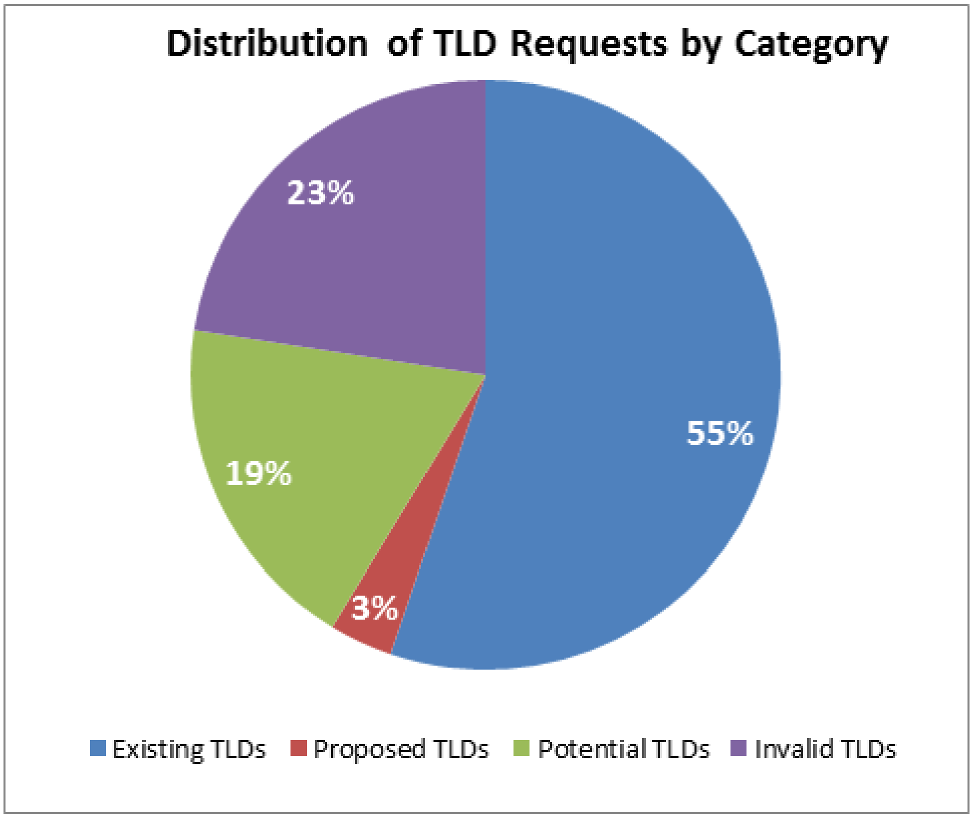

Figure 1—Distribution of Existing, Proposed, Potential, and Invalid TLDs (2013)

Table 4 shows the differences between 2012 and 2013 in the rank and number of occurrences (in thousands) of the top 100 proposed TLDs. The rank change and count change figures are given for comparison only; no conclusion about trends (in either direction) can be drawn from such a limited set of data.

Proposed TLD	2012 rank	2013 rank	Rank change	2012 count	2013 count	Change 2012-2013
home	1	1	0	595,024	952,944	60%
corp	2	2	0	122,794	144,507	18%
ice	21	3	18	1,837	19,789	977%
global	4	4	0	10,838	12,352	14%
med	29	5	24	1,262	10,801	756%
site	3	6	-3	13,013	10,716	-18%
ads	5	7	-2	7,799	10,563	35%

Proposed TLD	2012 rank	2013 rank	Rank change	2012 count	2013 count	Change 2012-2013
network	12	8	4	4,417	8,711	97%
group	7	9	-2	6,505	8,580	32%
cisco	9	10	-1	5,231	8,284	58%
box	8	11	-3	6,152	7,694	25%
prod	14	12	2	4,107	7,004	71%
iinet	6	13	-7	7,668	5,427	-29%
hsbc	10	14	-4	4,924	5,249	7%
inc	11	15	-4	4,622	5,208	13%
win	18	16	2	2,511	5,199	107%
dev	13	17	-4	4,344	5,058	16%
office	15	18	-3	3,833	4,006	5%
business	20	19	1	1,920	3,279	71%
host	16	20	-4	2,965	3,127	5%
star	31	21	10	1,040	2,435	134%
mail	25	22	3	1,505	2,383	58%
ltd	19	23	-4	1,962	1,990	1%
google	23	24	-1	1,644	1,859	13%
sap	169	25	144	91	1,735	1808%
app	17	26	-9	2,573	1,720	-33%
world	27	27	0	1,441	1,650	14%
mnet	30	28	2	1,132	1,568	38%
smart	26	29	-3	1,475	1,331	-10%
web	33	30	3	815	1,126	38%
orange	32	31	1	924	1,072	16%
red	24	32	-8	1,603	1,043	-35%
msd	43	33	10	534	956	79%
school	37	34	3	696	872	25%
bank	39	35	4	622	780	25%
casa	28	36	-8	1,283	771	-40%
telefonica	45	37	8	519	768	48%
zone	51	38	13	435	701	61%
movistar	118	39	79	156	660	324%

Proposed TLD	2012 rank	2013 rank	Rank change	2012 count	2013 count	Change 2012-2013
search	82	40	42	264	657	149%
abc	41	41	0	556	646	16%
llc	48	42	6	470	592	26%
youtube	34	43	-9	790	576	-27%
samsung	219	44	175	65	569	777%
tech	68	45	23	300	563	87%
hot	55	46	9	400	554	38%
you	44	47	-3	524	541	3%
ecom	46	48	-2	493	534	8%
hotel	52	49	3	426	530	25%
off	54	50	4	414	526	27%
cloud	119	51	68	155	514	231%
foo	62	52	10	347	513	48%
new	36	53	-17	704	500	-29%
bcn	93	54	39	213	495	132%
free	81	55	26	266	491	85%
top	53	56	-3	414	484	17%
one	63	57	6	337	482	43%
bet	91	58	33	224	479	113%
kpmg	949	59	890	2	477	24677%
wow	69	60	9	295	459	56%
yahoo	47	61	-14	486	437	-10%
blog	56	62	-6	395	432	10%
work	49	63	-14	443	404	-9%
chrome	110	64	46	167	384	130%
data	84	65	19	259	382	47%
link	22	66	-44	1,776	375	-79%
comcast	40	67	-27	578	369	-36%
cam	80	68	12	268	369	38%
gold	151	69	82	113	369	227%
medical	67	70	-3	310	368	19%
live	75	71	4	276	364	32%

Proposed TLD	2012 rank	2013 rank	Rank change	2012 count	2013 count	Change 2012-2013
art	77	72	5	276	345	25%
olympus	66	73	-7	321	343	7%
city	73	74	-1	281	342	22%
sew	76	75	1	276	339	23%
lanxess	60	76	-16	359	328	-9%
center	106	77	29	176	327	85%
ifm	99	78	21	189	326	73%
law	87	79	8	235	318	35%
goo	85	80	5	248	315	27%
plus	141	81	60	126	307	143%
apple	64	82	-18	330	292	-12%
zip	96	83	13	191	279	46%
gmail	117	84	33	156	275	76%
house	38	85	-47	649	271	-58%
company	95	86	9	195	263	35%
itau	83	87	-4	260	263	1%
thai	131	88	43	144	263	83%
show	74	89	-15	278	261	-6%
college	153	90	63	112	257	131%
taobao	155	91	64	110	257	134%
amazon	152	92	60	113	254	126%
schule	65	93	-28	325	254	-22%
pub	127	94	33	148	253	71%
bom	124	95	29	150	251	67%
ibm	50	96	-46	437	250	-43%
ericsson	105	97	8	178	246	39%
vet	109	98	11	169	243	44%
here	101	99	2	185	243	31%
man	112	100	12	165	237	44%

Table 4—Change in rank and occurrence from 2012 to 2013

4.1.2 Request sources

In some data sets the source IP addresses were obfuscated or had the low-end address bits masked out for legal reasons, generally related to privacy or confidentiality. All such addresses have been taken at face value and treated as valid source addresses for this analysis.

This simplifying assumption is expected to have had little impact on the IP address prefix counts for each TLD. The appropriate prefix count would have been incremented whenever a masked source address was in the input data set because the prefix would be the same whether or not the low-end address bits had been masked. Obfuscated IP addresses will have been mapped into RFC1918 private address space for IPv4 or locally scoped IPv6 addresses. The discrete prefix counts for these should be broadly in line with what would have been the counts for the actual prefixes if they had been available. It would also have been difficult to differentiate between these obfuscated addresses and DNS requests which genuinely contained those source addresses when they arrived at the root servers.

For each proposed TLD appearing at any position in the DNS name, each distinct IP address prefix was determined so we counted the number of distinct IP address prefixes that appeared for each proposed TLD. For IPv4 the prefix is a /24; for IPv6 the prefix is a /32.

Table 5 shows the number (in thousands) of distinct IP address prefixes used to access each of the most queried proposed TLD strings for 2012:

Rank	String	Count (thousands)	Prefix Count (thousands)
1	home	595,024	1,015
2	corp	122,794	793
3	site	13,013	92
4	global	10,838	433
5	ads	7,799	225
6	iinet	7,668	108
7	group	6,505	130
8	box	6,152	118
9	cisco	5,231	128
10	hsbc	4,924	112
11	inc	4,622	73
12	network	4,417	82
13	dev	4,344	166

Rank	String	Count (thousands)	Prefix Count (thousands)
14	prod	4,107	171
15	office	3,833	121
16	host	2,965	137
17	app	2,573	143
18	win	2,511	70
19	ltd	1,962	53
20	business	1,920	98
21	ice	1,837	101
22	link	1,776	141
23	google	1,644	1,317
24	red	1,603	155
25	mail	1,505	713
26	smart	1,475	68
27	world	1,441	41
28	casa	1,283	36
29	med	1,262	118
30	mnet	1,132	45
31	star	1,040	106
32	orange	924	214
33	web	815	263
34	youtube	790	353
35	vip	789	165

Table 5—Source IP address prefixes for top 35 ranked proposed TLDs (2012)

Table 6 shows the number (in thousands) of distinct IP address prefixes used to access each of the most queried proposed TLD strings for 2013, including the 2012 rank for comparison:

2013 Rank	2012 Rank	String	Count (thousands)	Prefix Count (thousands)
1	1	home	952,944	302
2	2	corp	144,507	185
3	21	ice	19,789	48
4	4	global	12,352	308

2013 Rank	2012 Rank	String	Count (thousands)	Prefix Count (thousands)
5	29	med	10,801	80
6	3	site	10,716	50
7	5	ads	10,563	148
8	12	network	8,711	57
9	7	group	8,580	45
10	9	cisco	8,284	78
11	8	box	7,694	89
12	14	prod	7,004	82
13	6	iinet	5,427	70
14	10	hsbc	5,249	90
15	11	inc	5,208	38
16	18	win	5,199	41
17	13	dev	5,058	104
18	15	office	4,006	88
19	20	business	3,279	59
20	16	host	3,127	98
21	31	star	2,435	88
22	25	mail	2,383	526
23	19	ltd	1,990	40
24	23	google	1,859	926
25	169	sap	1,735	41
26	17	app	1,720	112
27	27	world	1,650	24
28	30	mnet	1,568	37
29	26	smart	1,331	38
30	33	web	1,126	191
31	32	orange	1,072	220
32	24	red	1,043	232
33	43	msd	956	11
34	37	school	872	28
35	39	bank	780	38

Table 6—Source IP address prefixes for top 35 ranked proposed TLDs (2013)

For most of the proposed TLDs for which these data have been analyzed, the top few prefixes that occur most often account for a very large fraction of the total number of occurrences. For example, for `home` (Figure 2) and `passagens` (Figure 3), the log-log plot of rank (X-axis) and number of occurrences (Y-axis) shows a few large contributors clustered at the top rank joined to a roughly power-law tail:

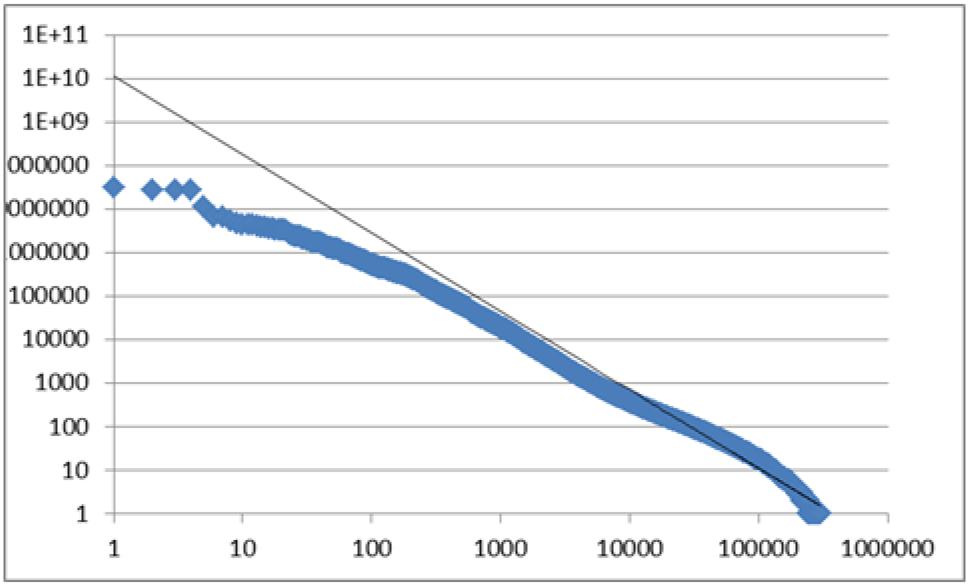

Figure 2—Rank/Occurrence plot for proposed TLD `home`

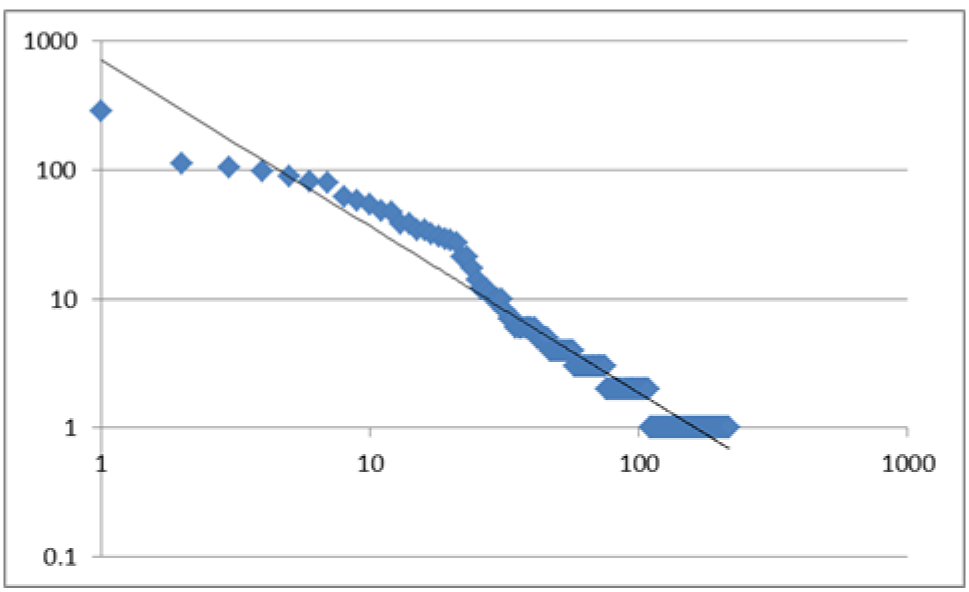

Figure 3— Rank/Occurrence plot for proposed TLD `passagens`

4.1.3 Second-level domain names

Tables 7 and 8 show the number of different second-level domain name labels that appear when a proposed TLD is in the TLD position for the top 35 proposed TLDs by occurrence in the 2012 (Table 7) and 2013 (Table 8) DITL data. The counts are capped at 100,000 for each root,[24] and the numbers in the table are in thousands:

	Total	a	c	e	f	h	i	j	k	l	m
home	1,000	100	100	100	100	100	100	100	100	100	100
corp	251	27	35	13	26	25	27	23	24	28	23
site	750	74	100	18	70	58	79	91	98	93	70
global	38	3	5	1	4	3	5	4	5	6	4
ads	37	4	4	2	4	3	5	4	4	4	3
iinet	379	9	10	1	18	8	100	100	23	100	9
group	25	2	3	1	3	2	3	3	3	3	2
box	606	49	66	40	77	37	68	59	67	73	69
cisco	868	88	100	29	100	85	85	100	95	100	84
hsbc	2	0	0	0	0	0	0	0	0	0	0
inc	44	4	6	2	5	4	5	5	4	5	4
network	84	8	12	2	11	7	8	8	10	12	7
dev	113	11	16	4	12	9	13	12	14	14	10
prod	110	12	15	8	10	10	17	7	11	11	10
office	186	17	24	6	20	16	20	19	23	22	18
host	33	3	4	1	4	2	3	6	3	4	5
app	56	5	7	6	6	4	6	7	6	6	5
win	17	2	2	1	2	2	2	2	2	2	2
ltd	22	2	3	1	2	2	2	3	3	2	1
business	243	1	6	0	64	1	8	48	12	2	100
ice	32	4	6	0	2	4	3	2	2	4	3
link	26	2	3	0	7	2	2	3	2	2	2
google	48	4	7	1	5	3	6	4	6	8	3
red	35	3	6	1	3	3	3	4	4	6	3
mail	97	8	11	3	13	8	9	13	12	11	9
smart	76	7	10	5	10	7	7	6	9	9	7
world	50	4	6	2	8	4	5	5	6	5	5
casa	260	13	36	6	44	16	18	38	18	53	17
med	16	2	2	1	2	2	2	2	2	1	1
mnet	12	1	1	0	1	1	2	1	1	2	1

[24] Totals that include at least one root count that reached the 100,000 cap (and is therefore an underestimate of the actual count) are indicated by cell shading.

	Total	a	c	e	f	h	i	j	k	l	m
star	12	1	2	0	1	1	1	1	1	1	1
orange	379	28	32	1	43	19	39	83	40	34	59
web	119	8	11	3	24	8	18	11	9	19	8
youtube	7	1	1	0	1	1	1	1	1	1	1
vip	19	2	3	1	2	1	2	2	2	3	2

Table 7—Number of distinct SLDs for top 35 proposed TLDs (2012)

	Total	a	c	d	e	f	h	i	j	k	l	m
home	1,100	100	100	100	100	100	100	100	100	100	100	100
corp	319	48	37	23	11	32	29	33	14	31	35	26
ice	52	4	3	2	1	2	2	4	1	4	28	2
global	47	6	5	3	1	4	4	6	2	5	8	4
med	16	2	2	1	0	1	1	2	1	2	2	1
site	482	58	55	26	8	43	30	74	24	64	67	33
ads	38	4	4	3	1	3	3	5	2	4	4	3
network	93	12	11	6	2	9	7	11	5	9	15	6
group	27	3	3	2	1	2	2	4	1	3	3	2
cisco	1,044	100	100	100	44	100	100	100	100	100	100	100
box	493	100	53	23	21	46	41	70	1	55	29	53
prod	217	33	30	17	1	21	21	26	3	25	23	17
iinet	525	19	38	100	0	24	10	100	100	18	100	14
hsbc	2	0	0	0	0	0	0	0	0	0	0	0
inc	73	10	7	5	3	7	6	8	4	8	8	7
win	19	2	2	1	0	2	1	3	1	2	2	2
dev	178	24	22	11	4	16	15	24	8	21	20	13
office	300	33	38	15	5	25	20	47	19	34	42	22
business	524	100	66	15	6	15	13	38	100	56	15	100
host	42	5	5	2	0	4	3	6	3	5	5	5
star	20	2	3	1	0	2	1	3	1	2	3	1
mail	87	9	11	6	2	8	7	12	4	11	10	7
ltd	21	2	2	1	0	2	2	3	2	3	3	1
google	110	11	21	8	1	10	10	14	2	12	14	7
sap	6	1	1	0	0	1	0	1	0	1	1	0
app	67	8	8	5	2	6	5	9	4	7	7	6
world	74	11	8	4	3	7	7	9	4	8	7	6
mnet	8	1	1	1	0	1	1	1	0	1	1	1
smart	149	16	16	9	10	17	14	15	4	17	17	14
web	198	29	23	10	9	16	17	26	7	23	22	15

	Total	a	c	d	e	f	h	i	j	k	l	m
orange	406	74	34	8	7	15	13	36	81	45	3	90
red	76	6	10	10	1	4	10	5	3	15	10	3
msd	6	1	0	0	0	1	0	1	0	0	1	0
school	105	11	6	4	1	10	6	18	7	7	27	8
bank	16	2	2	1	0	2	1	2	1	2	2	1

Table 8— Number of distinct SLDs for top 35 proposed TLDs (2013)

4.2 The request stream at intermediate resolvers

Table 9 shows the number of existing TLDs and proposed TLDs for the top 100 (by rank) that appear in data contributed by one of the large third-party DNS resolver companies to the 2012 DITL exercise, with the 2013 DITL rank for the root servers included for comparison:

Resolver rank	DITL2103 rank	TLD	Existing TLD	Proposed TLD
1	1	com	28629149107	
2	2	net	8201397628	
3	5	arpa	7792280760	
4	3	org	2523176121	
5	11	br	346279329	
6	12	info	333717314	
7	26	in	321413018	
8	6	ru	289883785	
9	8	uk	203023315	
10	121	nu	202489116	
11	29	biz	178031064	
12	45	ar	173704960	
13	19	us	156768870	
14	13	edu	149511754	
15	7	cn	132455931	
16	27	gov	118941627	
17	25	ca	115405646	
18	20	tv	111191830	
19	35	co	108569516	
20	9	de	107262308	
21	18	tw	98743088	

Resolver rank	DITL2103 rank	TLD	Existing TLD	Proposed TLD
22	10	jp	92096003	
23	36	se	91781839	
24	14	au	80612334	
25	44	mx	75072649	
26	237	xxx	74208200	
27	32	ua	63309531	
28	28	it	56627173	
29	33	es	53502935	
30	21	eu	52332440	
31	74	tk	51940456	
32	22	fr	51275719	
33	107	mobi	49947557	
34	31	cc	46634944	
35	75	ir	46457563	
36	15	pl	42155715	
37	118	mail		35873064
38	56	cl	35873064	
39	30	me	35340510	
40	85	ae	30954250	
41	17	nl	25374104	
42	47	za	25193197	
43	57	mil	24210183	
44	40	vn	23330145	
45	96	pe	22613984	
46	23	kr	22332425	
47	50	dk	21201641	
48	39	ro	20828117	
49	16	corp		17963126
50	43	ch	17963126	
51	48	be	17311570	
52	139	ly	16719465	
53	4	home		15308666
54	55	hu	15308666	

Resolver rank	DITL2103 rank	TLD	Existing TLD	Proposed TLD
55	61	fi	14605814	
56	38	cz	14447479	
57	64	su	14002174	
58	62	ws	13477191	
59	63	ph	12240622	
60	37	id	12220033	
61	24	at	12218186	
62	58	my	10539518	
63	176	sv	10476560	
64	49	nz	10274271	
65	73	to	9974915	
66	52	sg	9806899	
67	54	no	9736066	
68	129	pro	9692656	
69	83	int	9475402	
70	34	tr	9321304	
71	53	pt	9276610	
72	150	host		8273964
73	46	hk	8273964	
74	51	il	7993371	
75	41	gr	7612146	
76	135	gt	7129000	
77	134	ad	7090946	
78	60	th	6563531	
79	130	fm	6457097	
80	133	bz	6217227	
81	93	cr	5890644	
82	137	cx	5751908	
83	105	am	5498630	
84	95	pk	5439649	
85	87	ms	5233686	
86	71	kz	4946185	
87	69	bg	4580740	

Resolver rank	DITL2103 rank	TLD	Existing TLD	Proposed TLD
88	72	ie	4564874	
89	101	name	4509675	
90	112	do	4422574	
91	76	rs	4401366	
92	131	st	3576987	
93	116	ec	3430331	
94	106	ve	3332651	
95	183	zw	3252956	
96	59	sk	3190816	
97	66	lt	3164469	
98	161	gl	2964218	
99	104	uy	2821225	
100	170	cm	2807183	

Table 9—Existing and proposed TLDs at a large third-party resolver (2012)

4.3 Data limitations and systematic errors

No analysis of root server traffic can ever be complete or definitive; there are too many actors and too much data. A full analysis of one day's traffic might well take a month or more, by which time the root server traffic and client behavior would likely be different—the network topology changes; resolving servers get added, removed, or renumbered; ISP routing or peering policies change; and resolving servers and edge devices get reconfigured. This Section describes the limitations of the data on which the current study relied, and by extension the boundaries that confine its results.

4.3.1 Incomplete coverage of root servers

The DITL data at DNS-OARC is the most complete set of root server traffic data that is available. Nevertheless, one of the ways in which this study could be considered incomplete is that it did not include traffic from all of the root server operators, as not all of the RSOs contributed to the 2012 or 2013 DITL exercises, and not all of the RSOs that did contribute included data from all of their anycast instances. None of the RSOs suggested the existence of any other repository where such data might be available. The study team is not aware of any alternative repository either. It was also pointed out that while it was generally straightforward for RSOs to contribute to DITL, practical and legal problems stand in the way of making traffic data available on a case-by-case basis for other research purposes.

The DITL exercise is a major undertaking for the root server operators. Substantial resources are needed to capture huge amounts of DNS traffic, typically tens of thousands of packets per second for each RSO. It can take several days for these files to be transferred to DNS-OARC. Some anycast locations only have modest amounts of bandwidth and it can take a week or more to transfer a few gigabytes of pcap data. Therefore it simply is not possible to capture every day's root server DNS traffic and transfer it to a central location in under a day. This is one of the reasons why DITL takes place only once a year.

It is possible that the results of this study have been affected by the absence of data from some root server operators. Perhaps the traffic at one of the non-participants is significantly different from what has been found from those who did contribute to DITL. This seems unlikely, however; Appendices D-O, R, and S show a high level of uniformity in the query name patterns across the participating root servers, so it would be reasonable to assume that traffic for the non-participating RSOs would also reflect those patterns.

4.3.2 Behavior of intermediate resolvers

Another known unknown is the behavior of the Internet's resolving name servers and the traffic patterns they experience. This is a hard problem to investigate for at least the following three reasons:

- For the very largest operators, the traffic volumes at their resolving servers dwarfs the DNS requests sent to the root server system. One of these providers claims to handle 500,000 queries per second—roughly the same amount of traffic as the root server system as a whole.
- ISPs and other service providers consider their traffic data to be commercially sensitive, and they may also wish to protect their customers' privacy. Very few of these providers are DNS-OARC members contributing DITL data.
- DNS traffic data are also subject to data protection and/or privacy legislation in many jurisdictions. Significant legal and policy barriers stand in the way of making those data available, even assuming that it were technically feasible to do so.

Despite these hurdles, we were able to obtain and analyze some resolver data. A global resolver operator contributed data to DNS-OARC for the 2012 DITL exercise. The TLD counts obtained from these data sets are shown in Table 7 in Section 4.2. This provider has a global footprint, and the data set they provided contains roughly 53 billion DNS queries, but information from other operators and during other time periods would be required in order to draw meaningful conclusions about the query stream at intermediate resolvers.

4.3.3 Weighting of resolver traffic

The study was unable to weight root server DNS requests by source IP address. In this study all requests were considered equal. However the reality is that some are more equal than others. It has not been possible to tell if a lookup for `whatever.newgTLD` came from a home user's DSL router or from a name server at a major ISP providing DNS resolver service for millions of customers. Therefore the counts are likely to be distorted because of the effects of caching at intermediate resolving servers. Measuring the extent of that distortion will be very difficult. It would not be possible to compensate for the impact of caching without getting access to a lot of sensitive information from those operating very large resolver farms.

This may mean that the counts of how "popular" a new gTLD string is in the current root server traffic could be too high or too low. For instance, millions of users at some ISP might issue lookups for `whatever.exampleTLD` but this might result in just one query at the root servers. Similarly, a new TLD might appear prominently in this report because of a large number of one-time lookups by resolving servers when in fact there are other proposed TLDs which are much more lowly ranked that are more commonly looked up on the Internet as a whole.

4.3.4 Systematic errors

Some systematic measurement and data-processing errors add "noise" to the data, but this is likely to have had a marginal impact on the results. For instance some DNS requests contained labels with trailing white space—`newgTLD .something`. (Apparently there are stub resolvers that inadvertently append white space to the query names they generate.) These may have confused the scripts and been discarded in some circumstances. It was not practical to write code to deal with these corner cases: just flag an error and move on. There were perhaps a few hundred thousand of these sorts of "bad packets"—insignificant in a data set comprising many tens of billions of DNS requests.

4.3.5 Temporal limitation

It could be argued that the DITL data sets cover a too narrow time window of root server traffic—just 2–3 days—and that a longer sampling interval would provide better data. This is not an unreasonable argument. For example, DNS traffic patterns could be different on different days. Perhaps there are traffic spikes at the beginning of the working week, or end user behavior changes from "work mode" to "leisure mode" on weekends. Or maybe certain batch jobs only run once a month, perhaps mailing list membership reminders or a monthly newsletter. Unless the DITL data gathering exercise covered these events, the resulting non-customary traffic patterns they might generate would not have been found.

However this argument overlooks what is practical. Firstly, it is unlikely that all of the participating root server operators could contribute one week or one month of pcap data to OARC. Some would not. So the data for a longer data gathering interval would probably come from a smaller number of RSOs, raising further concerns about the “completeness” of the data set. Even if all of the RSOs were able to supply data over a longer interval, it could take weeks or even months to get those pcaps to DNS-OARC. There would also be the obvious capacity problems for DNS-OARC in storing hundreds of terabytes, perhaps petabytes, of what would then become a Month in the Life of the Internet exercise. Finally, it would take many CPU-months to process so much data and this would require a very substantial investment in tooling and hardware.

There was also a short discussion about the data-gathering interval between members of the study team and the participating root server operators. There was a consensus that the 2–3 day DITL interval was a reasonable compromise given there was a broadly representative set of participating RSOs and this gave every edge device or resolving server a fair opportunity of appearing in the root server traffic. It was also noted that a longer data gathering interval could skew the results because traffic patterns could get counted twice (or more) as devices moved around the Internet: for example, a smartphone that issues the same set of queries each time it connects and disconnects or changes networks.

4.3.6 Geographical limitation

Another reasonable criticism would be that there has been no geolocation analysis of the observed traffic. The objective of gathering source address prefix information for each new gTLD was to assess how widely spread the sources were, not their actual geographic location. The goal was to find out if traffic for `.whatever` was localized or spread across the Internet. To that extent, the specific physical locations from which the traffic originated did not matter much. If traffic for a new gTLD was found to be coming mostly from a small number of prefixes, that would have been worthy of deeper analysis. However very few of the proposed TLD strings found in the root server traffic match that criterion. None of the most heavily used strings does.

In addition, the impact of resolving servers and their caches makes it very difficult to draw meaningful conclusions about where traffic actually originates. For instance, a device on a corporate network at a site in Asia might be making DNS lookups via the company firewall in Australia. Similarly, a device in Africa might be using a global resolver provider and it is a node in that provider’s network in Europe, which queries a root server instance in North America. This might be a topic for further study.

5 Name collision etiology

The scope of the study did not include investigating the origins or causes of the appearance in the root query stream of non-delegated potential or proposed TLDs, either in general or with respect to specific strings. To the extent that potentially useful information about origins or causes appeared in our analysis, however, we include it here.

5.1 Internal domain names

Widely adopted industry practices for the development of enterprise network naming schemes have long promoted the use of labels that are not delegated in the public DNS as top-level domain names.[25] A commonly recommended hierarchy would begin with `inc` at the top level, corporate division names (*e.g.*, finance, hr, research, sales) at the next level, and host or server names (*e.g.*, employee name, location, printer name) at the next. Such a name might be `dayton.sales.inc`. Although in principle enterprise network designers could use a delegated DNS TLD name at the top level of their internal naming scheme (creating names like `dayton.sales.tirecompany.com`, for example, instead of `dayton.sales.inc`), some guidelines counseled against it:

> Using "Private" Top-Level Domains
>
> In Windows 200x, you can create your own top-level domains for your internal networks. It's a very good idea, when applicable, to create top-level internal domains that do not exist outside your internal network. Using a top-level domain such as .home or .work makes it difficult for users outside your network to resolve IP addresses for computers inside your private network, since these top-level domains do not exist in the public DNS system.[26]

However, as systems can be configured to connect both to an enterprise network and simultaneously to a mobile wireless network or other non-enterprise network that relies on Internet DNS name resolution, or can be moved from an enterprise network to another network (*e.g.*, customer, client, or cyber café), "internal only" enterprise names can "escape" from their local environments and appear in the public Internet.

5.2 Search list processing[27]

In many cases a string appears to be used as an "undelegated TLD" (being used as the rightmost label in a name), but this is simply an artifact of domain search list processing.

[25] *e.g.*, "DNS Namespace Planning" (http://support.microsoft.com/kb/254680) and Appendix G of [20].
[26] This is a "head of the class" pullout in the MCSE exam prep guide [14].
[27] The text in this section is taken almost verbatim from [8].

As a hypothetical example, Example Widgets uses a sub-domain (`corp`) of their primary domain (`example.com`) to name their employee workstations, servers, printers and similar. They have an "intranet" server named `intranet.corp.example.com`. In order to allow their employees to simply type `intranet.corp` to access this server, the users' workstations are configured (probably using [12]) with the search-list set to `corp.example.com`, `example.com`. When a user enters `intranet.corp`, her workstation will try to resolve the name. [13] specifies that "in any event where a '.' exists in a specified name it should be assumed to be a fully qualified domain name (FQDN) and SHOULD be tried as a rooted name first," so the user's workstation will first try to resolve `intranet.corp`. As there is (currently) no `corp` TLD this will result in an NXDOMAIN response. The workstation will then append entries in the search-list until it is able to resolve the name; eventually `intranet.corp.example.com` will resolve.

If the `corp` label were to be delegated as a TLD and the sub-domain `intranet` created within it, the first lookup in this example (for `intranet.corp`) would no longer generate an NXDOMAIN response. This would stop the search-list processing, and direct the user to an incorrect (unintended) server.

5.3 Vendor defaults

Some cable modems and DSL routers (wireless or otherwise) are pre-configured with these strings as TLDs, in order to provide what appear to be DNS names for the devices themselves. This ensures that a well-known name for the device is available on the local network, which would typically be used by a web browser to configure the device. As these devices are generally connected to both a local network and the Internet, these names may leak from the local network to the Internet.

Proposed TLD strings that fall into this category include `home`, `iinet`, and `box`.

5.4 Other patterns

Visual examination of a small sample[28] of QNAMES in which the TLD label matches a proposed TLD string reveals patterns that might help to explain how they occur, even though the proposed TLDs are not delegated and so DNS currently returns an error (NXDOMAIN). Some of these for which we have data are described in the following subsections, and summarized in Tables 10 (2012) and 11 (2013) (numbers in thousands):

[28] The samples were obtained by inspecting every 1000th packet in the DITL data sets for each root.

Proposed TLD usage	all	a-root	c-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
SLD is an existing TLD	164,484	10,775	25,915	2,865	19,713	10,186	23,755	16,791	18,391	21,530	14,563
SLD is a Proposed TLD	57,036	5,034	9,206	1,441	6,725	4,567	6,068	4,910	6,329	8,496	4,260
10-character SLD	202,960	9,988	37,847	2,530	26,392	10,231	34,311	20,921	20,602	27,771	12,367
www.proposedTLD	3,704	288	500	92	443	292	422	413	454	430	370
_ldap. or _kerberos	28,710	2,620	4,759	692	3,437	2,363	2,754	2,670	2,791	4,306	2,318
_dns-sd	10,051	846	1,477	220	1,203	752	1,083	1,106	1,016	1,439	909
File moved-http://	157,180	5,444	16,800	1,238	42,388	7,941	17,291	25,781	14,258	19,367	6,672
_sip…	1,812	190	321	61	198	130	203	199	158	257	95
_xmpp…	59	4	5	0	7	6	6	10	8	10	3
mail at other than TLD	2,249	200	293	44	279	142	315	242	270	264	200
.proposedTLD. only	1	0	0	0	0	0	0	0	1	0	0
total	628,246	35,389	97,123	9,183	100,785	36,610	86,208	73,043	64,278	83,870	41,757

Table 10—Proposed TLD usage (2012)

Proposed TLD usage	all	a-root	c-root	d-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
SLD is an existing TLD	200,307	26,074	21,997	9,360	2,395	18,421	11,023	35,375	8,733	21,584	28,643	16,702
SLD is a Proposed TLD	64,044	11,197	7,410	4,168	987	4,651	4,008	8,194	3,413	6,055	10,235	3,726
10-character SLD	603,243	80,514	69,300	22,065	5,076	62,284	31,139	108,606	20,251	70,592	88,711	44,705
www.proposedTLD	3,245	658	304	219	44	320	199	397	182	309	395	218
_ldap. or _kerberos	36,980	6,798	4,160	2,386	589	3,345	2,549	4,516	1,724	3,343	5,208	2,362
_dns-sd	11,600	1,051	850	577	64	749	447	942	572	628	5,208	512
File moved-http://	142	3	2	2	0	2	3	45	1	5	78	1
_sip…	1,445	270	156	95	15	113	109	199	72	151	180	85
_xmpp…	84	14	5	5	1	14	4	11	3	6	13	8
mail at other than TLD	2,274	332	260	146	20	178	125	352	88	247	342	184
.proposedTLD. only	4	1	0	1	0	0	1	0	0	0	1	0
total	923,368	126,912	104,444	39,024	9,191	90,077	49,607	158,637	35,039	102,920	139,014	68,503

Table 11—Proposed TLD usage (2013)

Table 12 displays these data as percentages of the totals across all roots for 2012 and 2013:

Proposed TLD usage	2012	2013
SLD is an existing TLD	19%	15%
SLD is a Proposed TLD	6%	5%
10-character SLD	23%	46%
www.proposedTLD	0%	0%
_ldap. or _kerberos	3%	3%
_dns-sd	1%	1%
File moved-http://	18%	0%

Proposed TLD usage	2012	2013
_sip…	0%	0%
_xmpp…	0%	0%
mail at other than TLD	0%	0%
.proposedTLD. only	0%	0%
total	71%	70%

Table 12—Proposed TLD usage as percentages across all roots

5.4.1 SLD is an existing TLD

Common examples of domain names in this category are:

- <something>.com.home.
- <something>.<CC>.home.

in which <CC> is a two-letter country code (for example .uk. or .sg.).

These appear to be examples of a valid domain name that has had a TLD appended (incorrectly)—for example, by a commercial off-the-shelf (COTS) router or cable modem used at home or in a small office.

5.4.2 SLD is also a proposed TLD

Common examples of domain names in this category are:

- <something>.<company>.corp.

in which <company> is the name of a company that matches a proposed TLD.

These appear to be examples of an internal domain name being used (incorrectly) outside the administrative boundary of the company in which it is defined.

5.4.3 SLD is a random 10-alphabetic-character string

Often spotted near each other in the traces, examples of domain names in this category are

- lfbviakqaw.home.
- mdqrerrefm.home.
- uprxbvqnxa.home.

These domain names comprise ten apparently random alphabetic characters for the SLD and a proposed TLD (often, but not only, .home.).

Apparently the Google Chrome browser, as a defense against domain name hijacking, generates the pattern of three "random" 10-character alphabetic host names.[29] [30] When combined with the possibly incorrect addition of a TLD (such as `.home.`), for example by a home or branch office COTS router, this yields the pattern observed.

While we are sure that not every use of this pattern (10-alphabetic-character SLD and proposed TLD) is caused by this Chrome behavior, we believe from our sampling that it is likely to be the dominant cause.

5.4.4 Name is `www.<proposedTLD>`

Common examples in this category include:

- `www.youtube.`
- `www.google.`
- `www.yahoo.`
- `www.amazon.`

Possible explanations for these might include typographical errors, in which the TLD (for example, `.com.`) was omitted unintentionally. A pattern of use introduced by browsers in the 1990s in which `.com` was appended by default if no TLD was provided is likely to be responsible for this behavior becoming a user habit.

5.4.5 Name includes `_ldap` or `_kerberos` at the lowest level

Patterns observed show many requests of one of the forms:

- `_ldap._tcp.dc._msdcs.<etc.>`
- `_ldap._tcp.pdc._msdcs.<etc.>`
- `_ldap._tcp.<etc.>._sites.dc._msdcs.<etc.>`
- `_ldap._tcp.<etc.>._sites.gc._msdcs.<etc.>`
- `_ldap._tcp.<etc.>._sites.<etc.>`
- `_ldap._tcp.<etc.>`

---

29 http://code.google.com/p/chromium/issues/detail?id=47262&can=1&q=random%20host%20names&colspec=ID%20Stars%20Pri%20Area%20Feature%20Type%20Status%20Summary%20Modified%20Owner%20Mstone%20OS

30 https://code.google.com/p/chromium/codesearch#chromium/src/chrome/browser/intranet_redirect_detector.cc&sq=package:chromium&type=cs

- _kerberos._tcp.dc._msdcs.<etc.>
- _kerberos._tcp.<etc.>._sites.dc._msdcs.<etc.>
- _kerberos._tcp.<etc.>._sites.<etc.>
- _kerberos._tcp.<etc.>

Typically these are queries for SRV records, although sometimes they are requests for SOA records. They appear to be related to Microsoft Active Directory services.[31]

5.4.6 Name includes **_dns-sd** at one level, often the 3rd or 4th level of the name

Patterns observed show many requests of the form:

- <something>._dns-sd._udp.<proposedTLD>

Occasionally two levels occur after ._udp.

Typically these are lookups for PTR records, although sometimes they are queries for TXT records. They appear to be related to Apple's service discovery service (Bonjour or multicast DNS).

5.4.7 Name starts with "File moved-http://"

The predominant form of DNS name that has been observed in this category is of the form:

- File moved-http://www.whatismyip.<M>.<N>.Home.

in which <M> and <N> are one- to three-digit numbers (presumably two quads of an IPv4 address).

These all appear to be queries for A records.

5.4.8 Name includes **_sip**, **_sipinternal**, **_sipinternaltls**, **_sipfederationtls**, or **_sips** at the lowest level

Patterns observed show many requests of the form:

- _sip._tcp.<etc.>
- _sip._udp.<etc.>
- _sip._tls.<etc.>
- _sipinternal._tcp.<etc.>

[31] The opcodes for these requests were not analyzed, but it is consistent with Active Directory behavior that some requests are updates and therefore have "SOA" stored at the location in the packet that is identified with QTYPE for regular queries.

- _sipinternaltls._tcp.<etc.>
- _sipfederationtls._tcp.<etc.>

These are mostly SRV record lookups, which are typically associated with communication services such as Voice over IP (VoIP) telephony and video messaging.

5.4.9 Name includes `_xmpp-client`, `_xmpp-server`, or `_xmpconnect` at the lowest level

Patterns observed show many requests of the form:

- _xmpp-client.<etc.>
- _xmpp-server.<etc.>
- _xmppconnect.<etc.>

Typically the first two are queries for SRV records and the latter are queries for TXT records. These names are likely associated with attempts to discover XMPP[32] (a.k.a. Jabber) messaging services.

5.4.10 Name includes `mail` at the lowest level, and/or as the SLD

While many DNS names include `mail` at one level, many appear to fall under one of the categories described above as "SLD is an Existing TLD" or "SLD is Also a Proposed TLD."

These are predominantly lookups for A or AAAA records, but requests for other resource record types such as MX, TXT, and SRV have also been observed.

5.4.11 Name comprises just the proposed TLD

Examples of these are where the proposed TLD appears as the only part of the DNS name. Commonly appearing proposed TLD strings are:

- .home.
- .cisco.
- .honda.
- .toshiba.
- .ericsson.

[32] XMPP is defined as an Internet Standard by RFCs 6120 and 6121. More info is available from the XMPP Standards Foundation (http://xmpp.org).

6 Name collision consequences

This study focused on two specific consequences of name collision in the DNS:

- name resolution ambiguity with respect to private network pre-delegation uses of names that become new TLD labels, and
- the pre-delegation use of proposed TLD strings in names incorporated into X.509 public key certificates (which was described in [3]).

6.1 Name resolution ambiguity

One of the most important properties of any naming scheme is the unambiguous relationship between a name and its referent (the thing named). Name collision creates ambiguity and instability, because apparently identical strings name different things in different contexts. For systems that assume name resolution consistency, the consequences of name resolution ambiguity range from benign user confusion to application failures, denial of service, or serious breaches of security. These consequences accrue both specifically, as individual names collide, and generally, as name collision leads to a systemic erosion of confidence in the predictability of name resolution.

In the DNS context, this principle goes further and extends to the results of a DNS lookup. In general, it does not matter which network a device is connected to, what that device is, where that network is physically located, what DNS lookup software is used, which end user's application makes the lookup, or which name servers are queried to resolve the lookup. The DNS always returns the same answer. Problems however arise when private naming schemes—like those used on a corporate intranet—intersect or overlap with the public DNS. Introducing names to the Internet root zone that result in these sorts of collisions will create confusion and instability.

Private naming schemes often use name spaces anchored under top-level domains like `corp`, `intra,` or `internal`, making the not unreasonable assumption (at the time) that names like these would never exist on the public Internet. Provided that those two name spaces did not intersect or overlap, all would be well. These would work just fine provided that the corporate network is properly insulated from the public Internet, has carefully configured internal DNS setups and has tightly controlled access points between the two autonomous networks: *e.g.*, well-configured firewalls and application-level gateways such as a web proxy. Lookups on the corporate network would use the internal DNS, while those outside that network would have their queries resolved on the public Internet. Since the name spaces were disjoint, there would be no overlap and no prospect of name collisions where the same names appear in both places.

6.1.1 Name lookup ambiguity

Suppose that a corporate network uses the internal top-level domain `example` and ICANN delegates that domain as a gTLD on the public Internet. What will be the outcome of a lookup for `somehost.example`?

For a device on the public Internet, the answer is straightforward: the lookup returns whatever is in the public DNS for that name. On the corporate network, the answer is not so clear-cut: it depends on the internal name space. The end user or device might be told that `somehost.example` does not exist because no such name is present internally. They might be told that the name does exist and then be directed to the internal resource with that name instead of the one on the public Internet. In the latter scenario, users on the corporate network will not reach the same `somehost.example` as someone connected to the public Internet.

At first glance it may seem less of a concern that Internet users and devices would not be able to resolve the private network's internal `somehost.example`. After all, that name is found in a name space outside the public Internet and the internal resource would presumably only be accessible from the internal network anyway. Problems may arise here too, though. A user of this private network may rely on a Virtual Private Network (VPN) to get access to that network from the Internet. In some settings, say a hotel or coffee shop network, they will be relying on the DNS servers in that network. So the user's lookups of `somehost.example` will return whatever that name resolves to on the public Internet, not what it would resolve to on the private network. The end result could be that the user is told that a name does not exist (on the Internet) when in fact it does exist (on their internal network). Worse, they could be told the name does exist on the Internet and then be directed to a different resource for `somehost.example` than the one that they expected to reach.

In principle, these sorts of problems could be worked around to some extent. However the solutions are clumsy and would not scale. They would also be far from satisfactory because they would entail many configuration changes to the systems and platforms on private networks—for example, keeping track of all changes to both the internal and public `example` name spaces and perhaps applying ad-hoc workarounds whenever collisions were found or removed. It might also be necessary to change the configurations of the roving users' devices, perhaps on a regular basis. This is far from easy and might well be impractical. The organization might decide that the simplest solution would be to ignore the public `example` altogether and have its internal version of that top-level domain prevail for the corporate users. In that scenario, users and applications on the private network would never be able to access resources named in the public `example` namespace.

6.1.2 Instability on corporate networks

A corporate network using its private instance of `example` might well embed that name deep in the configuration of its network infrastructure. These systems may fail or behave unpredictably when `example` is introduced on the Internet. Extensive testing, audits, and risk analyses would have to be carried out by these organizations to assess the impact of "their" internal TLD appearing on the Internet. This could result in significant costs to the organization to assess the extent of the problems and threats to current IT operations and to develop risk mitigation plans and/or migration strategies for the internal network. Typical examples of this name configuration include firewalls, malware and anti-spam detection tools, mail systems, instant messaging services, web proxies, and calendaring systems.

A firewall may be configured to treat `example` domain names as "trusted" since they supposedly only originate on the internal network. Alarms may go off once these domain names appear in inbound traffic arriving from the Internet, something that ostensibly "cannot happen." Firewalls and malware/anti-spam defenses might also mistakenly consider this traffic to be safe (since `example` supposedly only comes from the internal network) and would not be subject to the same degree of scrutiny that would apply to traffic arriving from the public Internet.

Corporate mail systems may depend on internal configurations for `example` to decide how to route mail; for instance, no mail addressed to a recipient in `example` is allowed to leave the internal network. That would mean that no mail could be sent to email addresses using the public `example` TLD. Receiving email from the Internet for this TLD could also be a problem. An organization's public mail servers might rewrite inbound email addresses of the form `username@example.com` to `username@something.example` before injecting the messages into its internal mail systems. If `something.example` exists on the public Internet, these messages could be directed there instead of to the internal systems.

Corporate networks often use web proxies to manage web access for their users, restricting access to authorized users and filtering undesirable content. Such networks typically would have proxy configurations to direct lookups for all `example` domain names to the internal DNS. Users on these networks might only get access to resources in the internal name space and never get to see the Internet's `example` name space.

Similar considerations apply to calendaring tools and, in general, to any application that uses URLs. When would a lookup of `cal.sales.example` (say) resolve to the internal corporate calendar server and when would it resolve to the same name on the public Internet? What happens when the wrong calendar server is reached? How would an end user or application deal with this, and how could troubleshooting be done by IT support to resolve such problems?

6.1.3 Non-query DNS traffic

Although the overwhelming majority of the observed DNS traffic in this study has been name lookups (*i.e.*, conventional queries), some other DNS requests have been detected. These are mostly Dynamic Updates—traffic that should never reach the root servers. After all, changes to the DNS root are not carried out using Dynamic Updates, let alone ones originating from random IP addresses on the Internet. The most likely explanation for this behavior would be misconfigured Active Directory installations that leak from an internal network to the public Internet. It should be noted however that this study did not examine the root cause of this traffic.

At present, if a client sends a Dynamic Update for `myhost.example` to the root, the root servers will return a REFUSED or NOTAUTH response. However, once `example` gets delegated on the public Internet, the root servers will return a referral response to the `example` name servers instead.

It is not known what impact, if any, this might have on the end client or how this could change its subsequent behavior. Currently, no significant harm appears to result when these Dynamic Update requests receive a REFUSED or NOTAUTH error response. Returning a referral response after `example` is delegated at the root might cause these clients to fail or behave unexpectedly. It seems likely that this would create end user confusion and support problems for the organization’s IT department.

There is also a remote possibility that these erroneous Dynamic Updates would succeed after `example` was delegated. The security and stability consequences of such behavior are obvious.

6.1.4 Resolver search lists

Search lists are widely used in stub resolver configurations. The rationale for using these is to save end users and applications the trouble of constructing fully-qualified domain names (FQDNs) for their DNS lookups. Each domain name in the search list is tried in turn, appending that to the original string until a successful lookup is done or the search list is exhausted. Often a “working” stub resolver configuration is arrived at by a process of trial and error without the system administrator really understanding or documenting what that stub resolver is doing. Such setups can have hidden dependencies on the contents of the Internet root zone.

Suppose a stub resolver search list consists of `example.com` and `example.net`. If the end user or application supplies `myhost.example` to the stub resolver, it will query for `myhost.example.example.com`, then try `myhost.example.example.net` before giving up. The stub resolver might or might not first lookup `myhost.example` before trying the search list. It depends on how the stub resolver is configured.

In the above example, the local environment is relying on lookups of `myhost.example` to fail so that the domain names constructed from its stub resolver search list get tried. Eventually a lookup of `myhost.example.example.net` would be successful (assuming that the name is defined) and the end user would be directed to that resource.

Should `example` be delegated on the public Internet, the behavior of those stub resolver configurations would change. If `myhost.example` existed on the Internet, the result of that lookup would be returned to the end user. The local search list would not be tried. The application would be directed to `myhost.example` instead of the `myhost.example.example.net` that it expected to reach. A comparable problem would of course arise whenever `myhost.example` was deleted from the Internet: the stub resolver's search list would be used and the end user directed to `myhost.example.example.net` and not the `myhost.example` (which would no longer exist). Changes by a third party to some external resource would have changed local behavior.

Troubleshooting these problems would be difficult because nothing would have changed on the end user's system or its supporting network infrastructure. An external change by third parties would have caused the problem and modified local application/resolver behavior: for instance, by creating a `myhost.example` on the Internet that previously did not exist. Of course, such external changes can be intentionally designed to cause exploitable failures as a prelude to an attack on private systems.

6.1.5 DNSSEC

Further potential instabilities and confusion may arise from the use of Secure DNS (DNSSEC). If `example` exists in a private network and on the public Internet, there will be problems if either or both of these instances of `example` are signed.

If a private instance of `example` is signed, the internal DNS will almost certainly be relying on a locally configured trust anchor for that domain. The organization's validating servers would not be using a chain of trust to the Internet root for this internal version of `example`. However when the Internet version of `example` is signed, the root zone will contain DS records for that TLD's keys. These may confuse the validating name servers on the private network, resulting in false positives and negatives. There could be validation failures for names that should validate and possibly successful validations for names that should not. The validating resolver's behavior will depend on which trust anchors are used and in which order—*i.e.*, an external `example` name gets validated against the internal version's trust anchor or *vice versa*. Or an external `example` name successfully gets validated against the external trust anchor for that domain when local policy was to validate against the internal trust anchor and that would presumably fail for a name in the external `example` TLD.

This also introduces another potential set of failure modes because of changes by a third party. The behavior of validating name servers on the internal network may change whenever Secure DNS is introduced or withdrawn from the public `example` TLD.

Internal name servers may need extra configuration complexity to accommodate these situations: "do not validate `example` on the internal network because it is not signed but do this when resolving names on the public (signed) `example`" or "validate `example` on the internal network because it is signed but not when resolving names on the public (unsigned) `example` TLD."[33]

Should both versions of `example` be signed, the organization's validating servers might need special policy-based configuration—for instance when to favor the internal trust anchor for `example` over the public one. These policy considerations might change over time, requiring an open-ended commitment to monitor developments and make the correct choices whenever key rollover events took place.

Currently validating resolvers rely on using exactly one trust anchor for a given domain—there can be only one key for just one instance of `example`, and all validations for names in that domain will depend only on that trust anchor. Ad-hoc solutions and workarounds would have to be deployed whenever there were public and private versions of some TLD and lookups in both had to be validated. This would give rise to the problems outlined above. New failure modes and configuration complexity—themselves causes of instability and reduced robustness—would be introduced.

6.2 Internal name certificates

An "internal name" X.509 public key certificate contains a name that might be currently resolvable within the name space utilized by a particular organization but is not currently resolvable using the public DNS. Such certificates are assumed to be for private use only, or for mixed private/public use where registered public DNS names are also utilized in the same certificate. The internal names included in such certificates may collide with names that are also applied-for strings in the new gTLD program. The practice for issuing internal name certificates allows a person, not related to an applied-for TLD, to obtain a certificate for that TLD with little or no validation of rights to, or authority over, the "internal name." This means that an

[33] A name server might deploy techniques like BIND's Response Policy Zone (RPZ) to make this possible by allowing one instance of a zone to be "overlaid" with data from another.

application intended to operate securely in a private context with an entity authenticated by a cert issued by a widely trusted public CA[34] will also operate in an apparently secure manner with another equivalently named entity in the public context when the corresponding TLD is delegated at the public DNS root.

In SAC 057, SSAC identified and described potential consequences of the current, widespread practice of issuing internal name certificates by widely trusted CAs. Through cooperation between ICANN and the CA/Browser Forum, this problem has been further evaluated and the CA/Brower Forum has moved to modify CA policies to phase out and deprecate the use of internal name certificates. However, it is still possible today for nearly anyone to request and be issued an internal name cert by some widely trusted CAs that could unintentionally, or intentionally, conflict with DNS names that will become valid as new TLDs are delegated at the public DNS root. The CA operators who are members of the CA/Browser Forum intend to cease issuing internal name certs when corresponding TLDs are delegated, and to revoke any certs previously issued with conflicting names. Cert revocation will be an effective mitigation technique for some applications and user communities, but may not be effective in all cases. Until the practice of issuing internal name certs is completely eliminated, there will be some exposure due to unexpired internal name certs where name conflicts might exist.

The table in Appendix C shows the number of internal name certificates that have been issued by a representative sample of widely trusted CAs with proposed TLDs in either the subjectName or subjectAlternativeName fields of the certificate. Overall, 293 proposed TLDs have appeared in internal name certificates issued by these CAs.

6.2.1 Domain names and certificates

There are two primary uses for X.509 Public Key Certificates (a.k.a. “certs”):

- As a digitally-signed container for associating a *public key* with *issuer* and *subject* names and *usage attributes;*
- As a means for a third-party authority—a *Certificate Authority* or *CA*—to confirm the authenticity of the binding between the public key and the subject name(s) and usage attributes, in which case the CA is named within the cert as the *issuer.*

In the first case, a cert allows relying parties (*i.e.*, users of certificates) to retrieve a public key and any associated subject names or attributes from the cert itself. In its simplest form, a cert provides a means for labeling a public key with a subject name. Because a cert is digitally

[34] Widely trusted CAs refers to the operators of Certification Authorities with their root CA certs incorporated into popular browsers and operating systems, hence allowing widespread trust of certificates issued by these CAs.

signed, the relying party can confirm that the details of the cert have not been modified since the cert was signed—*i.e.*, data integrity is provided. It is common for certs to be *self-signed*, which means that the signature is applied using the private key associated with the public key in the cert. A self-signed cert will have identical issuer and subject names. If the relying party needs to confirm the authenticity of a self-signed cert, it must utilize *a priori* knowledge, or other services, such as a directory service.

It is also common for certs to be signed by CAs, which are named within the cert as the *issuer*, with the implication that the issuer and subject names *must* be different. The motivation for using CAs to sign certs is that relying parties need only confirm authenticity of the CA, and can then use the CA signature to confirm authenticity of potentially many subject certs, based on the trust that the relying party is willing to place in the CA, and the policies used by that CA to issue certs. Typically, a CA also has a cert for the CA itself that can be readily retrieved by relying parties, *e.g.*, using a directory service or *a priori* knowledge. A CA cert may be self-signed, or may in turn be signed by a superior CA. This can lead to a hierarchical trust relationship descending from a so-called *root CA*, which uses a self-signed cert for itself, and then issues certs for subordinate CAs, which may in turn issue certs for other subordinate CAs or non-CA subjects, sometimes referred to as "leaf" certs since there would be no subordinates.[35]

The issuer and subject names are defined as "distinguished names," and conform to the X.509 conventions for naming entities in a directory. Distinguished names can be information-rich with many descriptive fields and the ability to describe aspects of the subject (or issuer) within one or more contexts. For example, a distinguished name can describe an individual with their full formal name, and optionally by one or more aliases (nicknames), while also clarifying roles, positions within organizations, or locations within a geographical setting. One element of a distinguished name is the *Common Name*, or *CN*, which is intended to serve as a working *handle* for referencing the named entity within some specific context, such as, for example, a department within a division of a corporation.

For entities that are connected to an *internet* (private or public), it is common practice to use a traditional *domain name* (in the RFC 882 sense) as the Common Name in certs. This leverages local or global uniqueness of domain names to enforce conventions for mapping a subject (or issuer) named in a cert to a specific entity residing on an internet. In other words, there should be only one entity within a specific internet context that has a given domain name, and the cert provides a means for binding a public key to the domain name. In the case of the public Internet,

[35] While there are apparent similarities between DNS inverted trees and CA trust hierarchies (also inverted trees), there is no direct correlation, and these must be viewed as completely independent hierarchical relationships with no technical or conventional inter-relationships.

a registered domain name is (within certain real-world constraints) unique for all references that rely on the public DNS root.

The ability of certs to cryptographically bind public keys to domain names that can be assumed unique within the public Internet, or on a private internet, is a useful construct that has been widely used as the basis for various security measures. In particular, it is common practice to use certs to authenticate entities on an internet by their domain names. For example, the popular TLS[36] protocol (or its SSL predecessor) is widely used to authenticate entities on internets by confirming that the entity reachable by a given domain name is also able to prove it is in possession of the private key associated with the public key found within a cert referencing the same domain name, noting that current practice usually involves the relying party retrieving the cert from the server it is authenticating. However, the level of trust that a relying party can place in such authentication practices depends on many factors, including the uniqueness of domain names, the reliability of an internet to connect only to an entity (or entities) associated with a specific domain name, the trustworthiness of the cert and any issuing CAs, the level of protection from disclosure afforded to private keys, and the current validity status of the cert.

As an aside, there are many uses for public key (asymmetric) cryptography, and certs can be used in many applications to provide a means for associating public keys with named entities and usage attributes. Specific uses include authentication, exchange of symmetric keys (for privacy and confidentiality), application of digital signatures (source authentication), data integrity, and non-repudiation. However, this study focused almost exclusively on the role of authentication within the narrow scope of authenticating entities by their domain names.

It is also worth noting that distinguished names in certs can reference basic "host" domain names, as well as email addresses (in the RFC 822 sense). However, further discussion of certs used in the authentication of entities by email address name is outside of the scope of this Study, although potentially a topic worth further consideration.

Domain names used in certs can also be expressed with standard wildcard conventions, such as `*.xyz.example`, which would match any third-level domain name ending in `xyz.example`. Significantly, wildcards can be applied only for a single level; the name `level4.level3.xyz.example` would not match the previously illustrated wildcard expression, nor would just `xyz.example` be a match. Wildcard names can be used to

[36] Transport Layer Security—the successor to the Secure Sockets Layer (SSL) protocol. While TLS 1.0 and SSL 3.0 were virtually identical, recently discovered vulnerabilities have resulted in improvements in TLS bringing it to version 1.2. Continued use of SSL 3.0 is discouraged, although it is still widely used.

significantly extend the range or scope of internet-connected entities that might use the same cert and public key binding.

In addition to the Common Name within a cert's distinguished name, there is also a widely used extension referred to as the *subjectAlternativeName* or *SAN.* This provides a means for associating one or more alternative names with a cert, where these names are typically domain names or email addresses, though there are other options as well. One use for SANs is to allow a host to be authenticated by more than one name. For example, a host that can be reached from both a private internet, and the public Internet, will likely have different names depending on the network used to reach it. The SAN provides a means for the same cert to authenticate the host using either the public (registered) name or private *internal name.* Another usage scenario is where a single host is accessed by various names that are aliases, or associated with different services provided by the host. Similarly, multiple hosts may all use the same private key, and therefore the same public key, in which case the SAN extension allows a single cert to be used with each of these separately named hosts. There are no restrictions on the number of SANs allowed within a single cert, other than by policy or practical considerations.

Just as wildcard domain names can be used in a cert subject name, it is also possible to use wildcard names in the SAN extension. This makes it possible to have a single cert potentially apply to many domain names spanning multiple levels.

6.2.2 Authentication based on certificates and domain names

When public key certificates are used for authentication of entities reached via their domain names, there must be an assumption that only valid entities will be reachable by the name contained within a given cert. In other words, the assumption is that the domain name found within the cert for the subject is *unique.* This does not mean that only one entity can be associated with this name, since a domain name can be mapped to multiple IP addresses, but it should not be possible to establish an internet connection to any entity that is not validly referenced by the domain name.

To illustrate by example, when a web browser establishes a secure TLS (SSL) connection to a web server, then the browser—the relying party—is authenticating the server based on an assumption that *only* an authentic server can be reached using the domain name within the URL *and* that *only* an authentic server will possess the private key associated with the public key in the cert that is provided by the server as part of the initial TLS (SSL) protocol handshake. The cryptographic signature applied by the issuer to the cert allows the browser to confirm that the public key and domain name are bound to each other, and that no other public key or domain name could have been substituted by an unauthorized party.

Authentication based on these assumptions regarding domain names and certs has proven to be an essential means for assuring security in the global public Internet where many *ad hoc* connections are established between entities that may have never communicated before. However, for this form of authentication to have any level of trust amongst parties that have no prior knowledge of each other, there must be some means for the parties to rely on trust of a third party. Typically, the third parties are Certification Authorities that issue certs for subjects known by and reachable via domain names.

As the world wide web emerged and evolved to support secure communications based on first SSL—and later TLS—protocols, practices emerged for having a set of widely trusted CAs issue certs for web servers. At first, there were few well-defined policies for issuing certs, and CA procedures and practices were inconsistent. However, over the past two decades, some policies have become well established and accepted, while the procedures for issuing certs compliant with accepted policies have been developed and widely adopted. Originally, browsers were distributed with embedded databases of *trusted* CAs and their associated *root* certs. Later, operating systems also assumed responsibility for distributing and maintaining databases of trusted CAs. A typical database of trusted CAs has somewhere from about a dozen CAs to as many as a couple of hundred. These systems for distributing databases of trusted CAs and associated root certs is a vital facility for establishing secure communications in both the public Internet, and many private internets, though it is also recognized that there are security concerns with trust models based on these CA distribution procedures.

While it has proven to be both efficient and convenient to use databases of widely trusted CAs, this is not the only means for authenticating internet-connected entities using domain names and certs. One alternative is to rely on self-signed certs without the need to rely on a CAs. However, this requires that a relying party have some means for independently establishing the trustworthiness of a cert. A common approach used with browsers is for the first attempt to connect to a web server with a given domain name to present a warning dialog to the user where the user is expected to review the cert and the other particulars of the connection, and to then decide whether to accept the connection (and implicitly the authenticity of the web server) on either a one-time basis or for subsequent connections. This can be effective where users have the ability and knowledge to make such decisions on their own.

Another approach is to establish CAs that are not widely trusted, but that might be trusted within a given context, such as a private internet. This is a commonly used practice in many enterprises, and often mirrors use of private DNS services. In other words, within a private internet, authentication using certs may rely on both a private DNS service and a private CA, presuming that the CA's cert is distributed to the relying parties (*e.g.,* to all PCs on the network, perhaps through procedures that push "policies" to these PCs).

Yet another practice has emerged where widely trusted CAs issue certs with subjects or SANs that are based on domain names that are recognized only within a private internet context where there is a private DNS service. In such cases, the certs may be using domain names for subjects that are *not* resolvable within the public DNS. This practice is often referred to as issuing certs for so-called *internal names,* which are useable on a private internet, but not the public Internet. Such certs are sometimes referred to as "internal name certs."

While there has always been some controversy regarding this practice, it is has been widely employed, and is popular with many enterprises that maintain their own private name spaces. The simple reason for this popularity is the ease and practicality of relying on built-in methods within operating systems, browsers, and many other applications for distributing trusted CAs and their root certs.

It is also worth noting that there are real world situations that make it difficult to avoid reliance on certs that use internal names. A major challenge is having to rely on users to make appropriate decisions when presented with certificate warnings from their browsers in situations where their browser does not have a private CA cert installed in its trust database. Even if methods are provided for users to retrieve and install root certs for private CAs, these very methods create further vulnerabilities in that users could be tricked into installing a root cert for a bogus CA, which could have dire consequences. In practice, very few users have ever had to install new CA root certs in their browsers or operating systems, so there is little experience with performing these installation procedures.

While methods do exist within enterprise environments for having private CA root certs automatically distributed to user workstations and other devices (*e.g.,* Microsoft's Active Directory facilities), there are still many challenges associated with relying on such distribution methods. In particular, there are service providers who tend to interface with their customers private internets, and not directly via the public Internet, though they may reach the private internets via VPN connections over the public Internet. Where there are requirements, such as policy mandates, to provide authentication and confidentiality, such service providers may have no practical means for distributing private CA root certs to the myriad PCs and other devices scattered within potentially many private internets, or they may have to coexist with private name spaces over which they have no control. Although facilities such as Active Directory can be *federated* to extend trust across organizational boundaries, there are many practical limitations that make it difficult to leverage these facilities in some service delivery models. Retail payment services, medical services, and law enforcement agencies are examples of situations where practical solutions to extending trust while complying with policy guidelines may not exist today, other than relying on the built-in trusted CA databases associated with operating systems and browsers.

6.2.3 Certificates and name collision

Many security measures rely on authentication as an essential facility. For example, confidential communications is meaningless—no matter how strong the encryption—if communications is established with the wrong party. Access control is another example where authentication is an essential precursor to making appropriate decisions about privileges and access rights. Authentication is a challenging security problem, for which there are few effective solutions, and many known deficiencies in current practices.

The success of TLS as a popular means for establishing secure communications based on authentication of the destination service using certs and domain names has made this approach a mainstay for improving security in today's private internets and the public Internet at large. In fact, TLS, SSL, and related protocols are used for many applications besides just web browsing. Other examples include sending/receiving email (*e.g.*, STARTTLS), remote-access VPNs (*e.g.*, OpenVPN), many database access services, and system management facilities. Furthermore, the use of TLS and related protocols with certs is expanding rapidly as more organizations and service providers react to growing threats from a broader base of adversaries.

Therefore, any change that potentially introduces new exposures into systems based on TLS, or related protocols, is cause for concern. The emergence of name space conflicts resulting from the delegation of new TLDs to the root of the public DNS is, therefore, a concern if this could potentially undermine the fundamental assumptions of authentication based on certs and domain names. In particular, if it is possible for two *different* systems to be reached via the *same* domain name, then there is the potential that *both* systems might have valid, but different certs. In such a case, a relying party, such as a web browser, might attempt to establish a connection to some server the user intended to reach, but instead establishes an *apparently* secure[37] connection to a different server. This might be the result of accidental (unintentional) name conflicts or due to intentional malevolent attacks perpetrated by adversaries. In either case, there could be very real risks.

Other sections of this Study Report have outlined some of the ways in which name space conflicts could emerge when new gTLDs are delegated, so the focus here is on the security

[37] Any communication to an unintended party is *inherently insecure*, no matter what protocols are used.

implications when certs are utilized. Note that these are by no means the only security concerns where name space conflicts occur, but this Study's scope of investigation only includes a subset of the cert-related security concerns.

This Study has also focused on the problems associated with reliance on widely trusted CAs where name space conflicts might emerge. There are two obvious areas of concern:

- use of so-called internal name certs where valid certs have been, or might be, issued that reference non-public domain names, either in the subject CN or SANs, but where delegation of new gTLDs could result in registration of new domain names that conflict with internal names used within private networks; and
- newly registered domain names using recently delegated gTLDs that unintentionally or intentionally conflict with private name spaces, where the registrants can then legitimately request that certs be issued for these conflicting names.

In either case, the concern is that authentication could be undermined if multiple entities could be successfully authenticated using standard protocols and procedures, but with different certs. This opens up risks due to accidents and unintended conflicts, as well as risks from adversaries who directly exploit name space conflicts.

At the time that a new gTLD is delegated, the most immediate problem comes from the first area of concern, since there may well be certs already in existence that could exacerbate name space conflicts and introduce risks due to false-positive authentication[38] results. ICANN's SSAC described this problem and discussed its ramifications in SAC 057,[39] and the CA/Browser Forum published new guidance to CA operators[40] in 2011 deprecating the issuance of internal name certificates (which practice must cease entirely by October 2016[41]). This Study has explored the issues associated with internal name certs, and has sought information to further assess potential risks in the near-term when these certs will still be valid. Insights gained from these explorations are presented below.

However, it is important to not lose sight of the second area of concern noted above, namely that new registrations could lead to unintentional or intentional name space conflicts, and would allow certs to be issued by widely-trusted CAs that could result in false-positive authentications. This concern is likely to grow over time, and it is difficult to predict what the long-term

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[38] False-positive authentication is defined as any situation where some entity is successfully authenticated other than the entity intended by the user or requesting system. Note that this does not necessarily mean improper authentication has occurred, just that the entity that has been successfully authenticated is not the one that was intended.

[39] https://www.icann.org/en/groups/ssac/documents/sac-057-en.pdf

[40] https://cabforum.org/Guidance-Deprecated-Internal-Names.pdf

[41] https://www.cabforum.org/Baseline_Requirements_V1.pdf

consequences might be. While the risks associated with internal names certs will gradually fade away as these certs are phased out, there is no policy-mandated endpoint for risks resulting from certs issued legitimately to newly registered domain names that happen to conflict with private name spaces.

Furthermore, when a cert is issued by a private CA for a system that exists within a private internet context, then the subject (leaf) cert will chain up to the issuing CA, which may in turn chain to another superior CA until a self-signed root CA cert is encountered. If entities that rely on such private certs (*e.g.,* browsers) have the root certs of private CAs installed in their CA trust databases, then certs issued by these private CAs will be accepted without warnings or other errors. However, if a relying entity, such as a browser, were to somehow be directed to another system with the same domain name, but not the intended system, then the cert provided by this other system with the same name might chain to a root CA that is one of the widely-trusted CAs. In this case, the relying entity will still accept the cert as valid, and name conflicts can easily result in false-positive authentications. An example of where this kind of problem could occur is when a laptop or other mobile device used to access servers on a private internet is removed from the private setting, and connected to the public Internet, such as at the user's home, or at a hotel or airport lounge. Telecommuting practices based on the use of VPN connections to private internets is another common example where naming conflicts could easily occur. Note that this sort of false-positive authentication is a concern for both internal name certs, and certs issued for future valid public name spaces that happen to conflict with private name spaces.

While the above concerns have been expressed in terms of services residing in future public name spaces but conflicting with services deployed in private name spaces, it is also possible to reverse the situation. Specifically, if a private domain name conflicts with a public domain name, then certs might be issued for the private domain name that could result in false-positive authentication against the private service, when the public service was the intended destination. Scenarios of this type could represent significant exposures and viable opportunities for abuse.

Another point worth noting is that authentication using certs with domain names for subjects are typically used for one-way authentication. For example, with TLS and SSL protocols in a traditional browser and web server interaction, only the server is authenticated to the browser via the cert. In reality, these protocols do support *mutual* authentication of both parties, where each presents a cert, however this is rarely used. Instead, the web server authenticates the user by requesting credentials, such as a userid and password. Given this asymmetric authentication of the parties, a likely objective of an attacker exploiting exposures due to name space conflicts will be to confuse users into thinking they are securely communicating with a known, trusted server, when instead, they are communicating with the attacker's server which may then capture user credentials, perhaps as a prelude to a man-in-the-middle attack, or an attack against systems within a private context. When true mutual authentication is not used, there are more opportunities to exploit vulnerabilities in one-way or asymmetric authentication schemes.

7 Name collision risks

7.1 Name space instability

Tables 1 and 2 in Section 4.1.1 show that the proposed TLD strings `corp` and `home` appear frequently in the request stream at the root, and would therefore be more likely than strings that appear less frequently to be involved in name space collisions if they were delegated as new TLDs. This Section discusses the name space instability issues that may arise for these two proposed TLDs in particular, but the general principles apply to any proposed TLD that is in widespread private use today, and that appears unintentionally on the Internet.

7.1.1 Instability issues for **`corp`**

As explained in Section 6.1, the result of a lookup of `myhost.corp` may change if `corp` is delegated into the Internet root zone. This TLD is often used on corporate networks, so it is unclear what might happen to applications on those networks when a lookup of `myhost.corp` is done. It might fail. It might resolve against the internal, private name space instead of that on the public Internet or *vice versa*. This would depend on the DNS configurations of those individual private networks.

That in turn may well mean that the current, well-known behavior of applications and systems becomes uncertain and undefined. For instance users could be taken to the wrong web site (and possibly be exposed to phishing attacks) or told that web sites do not exist when they do, depending on how the `.corp` TLD is resolved. A corporate mail system might attempt to deliver email to the wrong server, and this could expose sensitive or confidential information to someone who was not supposed to receive it. In essence, everything deployed in the private network would need to be checked.

There are no easy solutions to these problems. In an ideal world, the operators of these private networks would get a timely notification of the new TLD's delegation and then take action to address these issues. That seems very improbable. Even if ICANN generated sufficient publicity about the new TLD's delegation, there is no guarantee that this will come to the attention of the management or operators of the private networks that could be jeopardized by the delegation. If they are made aware, they may not appreciate that their network is at risk; after all, how could a change to something on another network, albeit the public Internet, affect the operation of their isolated private network? When network operators are aware of potential risks, they may or may not carry out a detailed audit to gauge the extent of the problem. That risk assessment might be incomplete or overlook elements.

Assuming that a comprehensive risk/threat analysis were carried out, the operator would need time to devise a mitigation strategy and/or reconfigure key components of their infrastructure. Money would have to be spent and other resources would have to be committed to these efforts. These would need to be properly planned, integrated into the organization's budget cycle, and prioritized against other IT projects. Service delivery partners and outsourcing providers might need to be consulted and contracts revisited to carry out assessments or execute change requests. All of this would take considerable amounts of time, possibly a year or more. It seems reasonable to estimate that the amount of effort involved might be comparable to a wholesale renumbering of the internal network or the Y2K problem.

In some cases, there might be no simple way for the organization to take action. Their ad-hoc use of the new gTLD inside their network might well be too pervasive and/or diffuse. For instance, if the organization were using `corp` (say) as the anchor for their Active Directory service, it might be impossible to change that without unacceptable levels of disruption and cost. Every laptop and desktop would need to be reconfigured, while core servers such as domain controllers would have to be reconfigured. In all likelihood everything on the internal network would need to be issued new login credentials—Kerberos tickets and/or X.509 certificates—based upon some new domain name.

Faced with the prospect of so much upheaval and cost, the operator of an affected network might take a pragmatic approach: block all access to the Internet version of `corp` (say) from their network and vice versa. That way, they could carry on with routine operations as if the delegation of `corp` had never happened. That in itself would lead to instability and lack of robustness, because two or more communities of users would be unable to use `.corp` to communicate with each other. It might also be ineffective for roaming users, who might be exposed to potentially security-compromising inconsistencies when moving among their own corporate network, the Internet, and other private networks.

7.1.2 Instability issues for `home`

It seems reasonable to assume that `home` is typically used for CPE (Customer Premises Equipment)—cable modems, DSL routers, wireless access points, printers, and similar devices used in small office or home environments that are not managed by an IT professional. Here, the device is likely to have a well-known name—*e.g.*, `model-number.home`—for itself. This name would be used by a web browser to configure and manage the device. A computer on the local network would use this device for DNS resolution. The device would recognize lookups for its own name and answer accordingly.

The DNS resolver in this device would almost certainly assume that the home TLD does not exist or that it is authoritative for the domain, so local lookups for publicly-defined .home domain names would terminate at the DNS resolver in the device. This would mean that applications on the local network would be unable to reach the Internet's home TLD.

In principle it should be straightforward to fix these problems. One option would be to upgrade the device's firmware once the vendor had prepared a fix. End users might never hear about this or have the skill or inclination to apply a patch. In some environments the ISP might be able to take care of this using a standard like TR-069 to do the upgrade or reconfigure a router or cable modem remotely. However this would not work if end customers used their own devices instead of equipment supplied by the ISP. It also seems unrealistic to expect that all of these devices could or would get fixed before home was delegated. If a vendor had gone out of business or stopped supporting a device, the end user would be obliged to buy a replacement if they needed to access home on the Internet.

7.1.3 Instability issues for all new TLDs

The proposed TLDs corp and home stand out in terms of query volume, and the use cases described in the previous two sections are well-documented. However, other labels are likely to be used in similar ways, and therefore to be subject to the same issues. For instance, site is used in ways that are very similar to those described for home; and based solely on semantics, we might expect office, group, and inc to be used in ways that are very similar to those described for corp.

Table 13 shows counts (in thousands) of selected QTYPEs for requests to the root for the top 100 proposed TLDs:

Proposed TLD	A	AAAA	MX	PTR	SRV	TXT
home	878,505	46,336	12,237	5,677	1,842	3,930
corp	100,610	3,349	2,437	3,370	21,965	258
ice	19,663	28	2	10	30	5
global	7,858	369	28	64	2,349	16
med	5,631	4,930	20	3	94	6
site	2,932	7,039	230	30	135	73
ads	6,258	854	23	50	2,003	16
network	6,854	563	9	280	559	48
cisco	6,694	482	80	481	57	63
group	5,991	127	13	23	1,544	16
box	5,742	1,129	49	371	234	49

Proposed TLD	A	AAAA	MX	PTR	SRV	TXT
prod	5,306	854	17	98	293	18
iinet	4,796	411	15	43	49	46
hsbc	4,811	12	10	34	363	2
inc	3,206	163	202	40	1,044	26
dev	3,970	311	18	36	297	15
win	3,524	13	6	9	798	2
office	2,124	269	12	183	807	33
business	2,616	419	166	21	10	25
host	1,054	1,833	53	8	60	35
mail	1,188	165	660	9	100	116
star	1,910	48	5	8	246	1
ltd	1,448	37	18	10	342	5
google	1,574	107	10	109	20	17
sap	1,688	7	2	6	8	1
app	1,644	38	2	3	11	1
world	1,221	81	7	13	224	2
mnet	966	22	24	2	396	1
smart	144	1,168	0	3	5	4
orange	877	84	32	36	7	13
web	799	99	48	19	60	10
msd	766	11	0	5	106	1
red	621	29	29	19	180	6
telefonica	705	15	3	4	32	2
casa	513	76	36	75	13	9
bank	607	18	6	3	80	5
school	483	22	5	22	177	5
movistar	545	49	23	24	8	9
search	201	441	1	4	1	9
zone	520	29	4	7	83	2
abc	418	83	12	11	61	1
youtube	539	24	0	6	1	1
samsung	460	61	1	11	2	18
hot	240	295	9	3	4	0
you	470	25	26	8	1	1
ecom	479	15	15	2	16	2
llc	380	7	3	8	128	2
tech	397	18	4	5	80	1
foo	463	13	4	5	10	6
free	410	26	17	23	4	2

Proposed TLD	A	AAAA	MX	PTR	SRV	TXT
kpmg	2	474	0		0	
bet	188	130	137	5	5	1
bcn	389	6	2	4	62	1
hotel	345	22	1	40	52	4
new	272	46	46	33	36	7
wow	389	13	21	6	4	1
blog	385	43	1	0	0	0
one	287	17	15	11	94	6
top	288	18	5	4	111	1
off	267	73	51	7	28	1
yahoo	261	21	90	22	27	4
cloud	252	69	4	8	63	13
chrome	19	363	0	1	0	0
link	312	23	8	9	11	2
comcast	250	23	9	69	5	8
gold	323	13	7	14	3	2
data	308	16	9	5	16	1
cam	202	19	103	4	14	3
art	300	13	8	8	8	1
work	239	31	7	17	39	3
live	199	50	45	5	23	4
ifm	298	1	0	0	22	0
lanxess	249	1	1	0	61	0
goo	264	17	28	1	1	1
olympus	244	15	5	9	37	1
sew	242	2	0	0	65	0
city	209	22	6	13	48	3
center	178	12	4	4	99	1
zip	213	33	28	0	2	0
plus	117	19	99	3	37	0
gmail	190	14	55	3	8	2
apple	209	10	1	30	4	8
thai	223	18	0	1	14	3
law	182	3	7	7	58	1
taobao	254	3	0			0
show	208	43	1	0	3	0
itau	211	3	1	8	31	0
house	147	25	4	61	11	5
amazon	243	5	0	1	0	0

Proposed TLD	A	AAAA	MX	PTR	SRV	TXT
ericsson	26	217	1	1	1	0
college	151	58	1	2	30	0
bom	167	14	57	0	2	0
ibm	174	22	24	3	10	0
company	149	7	19	3	49	1
sfr	135	18	5	55	5	5
man	169	12	8	4	23	1
pub	159	24	2	16	12	2
services	188	4	2	2	18	2
page	75	136	2	1	0	0
delta	157	36	1	5	13	1

Table 13—QTYPEs of root server requests for the top 100 proposed TLDs (2013)

All of these TLDs have requests for MX records, and all but one have requests for SRV records. This suggests that there are systems on the Internet today that have been configured, possibly by accident, to locate these resources. Currently these lookups fail for non-delegated TLD strings, but if those strings were delegated those lookups would succeed. A mail system might then be able to resolve `mydomain.network` (for example) and deliver email to that destination, instead of performing whatever action it previously took after a lookup failure. This could mean that email goes astray because it gets delivered to the wrong destination, perhaps disclosing sensitive information.

Similarly, SIP clients—perhaps the heaviest users of SRV record lookups—might initiate contact with a SIP server when that previously did not happen because the lookups failed. If a SIP client's SRV lookups succeeded after the TLD was delegated, it might contact the wrong SIP service and either be denied access or have a VoIP session intercepted by a third party. If done with malicious intent, the operator of such a newly introduced SIP server might go undetected for a long time.

7.2 Internal name certificates issued by widely-trusted CAs

The risks posed by the use of internal name certificates as described in Section 6.2 depend on the following factors:

- How many widely trusted CAs currently have policies that allow them to issue certs with internal names. Current evidence suggests that only about half of the trusted CAs issue internal name certs, but the ones that do issue these certs are, in several cases, high-volume issuers.

- Whether or not additional constraints are imposed on the issuing of certs that include internal names. For example, a trusted CA might limit the validity interval for internal name certs, or require additional verification from the requesting party. Somewhat related is the potential for new internal name certs to be requested by adversaries intending to exploit name space conflicts in the future, and whether or not CAs are implementing any new policies to reduce such exposures.
- The timeframe over which internal name certs will be valid—*i.e.*, how long before all such certs expire.
- The number of certs that incorporate internal names that could conflict with applied-for gTLDs that may be delegated at the public DNS root over the next few years.
- The actual structure of the internal names used in certs, since many names may not be susceptible to name conflicts when new gTLDs are delegated.
- The number of Subject Alternative Names or SANs allowed within a cert that are based on internal names. This appears to be a fairly common practice, as many organizations requesting internal name certs will have multiple systems that they want to use the cert with, such as primary and backup servers.
- Whether wildcards are allowed or used for internal names. Use of wildcards could substantially increase the exposure for a single cert that incorporates such a name, since there might be many matches, and a single cert deployed on a single server could successfully authenticate against every name within an entire name space.
- The policies of a new gTLD registry will also determine the scope of exposures for a given TLD. For example, if a company uses its name as a TLD for its internal private name space, and has also applied for a gTLD using the same company name, then presumably registrations of names in this space will be restricted, and any internal name certs used by such a company can be protected through domain name registration policies and procedures.
- The popularity of certain second or third level domain names will partially determine the exposure to name space conflicts. For example, domain names like `www.example`, `mail.example` or `server.example` are much more likely to conflict should `example` be delegated at the public root. Internal name certs that incorporate such popular names are much more likely to conflict with certs issued within other private internets.
- Timely revocation of internal name certs that conflict with newly delegated TLDs.
- The effectiveness of revocation as a means for causing relying parties to reject authentication using revoked certs that have not expired. This may depend on the community of use, or the affected applications, since revocation depends on relying parties to query the current validity of certificates.

To get a better handle on these risk factors, this Study has leveraged available information sources, and also sought to acquire additional information from the operators of widely trusted CAs. One useful source of information already collected from CA operators came from the

Mozilla organization, and a survey they initiated in January of this year.[42] One question asked of the CA operators was whether they currently issue certificates using internal server names (or private IP addresses), and if they do, when do they anticipate ceasing this practice. The results of this Mozilla survey were later published,[43] and have been reviewed by this Study.

A total of 64 CA operators that are currently in the trust database circulated with Mozilla browsers and other applications responded to this survey, and 33 indicated that they do not currently issue internal name certificates. Note that these 64 CA operators are responsible for 158 trusted CA root certs within Mozilla's trust database, because some of these operators have multiple CAs. Since this published survey shows which CA operators currently issue internal name certs, it is fairly easy to see that some of the largest CA operators responsible for a significant portion of all active certs issued by widely-trusted CAs are also issuing, or have issued, internal name certs. However, it is not possible to ascertain from this information how many internal name certs have been issued.

A questionnaire posted to the CA operators asked similar questions. Table 14 summarizes answers received from a total of 16 respondents,[44] reflecting large CAs as well as smaller CAs, some of which focus on specific markets.

Questions	Answers	
(1) Are any of your publicly-trusted CAs allowed to issue certificates to non-public domain names?	Yes:	6
	No:	9
	No, but…	1
(2) Do you allow external third parties (subordinate/cross-signed CAs, registration agents, etc.) to approve issuance of these types of certificates under your publicly-trusted root CA?	Yes:	2
	No:	11
	No, but…	2
(3) Do you currently issue SSL/TLS certificates with non-public/internal names in the Common Name (CN) or Subject Alternative Names (SANs)? (originally question #8)	Yes:	6
	No:	9
	No, but…	1

Table 14—CA questionnaire answers

[42] https://wiki.mozilla.org/CA:Communications#January_10.2C_2013
[43] https://docs.google.com/spreadsheet/pub?key=0Ah-tHXMAwqU3dHdISmM3c05tb1dMQjlJclJqS21QNmc&output=html
[44] Of the 16 respondents, one did not answer Question 2.

The first question is a broader question intended to ascertain whether certs with non-public or internal names are issued for any application, for example secure email as well as for TLS usage. The "No, but…" is a paraphrasing of a response from a CA that has a standing policy to not issue such certs, but does have some exceptions in specific circumstances.

Since some CA operators allow other organizations to operate subordinate CAs, the second question tried to distinguish between the policies of the root CA versus subordinate, third-party CAs. In this case, the paraphrased "No, but…" responses indicated that there were exceptions in special cases.

The last question was specific to TLS and SSL certs only. In general, the responses are very similar to what were received from the first question.

8 Name collision risk assessment

Risk[45] in the context of this study is understood as the product of two variables:[46]

- Probability of occurrence: how likely is it that the event will occur?
- Severity of consequences: should the event occur, what type and magnitude of harm would ensue, and how and by whom could it be remediated?

The risk assessment function must also account for uncertainty in the values of these variables. For example, if it is not possible to confidently estimate the type and magnitude of harm associated with the occurrence of an event, it may be necessary (or at least prudent) to add a constant factor of appropriate magnitude to the risk equation to ensure that it does not underestimate the actual risk.

The risk associated with the potential collision of a newly-delegated TLD label and syntactically identical names that were in use prior to that delegation can therefore be assessed analytically by either measuring or estimating the value of these variables. The magnitude of the "uncertainty constant" cannot be established analytically, and is therefore a policy decision that is beyond the scope of this study.

8.1 Probability of occurrence

We make several assumptions about the measurements of proposed TLD occurrence that were extracted from the 2012 and 2013 DITL data:

- The 2012 and 2013 DITL data adequately[47] represent the global continuous query stream to the DNS root. Because these data can only approximate the global query stream (as discussed in Section 4.3), this is an assumption rather than an assertion.
- The query stream at the root is an adequate proxy for the global continuous query stream at all publicly accessible DNS resolvers. As the data from the single non-root resolver that were available to this study are much less representative than those from the root servers, this is an assumption rather than an assertion.

The probability of occurrence can be measured (with limitations that are described in Section 6), and as such was the principal focus of the current study.

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[45] Risk here is "delegation risk"—the risk that delegating a string as a new gTLD label will cause events to occur (name collisions) that may produce harmful consequences.

[46] Because "risk" is an inherently subjective concept, we use mathematical language (*e.g.*, "product" and "variables") in this report as a convenient way in which to describe conceptual relationships, not to suggest that risk assessment involves an actual numerical computation.

[47] In making these assumptions, we use the term "adequate(ly)" to assert that we consider reliance on them to be reasonable with respect to the claims that we make for the precision of the study conclusions.

8.2 Severity of consequences

The risk assessment variable “severity of consequences” combines five elements:

- the magnitude (cost) of the consequences;
- who would be harmed (directly or indirectly) by the consequences;
- the cost of remediation;
- who would be responsible for remediation; and
- the capability of the remediating party(ies).

We make several assumptions about the potential consequences of name collision with respect to different categories of proposed TLD:

- The severity of collisions involving proposed TLD strings that are brand names or trademarks belonging to the corresponding applicant, or are otherwise intimately associated specifically with that applicant, is likely to be relatively low. Harm, cost, and remediation are likely to be concentrated, or even completely contained, within the organizational footprint of the applicant.
- Proposed TLD strings that appear almost entirely in queries from a small number of source IP address prefixes are likely to be associated with less severe consequences if they collide than proposed TLD strings that are more broadly distributed across many sources. Although harm and cost are not factors in this assumption, remediation is likely to be more effectively concentrated when the number of query sources is small.
- “Harm” includes both harm to a new TLD registry that inherits a (presumably unrelated) pre-delegation query stream for its string (as described in [1]) and harm to pre-delegation users of the string who may or may not even be aware that the string has been delegated as a new TLD in the public DNS.
- The potential harm associated with proposed TLD strings that appear with some frequency in internal name certificates is greater than for proposed TLD strings that do not.
- The potential harm associated with proposed TLD strings that appear with some frequency in requests to the root for record types other than A/AAAA (particularly SRV and MX) is greater than for proposed TLD strings that do not.

None of the five elements of “severity of consequences” is directly measurable from Internet traffic. As the current study did not include either (a) simulation or other experimental exercises or (b) an historical investigation and analysis of name collision in other contexts,[48] the value of this variable must be estimated.

[48] For example, the name collision that presumably occurs when two previously separate Microsoft Active Directory domains are merged by a company that has just acquired another.

8.3 Risk assessment framework

The risk assessment formula described above is a product of factors. If either factor is very large it will produce a large product even for small values of the other factor; and if either factor is very small it will produce a small product unless the other factor is very large. If either factor is zero—name collision does not occur, or no harm ensues from collision—the risk is zero unless a policy decision adds a non-zero uncertainty constant to the equation. The uncertainty constant expresses the level of confidence in the accuracy of the measured or estimated values of the two factors and in the viability of the formula as a model for all of the relevant risks.

In practice the uncertainty constant will almost certainly be non-zero, as no amount of measurement can guarantee that name collision will never occur, and it is almost never possible to determine before the fact all of the ways in which harm might ensue from such a collision. As risk assessment will therefore rarely (if ever) produce a zero-risk conclusion, effective risk management will depend on establishing an organizational "comfort level" with respect to uncertainty.

8.3.1 Low risk

Proposed TLD strings that do not appear at all in the root or intermediate resolver query streams can be considered to represent low practical risk with respect to name collision.[49] Table 15 shows the 46 proposed TLD strings that do not appear at all (in the TLD position) in either the 2012 or the 2013 DITL data:

[49] Of course this is true only within the scope and limitations of the current study, some of which are described in Section 4.3, and with respect to the current round of the new gTLD program.

allfinanzberater	schwarzgroup	xn--dkwm73cwpn	xn--mgba7c0bbn0a
allfinanzberatung	xn--1ck2e1b	xn--fct429k	xn--mgbi4ecexp
cashbackbonus	xn--30rr7y	xn--fzys8d69uvgm	xn--mgbv6cfpo
frogans	xn--3oq18vl8pn36a	xn--hdb9cza1b	xn--pbt977c
imamat	xn--3pxu8k	xn--hxt035cmppuel	xn--pssy2u
kerryhotels	xn--55qx5d8y0buji4b870u	xn--hxt035czzpffl	xn--tiq49xqyj
kerrylogisitics	xn--80aqecdr1a	xn--i1b6b1a6a2e	xn--tqq33ed31aqia
kerryproperties	xn--b4w605ferd	xn--imr513n	xn--vermgensberater-ctb
lefrak	xn--bck1b9a5dre4c	xn--j6w470d71issc	xn--vhquv
mzansimagic	xn--c1yn36f	xn--jvr189m	xn--w4rs40l
northlandinsurance	xn--cck2b3b	xn--kcrx7bb75ajk3b	
onyourside	xn--czr694b	xn--mgba3a3ejt	

Table 15—Proposed TLDs absent from both 2012 and 2013 DITL data

For a broad range of policy decisions concerning the way in which ICANN and the Internet community define delegation risk, it is also reasonable to consider that proposed TLDs that appear in the query stream at the root less frequently than any existing (currently delegated) TLD represent low practical risk. Based on the DITL data available to this study, in 2012 the least frequently queried existing TLD was `sx` (25,768); in 2013, the least frequently queried existing TLD was `sj` (49,842).

Another reasonable threshold for "low risk" could be established by reference to the number of queries for existing TLDs that are empty (meaning that their zones contain only the necessary DNS meta-data). The previously cited `sj` satisfies this criterion, as does the related[50] ccTLD `bv` (with 56,080 queries in the 2013 DITL data).

Applying either criterion using the 2013 DITL data would set the "low risk" threshold at the level of the query count for `sj`, which in the list of proposed TLDs occurs between rank 281 and rank 282. 1114 of the 1395 proposed TLDs would therefore fall below this threshold.

8.3.2 Non-customary risk

A small number of proposed TLDs belong in a separate risk category because they challenge the user and infrastructure expectations established by existing rules and practices in special ways.

[50] The country codes `sj` and `bv` are both associated with mostly uninhabited Norwegian colonies (Svalbard and Jan Mayen in the case of `sj`, and Bouvet Island in the case of `bv`).

For example, this report (and others, including [3]) documents the ways in which expectations with respect to names that "won't resolve outside of the local domain because they are not delegated in the public DNS" are challenged by the proposed delegation of those strings as public gTLD labels. That challenge applies to all of the proposed TLDs that occur at least once in the root query stream, to a greater or lesser degree depending (in part) on the frequency with which they occur. But a new gTLD proposed as a so-called "dotless domain"[51] presents an additional challenge to expectations with respect to names that "won't resolve outside of our local domain because they consist of a single label, and that's not allowed in the public DNS," potentially disrupting deeply embedded assumptions about the way in which search list processing should proceed. A recently completed separate study of "dotless domains" supports this observation:

> The study confirmed that if systems [were] configured to use dotless domain names to locate intranet hosts, and these systems were to mistakenly use a public DNS server for name resolution, any dotless name collisions would cause the system to attempt to interact with the Internet facing host. The study also suggests that users accustomed to accessing intranet resources via dotless names may unknowingly access untrusted Internet resources that share the same dotless names. [17]

The Name Collision study was not designed to identify all instances of non-customary risk in the applications for proposed TLDs, so this "dotless domain" example is illustrative rather than definitive. Other non-customary risks might be associated with other proposed registry services.

8.3.3 Calculated risk

Because of the way in which we have defined the risk assessment formula as a product of factors, the risk associated with a proposed TLD string that appears in the query stream with low frequency is dominated by the magnitude of the other factor (severity of consequence). This study did not attempt to investigate the potential consequences of string collision for every proposed TLD in the "long tail" of the occurrence distribution.

Properly calculating the risk of delegating a proposed TLD in this category would require an investigation of the context(s) in which the corresponding string is currently used and the circumstances under which it might collide with a syntactically identical delegated TLD.

For some strings in this category, it might be reasonable to assume (or to determine with minimal effort) that the "severity of consequence" factor is small enough[52] to ensure that the product of occurrence and severity is also small. For some other strings in this category, it might be

[51] A "dotless domain" is a fully-qualified domain name that consists of a single label. In the current new gTLD round, one applicant for the string "search" has proposed to operate the TLD as a dotless domain.

[52] It should be obvious that "how small is 'small enough'?" is a policy question involving the values and priorities of ICANN and the Internet community, not an objectively measurable threshold.

necessary (or at least prudent) to assume (or determine) that the “severity of consequence” factor is large enough to produce a non-small risk product. In both cases, the result would also be influenced by the policy decision with respect to the value of the uncertainty constant.

Because the occurrence of proposed TLDs in the query stream at the root is distributed (roughly) according to a power law with a large head and a long tail, a reasonable policy decision might be to accept the frequency of occurrence as a first-order estimate of the risk product for the “top N” most frequently occurring strings. That estimate could then be fine-tuned according to the amount of information available concerning the magnitude of the “severity of consequences” factor.

Plotting frequency of occurrence on one axis and severity of consequences on the other (with the highest frequency of occurrence and highest severity of consequences in the lower left corner) would then distribute the “calculated risk” strings in a gradient diagram such as the one shown in Figure 4:

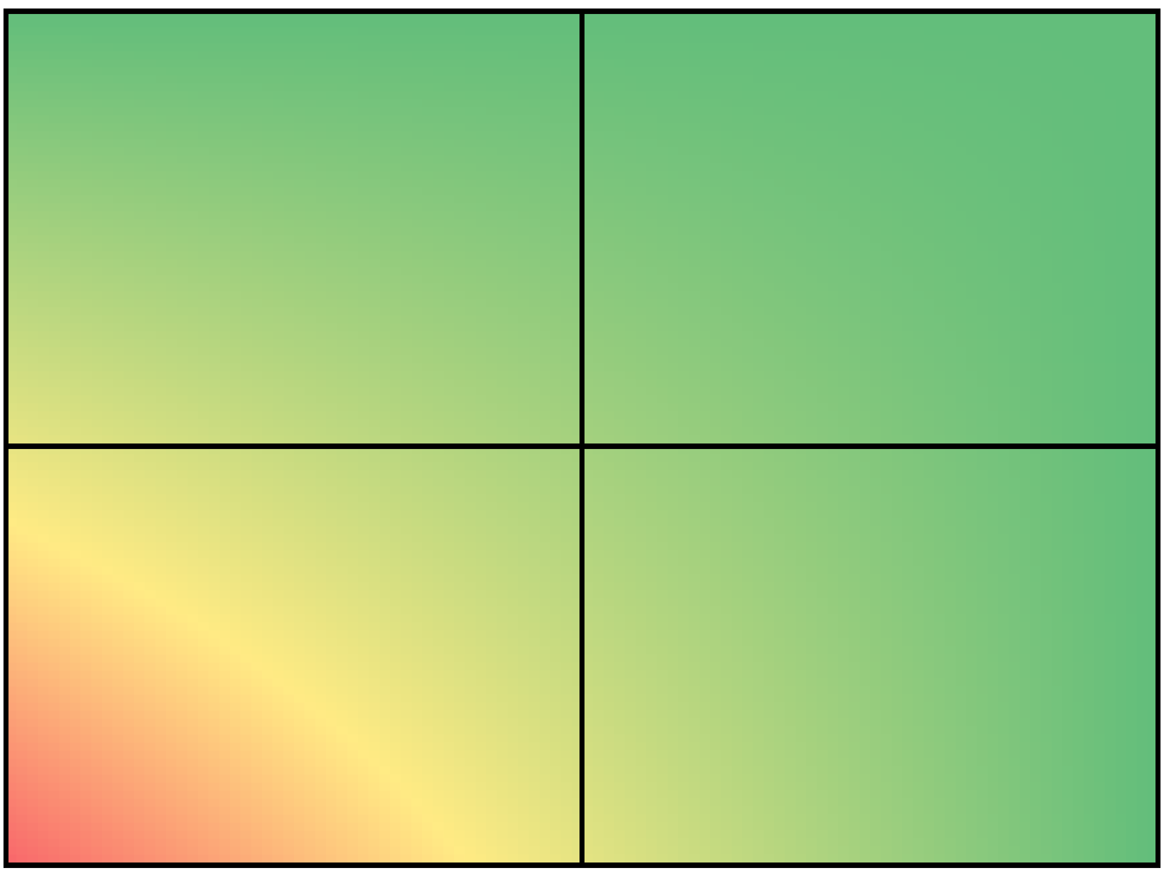

Figure 4—Occurrence/Consequences gradient plot

The gradient plotted in Figure 4 is uniform with respect to the distribution of risk products; that is, it does not illustrate the effect of the “uncertainty constant” in the risk assessment formula. It is therefore useful primarily as a tool to support the policy decision-making process rather than a template for the allocation of specific strings or categories to particular positions within the plot.

Determining where in such a plot a particular proposed TLD belongs involves both an analytical assessment of risk and policy decisions concerning what “risk” means in the context of delegating new TLDs into the Internet’s Domain Name System. For example:

- A policy decision that frequency of occurrence (likelihood of name collision) should be the dominant risk factor might lead to the designation of `home` and `corp` as the only “high risk” strings—they occur an order of magnitude more often in the 2012 and 2013 data than the next most frequently occurring string.
- A policy decision that severity of consequences should be the dominant risk factor might lead to the designation of every string that appears with frequency >N (for some value of N[53]) in either the 2012 or the 2013 data as “high risk” until further study determined the real-world consequences of name collision for each of those strings.
- A policy decision that the size of the potential harm footprint (how broadly the consequences of name collision would be felt) should be the dominant risk factor might lead to the designation of strings that appear in requests from many different IP address prefixes to be “high risk.”
- A policy decision that the feasibility and cost of mitigation should be the dominant risk factor might lead to the designation of strings for which the consequences of name collision would likely be limited to a user environment closely coupled to the applicant (such as `google` or `hsbc` among the top 35 applied-for strings by 2012 and 2013 rank) as “low risk.”
- A policy decision that name collision consequences that affect security should be the dominant risk factor might lead to the designation of the strings that appear most frequently in internal name certificates (`corp`, `mail`, `exchange`, `hsbc`, and `cba`, for example) as “high risk.”

[53] Of course, the choice of a value for “N” is also a policy decision. It could be based on a comparison with existing (cc) TLDs or a fraction of the total number of queries, but is essentially arbitrary.

9 Name collision risk mitigation

ICANN and its partners in the Internet community have a number of options available to mitigate the risks associated with name collision in the DNS. This section describes each option; its advantages and disadvantages; and the residual risk that would remain after it had been successfully implemented.

The viability, applicability, and cost of different risk mitigation options are important considerations in the policy decision to delegate or not delegate a particular string. For example, a string that is considered to be "high risk" because risk assessment finds that it scores high on occurrence frequency or severity of consequences (or both), but for which a very simple low-cost mitigation option is available, may be less "risky" with respect to the delegation policy decision than a string that scores lower during risk assessment but for which mitigation would be difficult or impossible.

It is important to note that in addition to these strategies for risk mitigation, there is a null option to "do nothing"—to make no attempt to mitigate the risks associated with name collision, and let the consequences accrue when and where they will. As a policy decision, this approach could reasonably be applied, for example, to strings in the "low risk" category and to some or all of the strings in the "uncalculated risk" category.

It is also important to note that this study and report are concerned primarily with risks to the Internet and its users associated with the occurrence and consequences of name collision—not risks to ICANN itself associated with new TLD delegation or risk mitigation policy decisions.

9.1 Just say no

An obvious solution to the potential collision of a new gTLD label with an existing string is to simply not delegate that label, and formally proscribe its future delegation—*e.g.*, by updating [15] to permanently reserve the string, or via the procedure described in [9] or [16]. This approach has been suggested for the "top 10" strings by [5], and many efforts have been made over the past few years to add to the list of formally reserved strings [15] other non-delegated strings that have been observed in widespread use [1] [9] [10] [16].

A literal "top 10" approach to this mitigation strategy would be indefensibly arbitrary (the study data provide no answer to the obvious question "why 10?"), but a policy decision could set the threshold at a level that could be defended by the rank and occurrence data provided by this study combined with a subjective assessment of ICANN's and the community's tolerance for uncertainty.

9.1.1 Advantages

A permanently reserved string cannot be delegated as a TLD label, and therefore cannot collide with any other use of the same string in other contexts. A permanently reserved string could also be recommended for use in private semantic domains.

9.1.2 Disadvantages

There is no disadvantage for the Internet or its users. The disadvantages to current or future applicants for permanently proscribed strings are obvious. Because the "top N" set membership inclusion criteria will inevitably change over time, this mitigation strategy would be effective beyond the current new gTLD application round only if those criteria (and the resulting set membership) were periodically re-evaluated.

9.1.3 Residual risk

This mitigation strategy leaves no residual risk to the Internet or its users.

9.2 Further study

For a string in the "non-customary risk" or "calculated risk" category, further study might lead to a determination that the "severity of consequences" factor in the risk assessment formula is small enough to ensure that the product of occurrence and severity is also small.

9.2.1 Advantages

Further study might shift a string from the "uncalculated risk" to the "calculated risk" category by providing information about the magnitude of the "severity of consequences" factor. It might also reduce the uncertainty constant in the risk assessment formula, facilitating a policy decision with respect to delegation of the string as a new TLD.

9.2.2 Disadvantages

Further study obviously involves a delay that may or may not be agreeable to applicants, and it may also require access to data that are not (or not readily) available. Depending on the way in which a resolution request arrives at the root, it may be difficult or impossible to determine the original source; and even if the source can be discovered, it might be difficult or impossible (because of lack of cooperation or understanding at the source) to determine precisely why a particular request was sent to the root.

The "further study" option also demands a termination condition: "at what point, after how much study, will it be possible for ICANN to make a final decision about this string?"

9.2.3 Residual risk

Unless further study concludes that the "severity of consequences" factor is zero, some risk will remain.

9.3 Wait until everyone has left the room

At least in principle, some uses of names that collide with proposed TLD strings could be eliminated: either phased out in favor of alternatives or abandoned entirely. For example, hardware and software systems that ship pre-configured to advertise local default domains such as `home` could be upgraded to behave otherwise. In these cases, a temporary moratorium on delegation, to allow time for vendors and users to abandon the conflicting use or to migrate to an alternative, might be a reasonable alternative to the permanent "just say no." Similarly, a delay of 120 days[54] before activating a new gTLD delegation could mitigate the risk associated with internal name certificates described in Sections 6.2 and 7.2.

9.3.1 Advantages

A temporary injunction that delays the delegation of a string pending evacuation of users from the "danger zone" would be less restrictive than a permanent ban.

9.3.2 Disadvantages

Anyone familiar with commercial software and hardware knows that migrating even a relatively small user base from one version of the same system to another—much less from one system to a different system—is almost never as straightforward in practice as it seems to be in principle. Legacy systems may not be upgradable even in principle, and consumer-grade devices in particular are highly unlikely to upgrade unless forced by a commercial vendor to do so. The time scales are likely to be years—potentially decades—rather than months.

Embracing "wait until..." as a mitigation strategy would therefore require policy decisions with respect to the degree of evacuation that would be accepted as functionally equivalent to "everyone" and a mechanism for coordinating the evacuation among the many different agents (vendors, users, industry consortia, *etc.*) who would have to cooperate in order for it to succeed.

9.3.3 Residual risk

Because no evacuation could ever be complete, the risks associated with name collision would remain for whatever fraction of the affected population would not or could not participate in it.

[54] As noted in Section 6.2, the CA operators who are members of the CA/Browser Forum have agreed to revoke internal name certificates within 120 days after the contract for a corresponding TLD has been signed, and to stop issuing internal name certificates for that TLD within 30 days of contract signing.

9.4 Look before you leap

Verisign [4] and others (including [8]) have recommended that before a new TLD is permanently delegated to an applicant, it undergo a period of "live test"[55] during which it is added to the root zone file with a short TTL (so that it can be flushed out quickly if something goes wrong) while a monitoring system watches for impacts on Internet security or stability.

9.4.1 Advantages

A "trial run" in which a newly-delegated TLD is closely monitored for negative effects and quickly withdrawn if any appear could provide a level of confidence in the safety of a new delegation comparable to that which is achieved by other product-safety testing regimes, such as pharmaceutical and medical-device trials or probationary-period licensing of newly trained skilled craftsmen.

9.4.2 Disadvantages

The practical barriers to instrumenting the global Internet in such a way as to effectively perform the necessary monitoring may be insurmountable. Not least among these is the issue of trust and liability—for example, would the operator of a "live test" be expected to protect Internet users from harm during the test, or be responsible for damages that might result from running the test?

9.4.3 Residual risk

No "trial run" (particularly one of limited duration) could perfectly simulate the dynamics of a fully-delegated TLD and its registry, so some risk would remain even after some period of running a live test.

9.5 Notify affected parties

For some proposed TLDs in the current round, it may be possible to identify the parties most likely to be affected by name collision, and to notify them before the proposed TLD is delegated as a new gTLD.

9.5.1 Advantages

Prior notice of the impending delegation of a new gTLD that might collide with the existing use of an identical name string could enable affected parties to either change their existing uses or take other steps to prepare for potential consequences.

[55] Verisign calls this "ephemeral delegation."

9.5.2 Disadvantages

Notification increases awareness, but does not directly mitigate any potential consequence of name collision other than surprise. For many proposed TLDs it might be difficult or impossible to determine which parties could be affected by name collision. Because affected parties might or might not understand the potential risks and consequences of name collision and how to manage them, either in general or with respect to their own existing uses, notification might be ineffective without substantial concomitant technical and educational assistance.

9.5.3 Residual risk

In most cases at least some potentially affected parties will not be recognized and notified; and those that are recognized and notified may or may not be able to effectively prepare for the effects of name collision on their existing uses, with or without assistance.

10 References

[1] Invalid Top Level Domain Queries at the Root Level of the Domain Name System (SAC 045). http://www.icann.org/en/groups/ssac/documents/sac-045-en.pdf

[2] Report of the Security and Stability Advisory Committee on Root Scaling (SAC 046). http://www.icann.org/en/groups/ssac/documents/sac-046-en.pdf

[3] SSAC Advisory on Internal Name Certificates (SAC 057). http://www.icann.org/en/groups/ssac/documents/sac-057-en.pdf

[4] Reply Comments from Verisign Regarding the GAC's Safeguards Applicable to New gTLDs and Comments Related to Security and Stability. http://forum.icann.org/lists/comments-gac-safeguard-advice-23apr13/pdfTKBqiN1Eza.pdf

[5] Letter of 15 March 2013 from Brad Hill and Bill Smith, PayPal Information Risk Management, to Fadi Chehadé and Stephen D. Crocker re: Proposed delegation of invalid names from SAC 045 and RFC 6762. http://www.icann.org/en/news/correspondence/hill-smith-to-chehade-crocker-15mar13-en

[7] Response to the ICANN Board Regarding Interdisciplinary Studies (SAC 059). http://www.icann.org/en/groups/ssac/documents/sac-059-en.pdf

[8] A Procedure for Cautious Delegation of a DNS Name (O. Kolkman, A. Sullivan, and W. Kumari). http://www.ietf.org/id/draft-kolkman-cautious-delegation-01.txt

[9] RFC 6761—Special-Use Domain Names (S. Cheshire and M. Krochmal). http://www.rfc-editor.org/rfc/rfc6761.txt

[10] RFC 6762—Multicast DNS (S. Cheshire and M. Krochmal). http://www.rfc-editor.org/rfc/rfc6762.txt

[11] RFC 6265—HTTP State Management Mechanism (A. Barth). http://www.rfc-editor.org/rfc/rfc6265.txt

[12] RFC 3379—Delegated Path Validation and Delegated Path Discovery Protocol Requirements (D. Pinkas and R. Housley). http://www. rfc-editor.org/rfc/rfc3379.txt

[13] RFC1535—A Security Problem and Proposed Correction With Widely Deployed DNS Software (E. Gavron). http://www.rfc-editor.org/rfc/rfc1535.txt

[14] MCSE: Planning, Implementing and Maintaining a Windows Server 2003 Environment, Chapter 1: Implementing DNS in a Windows Server 2003 Network.

http://www.syngress.com/hacking-and-penetration-testing/MCSE-Planning-Implementing-and-Maintaining-a-Windows-Server-2003-Environment-for-an-MCSE-Certified-o (*sic*)

[15] RFC 2606—Reserved Top Level DNS Names (D. Eastlake and A. Panitz). http://www.rfc-editor.org/rfc/rfc2606.txt

[16] Reserved Top Level Domain Names (L. Chapin and M. McFadden). http://tools.ietf.org/html/draft-chapin-rfc2606bis-00

[17] ICANN Dotless Domain Name Security and Stability Study (Carve Systems).

[18] Signposts in Cyberspace: The Domain Name System and Internet Navigation. Committee on Internet Navigation and the Domain Name System: Technical Alternatives and Policy Implications, National Research Council (USA), 2005. http://www.nap.edu/books/0309096405/html

[19] gTLD Applicant Guidebook Version 2012-06-04. http://newgtlds.icann.org/en/applicants/agb

[20] RFC 6762—Multicast DNS (S. Cheshire and M. Krochmal). http://www.rfc-editor.org/rfc/rfc6762.txt

[21] The NetBIOS Interface (Microsoft). http://msdn.microsoft.com/en-us/library/bb870913(v=vs.85).aspx

[22] DNS Measurements at a Root Server (Nevil Brownlee, kc Claffy, and Evi Nemeth). http://www.caida.org/publications/papers/2001/DNSMeasRoot

Appendix A—Complete 2012 Counts

The following table shows the complete list of the 1391 proposed TLDs that appeared at any level in a 2012 DITL QNAME in order of highest occurrence at the TLD level.

The counts for the appearance at the SLD level and all other levels (along with total number of appearances anywhere in a DNS name) are included.

Counts are shown in thousands, rounded to the nearest thousand. A blank entry represents an actual count of zero; a "0" entry represents a non-zero count that rounds to zero.

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
1	home	595,024	24,117	3,723	622,865
2	corp	122,794	31,084	39,985	193,864
3	site	13,013	212	412	13,637
4	global	10,838	8,895	13,838	33,571
5	ads	7,799	1,501	6,635	15,935
6	iinet	7,668	236	3,416	11,320
7	group	6,505	4,374	1,924	12,804
8	box	6,152	860	1,128	8,141
9	cisco	5,231	2,317	343	7,891
10	hsbc	4,924	398	1,161	6,482
11	inc	4,622	341	130	5,094
12	network	4,417	2,593	1,940	8,950
13	dev	4,344	1,614	2,499	8,457
14	prod	4,107	754	6,481	11,343
15	office	3,833	2,503	3,103	9,439
16	host	2,965	4,399	1,782	9,145
17	app	2,573	416	2,067	5,056
18	win	2,511	376	1,283	4,171
19	ltd	1,962	454	76	2,492
20	business	1,920	188	1,937	4,045
21	ice	1,837	547	1,139	3,523
22	link	1,776	829	1,404	4,009
23	google	1,644	209,697	30,520	241,861
24	red	1,603	359	1,409	3,370

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
25	mail	1,505	26,137	43,010	70,653
26	smart	1,475	532	364	2,371
27	world	1,441	409	159	2,009
28	casa	1,283	432	104	1,820
29	med	1,262	246	3,141	4,649
30	mnet	1,132	222	389	1,743
31	star	1,040	204	1,586	2,830
32	orange	924	8,518	2,743	12,185
33	web	815	2,628	4,835	8,278
34	youtube	790	17,703	2,844	21,337
35	vip	789	875	5,631	7,295
36	new	704	126	420	1,250
37	school	696	1,618	375	2,689
38	house	649	268	498	1,415
39	bank	622	12,059	621	13,302
40	comcast	578	8,046	7,411	16,035
41	abc	556	1,023	5,341	6,920
42	unicorn	549	19	9	577
43	msd	534	172	348	1,054
44	you	524	108	245	877
45	telefonica	519	1,245	271	2,034
46	ecom	493	20	54	567
47	yahoo	486	93,881	22,629	116,997
48	llc	470	72	65	607
49	work	443	1,599	210	2,253
50	ibm	437	7,046	1,174	8,657
51	zone	435	452	76,779	77,666
52	hotel	426	483	187	1,096
53	top	414	354	1,351	2,120
54	off	414	33	40	488
55	hot	400	82	732	1,215
56	blog	395	922	6,326	7,643
57	sfr	387	2,239	633	3,260

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
58	family	384	111	65	559
59	vivo	364	19	653	1,035
60	lanxess	359	6	16	381
61	gmbh	359	22	10	391
62	foo	347	103	12	462
63	one	337	980	1,824	3,141
64	apple	330	24,548	8,632	33,510
65	schule	325	3,124	78	3,527
66	olympus	321	919	106	1,346
67	medical	310	143	59	512
68	tech	300	261	386	948
69	wow	295	510	242	1,047
70	auto	291	303	1,670	2,264
71	xyz	288	94	14	396
72	matrix	287	511	415	1,212
73	city	281	184	2,313	2,778
74	show	278	90	376	744
75	live	276	10,790	4,895	15,962
76	sew	276	8	7	291
77	art	276	383	106	765
78	maison	269	114	7	389
79	media	269	711	5,471	6,451
80	cam	268	403	1,073	1,743
81	free	266	1,665	678	2,609
82	search	264	357	6,374	6,995
83	itau	260	71	499	830
84	data	259	1,435	3,323	5,017
85	goo	248	64	4,640	4,952
86	csc	244	968	719	1,931
87	law	235	465	621	1,321
88	dell	232	15,533	510	16,275
89	philips	228	242	473	942
90	beer	228	94	6	328

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
91	bet	224	56	98	378
92	fox	213	147	109	470
93	bcn	213	135	300	648
94	ses	195	136	950	1,281
95	company	195	28,772	2,456	31,423
96	zip	191	1,762	44	1,997
97	studio	190	580	52	822
98	services	189	729	6,115	7,033
99	ifm	189	30	29	247
100	mit	186	5,639	348	6,173
101	here	185	22	23	230
102	news	181	243	7,229	7,653
103	windows	180	8,421	556	9,156
104	aaa	179	371	112	661
105	ericsson	178	707	60	945
106	center	176	259	259	695
107	goog	176	50	11	238
108	computer	176	219	47	442
109	vet	169	39	39	247
110	chrome	167	126	175	468
111	hospital	165	259	37	461
112	man	165	319	4,199	4,683
113	nyc	163	661	1,605	2,429
114	acer	163	1,050	121	1,334
115	moe	160	298	533	991
116	hosting	159	6,893	3,077	10,128
117	gmail	156	2,000	1,176	3,333
118	movistar	156	605	1,186	1,947
119	cloud	155	356	7,878	8,389
120	sbs	153	837	747	1,737
121	delta	152	1,730	410	2,293
122	cba	152	342	265	759
123	hotmail	152	4,575	2,342	7,069

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
124	bom	150	61	687	898
125	svr	149	108	738	995
126	mobile	149	2,482	2,292	4,923
127	pub	148	306	621	1,075
128	natura	146	648	12	806
129	fit	145	189	107	441
130	video	145	81	5,193	5,419
131	thai	144	20	58	221
132	online	144	2,652	19,759	22,555
133	fish	140	33	75	247
134	sky	137	3,026	1,113	4,276
135	sca	137	173	68	378
136	farm	133	42	63	237
137	llp	129	13	5	147
138	aol	129	24,994	3,044	28,166
139	kids	128	42	90	260
140	hughes	127	49	69	244
141	plus	126	409	3,449	3,984
142	and	125	87	105	318
143	sohu	125	12,324	2,645	15,093
144	exchange	125	1,141	659	1,925
145	terra	119	3,028	2,832	5,979
146	design	116	161	103	381
147	london	116	153	392	661
148	team	116	216	200	533
149	spa	115	350	66	531
150	sina	113	6,872	21,325	28,311
151	gold	113	74	217	405
152	amazon	113	14,162	2,265	16,540
153	college	112	147	57	315
154	lol	111	170	235	516
155	taobao	110	17,374	1,509	18,993
156	now	109	93	193	395

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
157	earth	108	109	833	1,050
158	management	106	142	104	352
159	digital	106	111	75	292
160	store	103	204	26,151	26,458
161	bar	101	80	218	400
162	green	101	419	425	944
163	shop	99	281	2,508	2,888
164	stc	98	271	395	765
165	icbc	96	8	7,738	7,843
166	toshiba	96	921	422	1,438
167	cpa	92	174	93	360
168	sony	91	983	3,079	4,153
169	sap	91	21,600	550	22,241
170	madrid	91	104	108	303
171	dds	91	598	35	723
172	cal	89	255	114	458
173	email	89	280	11,648	12,016
174	love	89	43	409	541
175	blue	86	357	366	809
176	africa	85	65	968	1,118
177	cafe	85	181	159	425
178	club	84	176	682	943
179	skype	83	6,388	1,064	7,535
180	microsoft	82	120,654	5,910	126,646
181	energy	82	174	593	849
182	space	81	809	153	1,043
183	paris	80	274	323	677
184	eco	80	156	137	374
185	security	80	292	827	1,199
186	dental	79	589	18	686
187	faith	77	38	24	139
188	sbi	77	66	34	177
189	sas	76	1,800	241	2,117

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
190	forum	76	153	1,958	2,187
191	town	75	16	309	399
192	photo	74	333	19,544	19,951
193	sex	74	116	85	275
194	ing	73	3,443	596	4,113
195	berlin	73	121	231	426
196	academy	73	187	44	305
197	baidu	73	35,686	2,001	37,760
198	secure	72	1,185	2,021	3,278
199	music	71	229	3,807	4,107
200	taxi	71	33	14	118
201	open	71	472	977	1,520
202	church	70	55	15	140
203	tax	70	62	134	266
204	mov	70	9	6	86
205	black	70	56	868	994
206	best	70	165	160	394
207	express	70	521	323	914
208	games	69	176	1,016	1,261
209	page	69	180	218	467
210	airtel	68	700	129	897
211	car	68	116	159	343
212	alibaba	67	1,693	872	2,633
213	est	67	64	86	217
214	engineering	67	222	406	695
215	finance	67	140	1,559	1,766
216	gal	65	32	47	144
217	tata	65	32	15	113
218	kim	65	28	41	134
219	samsung	65	5,582	987	6,635
220	hermes	65	88	152	305
221	pccw	64	57	7	129
222	srl	63	33	12	107

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
223	active	63	782	122	966
224	mom	62	36	30	129
225	bbb	62	303	51	416
226	training	62	236	100	399
227	life	61	773	180	1,015
228	solar	61	149	43	254
229	omega	60	245	150	456
230	sport	60	192	293	545
231	nexus	60	225	198	482
232	map	59	83	987	1,129
233	game	59	1,427	1,883	3,368
234	radio	58	239	357	655
235	systems	58	520	177	755
236	rogers	57	1,959	942	2,958
237	bbt	57	119	270	446
238	health	57	270	687	1,013
239	room	56	7	14	77
240	dot	56	1,094	578	1,729
241	ink	56	17	12	85
242	dad	56	284	4	343
243	wang	55	17	45	117
244	sydney	54	32	228	314
245	fun	54	15	193	262
246	roma	53	128	42	223
247	loreal	53	1,166	183	1,402
248	doha	52	4	31	87
249	run	52	25	77	154
250	cab	52	67	303	422
251	baby	52	132	69	253
252	prime	52	421	125	598
253	dish	52	12	17	82
254	band	51	12	20	84
255	ist	51	73	549	674

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
256	diet	50	17	61	127
257	lpl	49	268	45	362
258	marketing	49	97	253	399
259	htc	49	826	246	1,121
260	ooo	48	12	6	66
261	moi	48	40	143	232
262	website	48	124	97	269
263	vista	48	104	68	220
264	george	48	25	59	132
265	pwc	47	930	54	1,031
266	rio	47	58	111	216
267	anz	47	438	137	622
268	cbs	47	340	326	713
269	kia	46	139	72	258
270	honda	46	931	197	1,175
271	style	46	77	348	471
272	fashion	46	99	71	216
273	amp	46	115	326	487
274	hilton	44	300	64	409
275	day	44	345	70	459
276	java	44	216	103	363
277	land	44	139	53	236
278	ltda	44	2	0	46
279	call	44	37	38	118
280	solutions	43	177	105	325
281	canon	43	3,028	357	3,428
282	pay	43	27	186	256
283	imdb	42	1,097	76	1,216
284	ram	42	55	69	166
285	support	42	214	1,608	1,864
286	bio	42	61	498	602
287	international	42	73	92	207
288	blanco	42	51	3	95

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
289	clinic	41	224	12	277
290	crown	41	233	11	285
291	wtc	41	63	16	119
292	mini	40	61	2,100	2,201
293	bbc	40	442	7,896	8,378
294	spot	40	43	65	148
295	uno	40	149	16	205
296	fire	40	62	29	131
297	vision	40	578	50	668
298	camp	39	30	30	99
299	partners	39	805	477	1,321
300	wtf	39	31	14	84
301	bzh	39	10	3	52
302	kitchen	39	12	11	62
303	nec	39	402	497	937
304	srt	38	501	29	568
305	webs	38	1,201	217	1,456
306	haus	38	24	3	65
307	guardian	38	316	298	652
308	bms	38	526	402	965
309	care	37	64	52	153
310	hotels	37	669	131	837
311	circle	36	47	19	102
312	monster	36	798	274	1,108
313	boo	36	56	12	104
314	book	36	26	479	541
315	ntt	36	3,276	403	3,715
316	barcelona	36	98	59	193
317	miami	36	722	178	937
318	bmw	36	1,984	448	2,468
319	pet	35	22	873	930
320	cool	35	21	104	160
321	wiki	35	51	295	381

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
322	direct	34	66	364	464
323	nico	34	13	5	52
324	ikano	34	16	1	51
325	lincoln	34	96	122	252
326	porn	34	215	404	653
327	place	34	20	39	92
328	lilly	33	1,239	28	1,301
329	garden	33	33	10	76
330	tokyo	33	238	1,052	1,323
331	education	33	232	164	429
332	quest	32	738	30	801
333	chat	32	55	451	538
334	capital	32	408	198	638
335	bing	32	2,159	266	2,458
336	joy	32	918	166	1,115
337	dog	31	55	83	169
338	toyota	31	150	330	510
339	ren	31	22	100	153
340	uol	31	69	4,359	4,459
341	navy	31	5,921	593	6,545
342	cfa	31	63	47	141
343	bnl	31	103	120	253
344	kone	30	12	4	46
345	construction	30	185	25	240
346	salon	30	83	55	168
347	software	30	34	285	349
348	konami	30	42	94	166
349	shaw	30	164	49	243
350	chase	30	678	275	983
351	golf	30	88	100	218
352	market	30	42	410	482
353	army	30	5,734	584	6,348
354	ford	30	1,230	101	1,361

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
355	docomo	29	8	673	710
356	bot	29	59	109	197
357	gmx	29	941	838	1,808
358	legal	29	58	71	159
359	directory	29	262	283	575
360	apartments	29	31	8	68
361	swiss	29	347	11	387
362	phone	29	45	32	106
363	works	29	47	14	90
364	xn--42c2d9a	29	1	1	30
365	yandex	28	9,181	2,667	11,877
366	xbox	28	24,739	354	25,121
367	zero	28	48	53	130
368	reliance	28	70	22	119
369	fast	28	633	2,010	2,670
370	target	28	538	161	727
371	trade	27	692	351	1,071
372	next	27	117	1,052	1,197
373	frl	27	8	83	119
374	airbus	27	2,303	201	2,531
375	taipei	27	23	41	91
376	community	27	51	515	593
377	men	27	41	116	184
378	mlb	27	400	177	603
379	mma	27	47	191	264
380	aws	27	89	399	515
381	fly	26	34	88	148
382	build	26	53	27	106
383	tube	26	27	62	116
384	marriott	26	578	77	680
385	fan	26	17	19	62
386	oracle	26	5,661	1,218	6,905
387	moto	26	23	45	94

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
388	ninja	26	6	223	255
389	weir	25	4	2	31
390	axis	25	253	64	342
391	jnj	25	7,487	46	7,559
392	mcd	25	117	125	267
393	play	25	895	591	1,511
394	pin	25	275	20	320
395	trust	25	89	151	265
396	boston	25	263	187	475
397	moscow	24	48	171	244
398	how	24	98	24	146
399	kpn	23	7,686	98	7,808
400	sharp	23	47	792	862
401	expert	23	125	21	169
402	dealer	23	139	113	275
403	xerox	23	5,201	222	5,446
404	lat	23	26	85	134
405	gmc	23	92	35	149
406	tvs	23	35	8	65
407	schmidt	23	57	13	92
408	voyage	23	10	10	43
409	ott	23	78	57	157
410	abb	22	3,815	104	3,941
411	lds	22	1,153	146	1,322
412	are	22	25	43	90
413	smile	22	84	44	149
414	seven	22	1,055	143	1,220
415	storage	22	46	534	602
416	ping	22	53	1,159	1,234
417	read	22	17	28	67
418	mtn	22	65	332	418
419	polo	22	1,401	8	1,431
420	study	22	62	25	108

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
421	meo	22	11	2	35
422	contact	22	81	57	159
423	song	22	10	10	41
424	gay	22	32	43	96
425	ups	21	727	266	1,014
426	chk	21	15	64	101
427	flickr	21	715	611	1,347
428	delivery	21	319	239	579
429	homes	21	772	71	864
430	ong	21	8	2	32
431	koeln	21	11	56	88
432	tab	21	50	72	143
433	hamburg	21	80	100	201
434	total	21	83	28	132
435	globo	21	1,321	821	2,163
436	intel	21	1,229	140	1,390
437	dvr	21	94	5	119
438	aramco	21	47	10	78
439	ferrari	21	70	9	99
440	mls	21	363	100	484
441	download	21	136	48,304	48,460
442	casino	21	69	127	217
443	scb	20	86	41	148
444	shell	20	8,961	133	9,113
445	gent	20	9	14	43
446	frontier	20	85	113	218
447	virgin	20	159	55	234
448	bosch	20	297	71	388
449	rich	20	35	13	68
450	tools	20	57	13,067	13,144
451	cash	19	46	223	288
452	social	19	37	360	417
453	kiwi	19	54	16	89

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
454	pioneer	19	95	119	233
455	holiday	19	64	45	129
456	consulting	19	51	8	78
457	osaka	19	189	286	493
458	lasalle	19	51	22	92
459	amsterdam	19	46	406	471
460	gcc	19	237	85	340
461	mba	18	55	23	96
462	citi	18	122	56	196
463	flowers	18	178	7	203
464	antivirus	18	87	92	197
465	click	18	67	773	858
466	ski	18	52	26	95
467	properties	18	9	11	38
468	mcdonalds	18	67	81	166
469	walter	18	38	6	62
470	gallery	18	35	233	286
471	institute	17	31	10	58
472	press	17	833	76	926
473	maif	17	47	2	67
474	catholic	17	151	471	639
475	islam	17	13	13	43
476	cbn	17	185	2,498	2,700
477	shopping	17	427	607	1,051
478	money	17	355	784	1,156
479	help	16	91	541	648
480	fujitsu	16	1,778	444	2,239
481	weather	16	85,774	3,449	89,239
482	bloomberg	16	308	90	414
483	nba	16	11,693	196	11,906
484	sexy	16	13	97	127
485	itv	16	724	29	769
486	safe	16	45	64	125

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
487	krd	16	15	53	84
488	pharmacy	16	53	60	129
489	safeway	16	161	6	182
490	university	16	107	69	192
491	gap	16	100	59	175
492	promo	16	165	92	273
493	fail	15	89	7	112
494	weber	15	202	45	262
495	arte	15	111	13	139
496	sakura	15	33	433	481
497	ftr	15	26	5	46
498	nokia	15	3,511	269	3,795
499	pizza	15	15	5	35
500	watch	15	16	70	101
501	eat	15	11	11	36
502	able	15	31	32	77
503	citadel	15	200	15	229
504	qtel	15	13	167	194
505	vegas	14	159	47	221
506	crs	14	87	12	114
507	walmart	14	293	280	588
508	vin	14	35	15	64
509	coffee	14	23	7	44
510	heart	14	801	24	840
511	foundation	14	48	30	93
512	dubai	14	50	75	139
513	buy	14	160	301	476
514	agency	14	55	167	236
515	xn--j1aef	14	1	0	15
516	industries	14	14	4	31
517	tour	14	17	59	91
518	case	14	47	13	74
519	associates	14	10	11	36

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
520	doctor	14	33	9	56
521	gmo	14	114	7	135
522	like	14	20	62	96
523	technology	14	45	30	89
524	bond	14	31	72	116
525	istanbul	14	47	76	136
526	phd	14	261	18	293
527	cricket	14	2,967	139	3,119
528	translations	13	5	1	20
529	rip	13	22	128	164
530	wien	13	23	89	125
531	film	13	30	54	98
532	property	13	106	30	149
533	ril	13	82	3	99
534	mii	13	43	75	132
535	today	13	232	164	408
536	stream	13	918	470	1,402
537	viking	13	53	17	83
538	party	13	9	8	30
539	camera	13	56	15	84
540	suzuki	13	40	28	81
541	prof	13	8	39	61
542	science	13	36	366	415
543	hyundai	13	99	55	166
544	movie	13	20	208	241
545	accenture	13	706	110	829
546	melbourne	13	16	1,634	1,663
547	pink	13	18	13	44
548	living	13	21	54	87
549	norton	12	1,355	255	1,623
550	nike	12	365	65	442
551	kid	12	33	17	62
552	mango	12	197	99	308

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
553	tours	12	8	19	40
554	buzz	12	15	127	154
555	channel	12	11	10,290	10,313
556	dhl	12	515	461	988
557	gop	12	62	10	84
558	supply	12	8	8	28
559	healthcare	12	1,411	124	1,547
560	country	12	9	11	33
561	cars	12	98	102	211
562	caravan	12	120	13	145
563	xin	12	5	13	30
564	viva	12	66	1,202	1,279
565	sarl	12	10	1	23
566	discover	12	54	31	97
567	domains	12	1,261	133,810	135,082
568	sports	12	776	1,065	1,853
569	mtr	12	40	24	76
570	immo	12	36	7	55
571	photos	12	13	772	796
572	restaurant	12	21	48	80
573	audio	12	27	26	65
574	fiat	12	72	36	120
575	enterprises	12	8	1	21
576	nissan	11	502	974	1,488
577	jaguar	11	40	29	81
578	dupont	11	72	45	128
579	bingo	11	13	12	37
580	glass	11	39	10	60
581	baseball	11	12	86	109
582	food	11	1,797	1,450	3,258
583	panasonic	11	375	133	519
584	dtv	11	86	66	163
585	discount	11	7	58	75

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
586	jeep	11	38	7	55
587	esq	11	3	0	13
588	date	11	26	17	54
589	insurance	10	136	55	201
590	idn	10	21	18	49
591	trading	10	53	46	109
592	duck	10	13	7	30
593	schwarz	10	36	4	50
594	financial	10	54	15	79
595	drive	10	37	309	355
596	axa	10	394	75	479
597	graphics	10	60	106	176
598	emerson	10	946	93	1,050
599	zulu	10	5	13	28
600	limited	10	57	13	80
601	fitness	10	43	49	102
602	anthem	10	27	19	56
603	brother	10	55	111	176
604	bradesco	10	5	496	511
605	staples	10	370	153	533
606	docs	10	23	1,517	1,550
607	android	10	349	2,038	2,397
608	fedex	10	7,183	307	7,499
609	prudential	10	325	94	428
610	surf	10	3,018	13	3,041
611	bentley	10	254	38	301
612	tiffany	9	835	313	1,158
613	softbank	9	321	376	707
614	pid	9	8	4	21
615	epson	9	174	89	272
616	clinique	9	259	42	310
617	got	9	215	20	245
618	clubmed	9	20	35	65

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
619	ira	9	43	57	109
620	pnc	9	338	129	475
621	gea	9	47	5	61
622	infosys	9	794	162	965
623	memorial	9	7	4	20
624	desi	9	6	2	17
625	beauty	9	68	28	105
626	broadway	9	617	12	638
627	xfinity	9	26	36	71
628	sale	9	24	37	70
629	juniper	9	738	12	759
630	dnb	9	233	33	274
631	nationwide	9	558	18	584
632	wme	9	3	7	19
633	netflix	9	664	307	980
634	cfd	9	31	12	51
635	audi	9	1,505	87	1,600
636	bestbuy	8	150	168	326
637	physio	8	11	1	21
638	broker	8	271	15	294
639	irish	8	5	4	17
640	ceb	8	31	157	196
641	ged	8	34	3	45
642	ovh	8	29,900	930	30,838
643	tci	8	65	30	104
644	lexus	8	18	9	35
645	allstate	8	1,285	48	1,342
646	credit	8	16	514	538
647	archi	8	136	10	154
648	alstom	8	806	381	1,195
649	visa	8	472	234	714
650	nrw	8	326	87	422
651	ngo	8	27	85	120

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
652	select	8	126	1,940	2,074
653	asda	8	45	26	79
654	avery	8	25	5	38
655	bcg	8	73	167	249
656	horse	8	31	23	62
657	lifestyle	8	40	69	117
658	lego	8	84	24	116
659	rent	8	48	19	74
660	unicom	8	126	15	149
661	onl	8	12	2	22
662	nfl	8	239	104	351
663	fls	8	33	118	159
664	rocks	8	4	3	14
665	guru	8	21	39	67
666	kosher	8	5	1	13
667	obi	8	30	7	45
668	engineer	8	14	12	34
669	cheap	8	2	13	23
670	mint	8	196	20	224
671	lancaster	7	34	30	71
672	sapo	7	3,046	93	3,147
673	icu	7	13	26	47
674	furniture	7	19	7	34
675	racing	7	13	25	45
676	chevrolet	7	63	135	205
677	hyatt	7	100	64	170
678	patch	7	106	85	198
679	chevy	7	3	2	12
680	save	7	31	8	46
681	cologne	7	2	27	37
682	komatsu	7	35	86	128
683	deal	7	22	25	55
684	estate	7	95	7	109

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
685	hbo	7	260	23	290
686	loft	7	2,994	31	3,032
687	limo	7	48	1	55
688	bharti	7	3	1	11
689	hockey	7	8	10	25
690	theatre	7	33	84	124
691	meet	7	2	6	15
692	talk	7	19	1,262	1,288
693	meme	7	19	4	30
694	seat	7	182	20	209
695	ricoh	7	1,582	59	1,648
696	claims	7	46	4	56
697	football	7	30	53	89
698	farmers	7	60	11	78
699	aeg	7	33	3	43
700	dvag	7	5	1	13
701	tienda	7	10	32	48
702	kyoto	7	140	52	199
703	gratis	7	5	5	16
704	wales	7	187	30	224
705	starhub	7	14	4,514	4,535
706	protection	6	12	28	46
707	nagoya	6	121	37	165
708	azure	6	147	4	158
709	vanguard	6	266	22	294
710	tips	6	16	631	654
711	mitsubishi	6	16	5	27
712	cbre	6	40	29	76
713	yoga	6	6	4	15
714	chloe	6	8	3	17
715	rest	6	19	562	587
716	menu	6	7	11	24
717	wine	6	19	42	67

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
718	hair	6	12	5	23
719	dodge	6	40	6	52
720	gle	6	20	2	28
721	ceo	6	33	18	58
722	events	6	16	979	1,001
723	mutual	6	22	1	30
724	builders	6	10	2	18
725	bayern	6	238	12	256
726	gree	6	181	58	245
727	astrium	6	288	77	372
728	fund	6	8	20	33
729	gallo	6	7	1	14
730	jcb	6	142	8	157
731	hitachi	6	117	325	448
732	infiniti	6	75	31	112
733	trv	6	8	18	32
734	bid	6	19	151	176
735	yun	6	32	11	49
736	bugatti	6	6	4	15
737	merck	6	232	5,680	5,918
738	photography	6	36	7	49
739	zara	5	107	8	120
740	vig	5	23	26	54
741	fishing	5	5	5	15
742	flir	5	21	4	30
743	linde	5	895	1,023	1,923
744	sapphire	5	114	15	135
745	realty	5	20	87	113
746	loan	5	10	666	681
747	ipiranga	5	5	6	16
748	report	5	7	308	320
749	symantec	5	10,300	3,671	13,976
750	realtor	5	179	84	269

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
751	arab	5	6	10	21
752	nab	5	14	111	131
753	ally	5	7,398	13	7,416
754	lighting	5	20	15	41
755	toray	5	18	51	74
756	catering	5	11	3	20
757	soccer	5	39	17	62
758	ventures	5	7	1	13
759	mopar	5	5	1	11
760	charity	5	3	18	27
761	ubs	5	4,769	24	4,798
762	bike	5	9	26	40
763	weibo	5	2,954	611	3,569
764	etisalat	5	35	597	637
765	tui	5	50	258	312
766	abbott	5	737	54	796
767	juegos	5	68	104	177
768	kinder	5	9	3	17
769	poker	5	25	583	613
770	wed	5	5	3	13
771	leclerc	5	13	2	20
772	fido	5	2,092	7	2,104
773	skin	5	9	87	101
774	goodyear	5	27	13	46
775	pictures	5	8	118	130
776	moda	5	21	20	46
777	tdk	5	56	22	83
778	chanel	5	89	3	97
779	budapest	5	22	19	46
780	mortgage	5	121	134	260
781	tmall	5	806	49	860
782	forex	5	14	22	41
783	kddi	5	96	247	348

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
784	indians	5	4	6	15
785	volvo	5	2,373	103	2,481
786	pru	5	16	219	241
787	capetown	5	6	33	43
788	yokohama	5	73	25	102
789	pics	5	23	1,102	1,130
790	pets	5	4	31	40
791	wedding	5	5	31	41
792	safety	5	44	9	57
793	dance	4	15	10	30
794	diy	4	25	36	65
795	realestate	4	43	144	191
796	holdings	4	31	10	45
797	diamonds	4	7	3	14
798	afl	4	16	105	125
799	parts	4	19	87	110
800	sucks	4	1	3	8
801	surgery	4	31	10	45
802	americanexpress	4	941	63	1,009
803	homedepot	4	433	32	469
804	career	4	25	3,042	3,071
805	progressive	4	5,694	19	5,717
806	cards	4	9	117	131
807	quebec	4	14	23	41
808	jlc	4	31	4	39
809	jcp	4	22	7	34
810	bible	4	23	11	38
811	hoteles	4	108	7	119
812	kred	4	2	1	6
813	final	4	8	4	16
814	rwe	4	94	19	117
815	mobily	4	190	282	477
816	heinz	4	11	11	26

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
817	adult	4	25	26	55
818	payu	4	13	4	20
819	jll	4	68	21	93
820	nhk	4	9	1,037	1,050
821	soy	4	7	2	13
822	citic	4	14	4	21
823	pars	4	20	23	46
824	webcam	4	26	14	44
825	dwg	4	56	1	61
826	dentist	4	70	5	79
827	bbva	4	198	32	234
828	fyi	4	19	5	28
829	showtime	4	10	11	26
830	macys	4	88	27	119
831	nra	4	30	109	142
832	xn--c1avg	4	1	0	4
833	aco	4	86	10	100
834	repair	4	13	29	46
835	raid	4	40	16	60
836	seek	4	15	99	117
837	rehab	4	27	8	38
838	fidelity	4	2,214	225	2,442
839	boots	4	43	25	72
840	vodka	4	3	2	9
841	gucci	4	74	107	184
842	transformers	4	5	3	12
843	tennis	4	31	21	55
844	ksb	3	173	18	195
845	sanofi	3	28	31	62
846	eus	3	5	44	52
847	bauhaus	3	15	2	21
848	tunes	3	8	1	12
849	luxury	3	10	5	18

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
850	coach	3	31	9	43
851	playstation	3	3,231	205	3,439
852	shangrila	3	5	1	10
853	gdn	3	57	5	65
854	tattoo	3	10	7	21
855	xn--55qx5d	3	3	0	6
856	theater	3	17	21	41
857	thd	3	9	5	18
858	cruise	3	15	7	26
859	redstone	3	12	21	36
860	fans	3	19	22	44
861	shoes	3	19	13	35
862	booking	3	437	59	498
863	scot	3	10	53	66
864	nikon	3	134	23	160
865	airforce	3	6	193	203
866	lotto	3	8	14	25
867	qvc	3	243	23	268
868	amex	3	43	3	49
869	codes	3	4	5	11
870	jmp	3	24	4	31
871	jewelry	3	19	14	35
872	toys	3	6	15	25
873	monash	3	223	425	651
874	aig	3	849	60	912
875	productions	3	3	0	7
876	feedback	3	5	140	148
877	hiv	3	7	2	13
878	iveco	3	99	5	107
879	ruhr	3	7	4	14
880	markets	3	13	70	86
881	jpmorganchase	3	3,627	758	4,388
882	latino	3	5	49	56

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
883	chesapeake	3	42	6	50
884	jprs	3	22	31	56
885	banamex	3	10	7	19
886	lacaixa	3	246	29	278
887	stockholm	3	97	58	158
888	cern	3	747	22	772
889	sandvik	3	934	126	1,063
890	infy	3	7	1	11
891	gift	3	10	11	24
892	vistaprint	3	866	103	971
893	patagonia	3	24	8	35
894	reisen	3	6	6	15
895	winners	3	4	1	8
896	viajes	3	29	4	35
897	zippo	3	6	2	10
898	capitalone	3	1,157	277	1,437
899	durban	3	2	10	15
900	author	3	1	4	7
901	basketball	3	12	17	32
902	volkswagen	3	568	551	1,122
903	organic	3	43	4	49
904	helsinki	3	873	156	1,032
905	ketchup	3	0	1	4
906	rentals	3	14	5	22
907	honeywell	3	347	253	602
908	spiegel	2	257	144	403
909	landrover	2	20	8	30
910	careers	2	6	180	188
911	edeka	2	8	1	12
912	review	2	19	28	49
913	sncf	2	134	8	144
914	cartier	2	17	3	22
915	dnp	2	22	108	132

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
916	hkt	2	37	39	78
917	chrysler	2	797	11	811
918	silk	2	18	15	35
919	woodside	2	12	26	40
920	villas	2	6	1	9
921	barefoot	2	12	8	23
922	abogado	2	7	0	9
923	banque	2	2	23	28
924	lease	2	2	3	6
925	supplies	2	10	1	14
926	supersport	2	47	311	359
927	accountants	2	6	1	10
928	telecity	2	1,037	17	1,056
929	jpmorgan	2	365	92	458
930	xn--io0a7i	2	1	0	3
931	barclays	2	2,653	116	2,771
932	deloitte	2	1,013	833	1,848
933	lotte	2	49	806	857
934	rugby	2	12	12	26
935	auction	2	89	1,054	1,145
936	immobilien	2	24	6	32
937	netbank	2	5	146	152
938	bnpparibas	2	697	43	741
939	metlife	2	258	45	305
940	yellowpages	2	3,250	318	3,570
941	plumbing	2	5	2	9
942	hdfc	2	16	1	19
943	kfh	2	49	11	62
944	dating	2	65	54	121
945	brussels	2	42	42	86
946	doosan	2	1,423	11	1,437
947	vote	2	4	127	133
948	investments	2	2	173	176

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
949	kpmg	2	967	53	1,022
950	boehringer	2	11	331	343
951	equipment	2	7	3	12
952	architect	2	4	2	7
953	barclaycard	2	6	45	53
954	iwc	2	30	1	33
955	stroke	2	4	2	8
956	guide	2	7	40	49
957	lawyer	2	23	101	126
958	lupin	2	2	1	4
959	wilmar	2	4	4	10
960	godaddy	2	1,026	519	1,546
961	tickets	2	145	40	187
962	aquarelle	2	6	0	8
963	autos	2	32	267	301
964	aquitaine	2	17	5	24
965	christmas	2	2	42	46
966	mih	2	28	4	33
967	pohl	2	9	1	11
968	alcon	2	103	2	106
969	grainger	2	309	12	323
970	loans	2	4	652	658
971	firestone	2	12	2	16
972	analytics	2	9	1,056	1,067
973	hdfcbank	2	97	55	153
974	futbol	2	4	4	9
975	contractors	2	8	4	14
976	bofa	2	16	46	64
977	fage	1	1	0	2
978	zuerich	1	5	13	19
979	hiphop	1	16	4	21
980	deals	1	8	54	63
981	boats	1	97	4	102

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
982	attorney	1	9	3	13
983	adac	1	20	7	28
984	kindle	1	12	3	16
985	hgtv	1	1,354	554	1,910
986	guitars	1	1	0	3
987	montblanc	1	13	2	16
988	reise	1	11	6	18
989	mitek	1	10	1	12
990	locus	1	30	1	32
991	alipay	1	1,672	45	1,719
992	alsace	1	2	2	5
993	compare	1	4	11	17
994	boutique	1	9	23	34
995	condos	1	0	0	2
996	intuit	1	542	115	657
997	lamborghini	1	8	1	11
998	accountant	1	5	3	9
999	ieee	1	1,087	21	1,110
1000	lidl	1	18	30	49
1001	statefarm	1	2,149	19	2,169
1002	tirol	1	37	35	73
1003	yachts	1	1	1	3
1004	beats	1	5	2	8
1005	cimb	1	1,045	22	1,069
1006	scor	1	110	3	114
1007	skydrive	1	4	121	126
1008	samsclub	1	105	12	118
1009	audible	1	148	44	193
1010	teva	1	2,034	166	2,201
1011	cymru	1	1,177	115	1,293
1012	vlaanderen	1	54	9	64
1013	newholland	1	15	2	18
1014	coupon	1	1	5	8

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
1015	ferrero	1	39	5	45
1016	zappos	1	136	127	264
1017	glade	1	7	0	8
1018	dunlop	1	4	4	9
1019	cooking	1	53	12	66
1020	jio	1	0	0	2
1021	reviews	1	5	256	262
1022	avianca	1	153	2	156
1023	cuisinella	1	13	0	14
1024	aetna	1	121	36	158
1025	tatar	1	15	2	19
1026	fresenius	1	26	3	30
1027	fujixerox	1	14	52	67
1028	pitney	1	0	0	1
1029	jot	1	19	6	26
1030	xn--fhbei	1	0	0	1
1031	rmit	1	3	396	400
1032	cadillac	1	63	27	91
1033	rodeo	1	6	1	8
1034	ladbrokes	1	1,352	23	1,375
1035	oldnavy	1	19	17	37
1036	insure	1	22	1	24
1037	cleaning	1	4	2	7
1038	retirement	1	4	7	13
1039	halal	1	1	2	4
1040	delmonte	1	4	1	6
1041	finish	1	3	3	7
1042	otsuka	1	8	48	56
1043	clothing	1	8	32	41
1044	democrat	1	0	0	1
1045	thehartford	1	3,854	82	3,937
1046	okinawa	1	41	41	84
1047	buick	1	6	29	37

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
1048	alfaromeo	1	44	3	48
1049	abudhabi	1	68	6	75
1050	hangout	1	0	1	2
1051	livestrong	1	45	7	53
1052	comsec	1	5	11	17
1053	pfizer	1	3,444	112	3,557
1054	lamer	1	163	8	172
1055	xn--55qw42g	1	0	0	1
1056	flights	1	5	5	11
1057	warman	1	2	261	263
1058	foodnetwork	1	1,736	285	2,022
1059	gifts	1	50	10	61
1060	cruises	1	14	19	33
1061	rsvp	1	8	135	144
1062	statoil	1	85	5	91
1063	xn--80asehdb	1	0	0	1
1064	coupons	1	51	30	82
1065	blockbuster	1	30	11	42
1066	rocher	1	4	0	5
1067	aarp	1	309	118	427
1068	saarland	1	2	2	5
1069	marshalls	1	4	1	6
1070	bway	1	89	7	97
1071	xn--zfr164b	1	0	0	1
1072	bridgestone	1	61	16	77
1073	luxe	1	8	3	12
1074	origins	1	145	5	150
1075	tires	1	5	1	7
1076	stada	1	19	1	21
1077	observer	1	30	12	43
1078	xn--80aswg	1	3	1	5
1079	commbank	1	2	3,064	3,066
1080	guge	1	4	0	5

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
1081	webjet	1	18	17	36
1082	degree	1	32	1	34
1083	sener	1	3	1	5
1084	pamperedchef	1	33	1	35
1085	recipes	1	4	26	31
1086	travelers	1	351	7	359
1087	mormon	1	1	1	2
1088	sling	1	27	12	40
1089	bloomingdales	1	242	5	248
1090	garnier	1	18	16	34
1091	joburg	1	29	3	32
1092	latrobe	1	2	141	144
1093	weatherchannel	1	3	8	11
1094	courses	0	1	33	35
1095	shia	0	1	1	2
1096	creditunion	0	19	1	20
1097	aigo	0	8	0	9
1098	makeup	0	4	3	7
1099	flsmidth	0	15	28	43
1100	liaison	0	32	2	35
1101	williamhill	0	161	41	202
1102	hoteis	0	36	1	37
1103	swatch	0	17	5	23
1104	vana	0	6	1	7
1105	lancia	0	4	2	7
1106	dstv	0	214	3	217
1107	cialis	0	5	10	14
1108	transunion	0	24	9	33
1109	shiksha	0	23	1	25
1110	creditcard	0	2	83	86
1111	shouji	0	2	58	60
1112	gallup	0	35	15	50
1113	akdn	0	1	0	2

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
1114	locker	0	1	1	3
1115	motorcycles	0	0	5	5
1116	fairwinds	0	2	0	2
1117	frontdoor	0	562	241	803
1118	deutschepost	0	86	6	93
1119	travelchannel	0	507	132	639
1120	tatamotors	0	20	3	23
1121	vons	0	4	0	5
1122	tjx	0	32	25	57
1123	epost	0	43	61	104
1124	ubank	0	0	5	5
1125	goodhands	0	0	0	1
1126	erni	0	6	0	7
1127	actor	0	5	1	6
1128	autoinsurance	0	2	3	5
1129	versicherung	0	5	0	6
1130	verisign	0	675,916	966	676,882
1131	canalplus	0	70	22	92
1132	cipriani	0	6	0	7
1133	mattel	0	46	12	58
1134	digikey	0	130	13	144
1135	ollo	0	2	2	5
1136	bananarepublic	0	15	17	32
1137	nowtv	0	5	7	12
1138	xn--p1acf	0	0	0	0
1139	politie	0	24	10	33
1140	mozaic	0	1	1	2
1141	watches	0	4	6	11
1142	chartis	0	8	7	15
1143	eurovision	0	60	2	62
1144	saxo	0	9	1	10
1145	florist	0	14	4	18
1146	anquan	0	0	8	9

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
1147	corsica	0	6	1	7
1148	singles	0	4	10	15
1149	chintai	0	10	3	13
1150	xn--c2br7g	0	0	0	0
1151	theguardian	0	31	11	42
1152	abarth	0	1	0	2
1153	temasek	0	6	0	7
1154	scholarships	0	7	4	11
1155	grocery	0	2	18	19
1156	lifeinsurance	0	1	1	2
1157	cyou	0	43	1	45
1158	auspost	0	54	25	79
1159	tkmaxx	0	8	5	13
1160	tiaa	0	0	0	0
1161	mutuelle	0	5	1	6
1162	lundbeck	0	5	12	17
1163	amica	0	6	5	12
1164	uconnect	0	0	9	9
1165	jetzt	0	0	1	1
1166	xperia	0	1	1	2
1167	datsun	0	0	0	1
1168	schaeffler	0	40	1	41
1169	lancome	0	5	4	9
1170	xn--11b4c3d	0			0
1171	giving	0	0	2	3
1172	maserati	0	21	4	25
1173	redken	0	9	4	12
1174	piperlime	0	12	16	28
1175	kuokgroup	0	10	0	11
1176	netaporter	0	1	1	2
1177	shriram	0	1	0	1
1178	maybelline	0	10	9	20
1179	financialaid	0	0	1	2

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
1180	forsale	0	6	4	10
1181	vacations	0	36	1	37
1182	reit	0	6	4	9
1183	ultrabook	0	0	0	1
1184	neustar	0	97	1	99
1185	exposed	0	0	1	1
1186	xn--80adxhks	0	0	0	1
1187	amfam	0	96	14	110
1188	chatr	0	1	0	1
1189	rockwool	0	309	4	314
1190	kaufen	0	10	4	14
1191	xn--d1acj3b	0	0	0	0
1192	xn--flw351e	0	0	0	1
1193	mckinsey	0	211	3	214
1194	republican	0	0	0	1
1195	swiftcover	0	5	0	5
1196	panerai	0	2	0	2
1197	esurance	0	1,464	3	1,467
1198	gbiz	0	0	0	0
1199	voting	0	0	1	1
1200	tjmaxx	0	7	1	8
1201	xn--tckwe	0	0	0	0
1202	goldpoint	0	0	0	0
1203	xn--unup4y	0	0	0	1
1204	xn--mk1bu44c	0			0
1205	lipsy	0	0	23	23
1206	athleta	0	14	6	20
1207	multichoice	0	0	4	4
1208	yodobashi	0	50	2	52
1209	vuelos	0	1	1	2
1210	blackfriday	0	1	1	2
1211	xn--9krt00a	0	0	0	0
1212	dclk	0	0	1	1

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
1213	xn--ngbrx	0	0	0	0
1214	skolkovo	0	12	0	12
1215	lplfinancial	0	2	0	3
1216	statebank	0	6	0	7
1217	lgbt	0	0	0	1
1218	xn--5tzm5g	0	0	0	0
1219	calvinklein	0	7	1	7
1220	dabur	0	3	0	4
1221	vanish	0	2	2	5
1222	xn--efvy88h	0	0	0	0
1223	voto	0	1	0	1
1224	piaget	0	7	1	8
1225	caseih	0	9	0	9
1226	naspers	0	984	13	997
1227	duns	0	0	0	1
1228	yamaxun	0	0	0	0
1229	gotv	0	5	0	5
1230	xn--jlq480n2rg	0	0	0	0
1231	kerastase	0	2	0	3
1232	wolterskluwer	0	105	6	111
1233	carinsurance	0	5	2	7
1234	northwesternmutual	0	781	1	782
1235	catalonia	0	8	0	8
1236	homegoods	0	4	0	4
1237	ismaili	0	2	0	2
1238	cookingchannel	0	0	0	0
1239	xn--4gbrim	0	0	0	0
1240	gives	0	0	2	2
1241	xn--ses554g	0	0	0	0
1242	firmdale	0	4	0	4
1243	xn--mxtq1m	0	0	0	0
1244	xn--4gq48lf9j	0	0	0	0
1245	genting	0	364	6	370

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
1246	travelguard	0	11	2	13
1247	connectors	0	1	0	1
1248	ryukyu	0	0	3	3
1249	mtpc	0	1	0	1
1250	changiairport	0	7	0	7
1251	xn--cckwcxetd	0	0	0	0
1252	homesense	0	6	0	7
1253	nissay	0	0	1	1
1254	kiehls	0	20	3	23
1255	cancerresearch	0	2	0	2
1256	xn--ngbc5azd	0	0	0	0
1257	qpon	0	0	1	1
1258	everbank	0	10	20	30
1259	xn--kput3i	0	0	0	0
1260	xn--mgbb9fbpob	0	0	0	0
1261	mrporter	0	12	2	14
1262	ummah	0	8	1	9
1263	passagens	0	0	0	0
1264	ggee	0	3	0	3
1265	xihuan	0	2	1	3
1266	whoswho	0	2	11	13
1267	kyknet	0	0	0	0
1268	tushu	0	1	0	1
1269	gripe	0	0	0	0
1270	nextdirect	0	18	7	25
1271	praxi	0	3	0	3
1272	shopyourway	0	20	1	21
1273	bargains	0	0	3	3
1274	caremore	0	1	0	1
1275	xn--8y0a063a	0	0	0	0
1276	xn--mgbca7dzdo	0	0	0	0
1277	scjohnson	0	6	0	6
1278	xn--jlq61u9w7b	0	0	0	0

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
1279	iselect	0	14	8	21
1280	pictet	0	21	0	21
1281	gecompany	0	15	0	15
1282	americanfamily	0	8	1	8
1283	mutualfunds	0	0	0	0
1284	rightathome	0	15	0	16
1285	xn--6frz82g	0	0		0
1286	xn--6rtwn	0	0	0	0
1287	xn--otu796d	0	0		0
1288	rexroth	0	0	0	1
1289	orientexpress	0	1	0	2
1290	glean	0	0	3	4
1291	xn--qcka1pmc	0	0		0
1292	globalx	0	1	1	2
1293	wanggou	0	0	0	0
1294	xn--6qq986b3xl	0	0	0	0
1295	xn--fiq228c5hs	0	0	0	0
1296	travelersinsurance	0	0	0	0
1297	xn--mgbaakc7dvf	0	0	0	0
1298	afamilycompany	0	0		0
1299	dotafrica	0	0	0	0
1300	xn--eckvdtc9d	0	0		0
1301	olayangroup	0	0	0	0
1302	xn--estv75g	0	0	0	0
1303	bostik	0	7	1	8
1304	extraspace	0	5	0	5
1305	overheidnl	0			0
1306	allfinanz	0	2	0	2
1307	xn--czru2d	0	0	0	0
1308	xn--mgbab2bd	0	0	0	0
1309	justforu	0	0	0	0
1310	africamagic	0	0	0	0
1311	sandvikcoromant	0	0	0	0

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
1312	lixil	0	0	2	2
1313	xn--fes124c	0	0	0	0
1314	agakhan	0	0	0	0
1315	beknown	0	4	0	4
1316	xn--g2xx48c	0	0		0
1317	xn--q9jyb4c	0			0
1318	stcgroup	0	2	0	3
1319	tradershotels	0	0	0	0
1320	xn--nyqy26a	0	0	0	0
1321	nadex	0	2	0	2
1322	xn--xhq521b	0	0	0	0
1323	xn--45q11c	0	0	0	0
1324	cityeats	0	79	1	80
1325	olayan	0	1	0	1
1326	pramerica	0	4	0	4
1327	xn--rovu88b	0	0		0
1328	xn--vuq861b	0	0	0	0
1329	xn--kpu716f	0	0		0
1330	xn--gk3at1e	0	0	0	0
1331	xn--9et52u	0	0		0
1332	xn--vermgensberatung-pwb	0	0	0	0
1333	xn--5su34j936bgsg	0	0		0
1334	xn--1qqw23a	0	0	0	0
1335	persiangulf	0	0	0	0
1336	ansons	0	0	0	0
1337	xn--nqv7f	0	0		0
1338	xn--fiq64b	0	0	0	0
1339	hisamitsu	0	0	0	0
1340	guardianmedia	0	0	0	0
1341	redumbrella	0	0	0	0
1342	xn--kcrx77d1x4a	0	0	0	0
1343	richardli	0	0		0
1344	xn--rhqv96g	0	0	0	0

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
1345	xn--t60b56a	0	0		0
1346	xn--3oq18vl8pn36a		0		0
1347	xn--czr694b		0	0	0
1348	kerrylogisitics		0	0	0
1349	xn--hxt814e		0		0
1350	xn--czrs0t		0	0	0
1351	xn--pgb3ceoj		0		0
1352	imamat		0	0	0
1353	xn--55qx5d8y0buji4b870u			0	0
1354	xn--pbt977c		0		0
1355	xn--jvr189m		0	1	1
1356	schwarzgroup		0		0
1357	nowruz		0	0	0
1358	xn--30rr7y		0		0
1359	spreadbetting		0	0	1
1360	mrmuscle		0	0	0
1361	xn--mgbv6cfpo		0		0
1362	frogans		6	0	6
1363	xn--gckr3f0f			0	0
1364	lefrak		2	1	2
1365	onyourside		0	0	0
1366	xn--kcrx7bb75ajk3b			0	0
1367	xn--mgba7c0bbn0a		0		0
1368	northlandinsurance		0		0
1369	abbvie		0	0	0
1370	emerck		0		0
1371	xn--fct429k			0	0
1372	xn--1ck2e1b		0	0	0
1373	cashbackbonus		0		0
1374	kerryhotels		0		0
1375	xn--j6w470d71issc		0		0
1376	mzansimagic		0	0	0
1377	xn--tiq49xqyj		0		0

Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
1378	xn--dkwm73cwpn		0	0	0
1379	guardianlife		4	0	4
1380	xn--fjq720a		0		0
1381	xn--cg4bki		0	0	0
1382	xn--b4w605ferd		0		0
1383	xn--vhquv		0		0
1384	xn--vermgensberater-ctb		0		0
1385	xn--ngbe9e0a		0	0	0
1386	kerryproperties		0		0
1387	xn--3ds443g		0	0	0
1388	xn--mgba3a3ejt		0	0	0
1389	xn--mgbt3dhd		0	0	0
1390	xn--bck1b9a5dre4c		0	0	0
1391	xn--cck2b3b			0	0

Appendix B—Complete 2013 Counts

The following table shows the complete list of the 1395 proposed TLDs that appeared at any level in a 2013 DITL QNAME in order of highest occurrence at the TLD level.

The counts for the appearance at the SLD level and all other levels (along with total number of appearances anywhere in a DNS name) are included.

Counts are shown in thousands, rounded to the nearest thousand. A blank entry represents an actual count of zero; a “0” entry represents a non-zero count that rounds to zero.

2013 Rank	2012 Rank	Proposed TLD	As TLD	As SLD	At all other levels	Total
1	1	home	952,944	29,430	2,879	985,252
2	2	corp	144,507	41,746	43,792	230,045
3	21	ice	19,789	269	1,191	21,249
4	4	global	12,352	11,081	17,628	41,061
5	29	med	10,801	251	2,735	13,788
6	3	site	10,716	302	187	11,204
7	5	ads	10,563	2,045	12,082	24,690
8	12	network	8,711	2,823	936	12,470
9	7	group	8,580	5,570	2,022	16,171
10	9	cisco	8,284	4,525	314	13,124
11	8	box	7,694	940	803	9,437
12	14	prod	7,004	1,447	6,849	15,300
13	6	iinet	5,427	129	1,660	7,217
14	10	hsbc	5,249	407	1,209	6,864
15	11	inc	5,208	194	109	5,511
16	18	win	5,199	340	1,554	7,093
17	13	dev	5,058	2,271	2,930	10,259
18	15	office	4,006	3,125	3,031	10,162
19	20	business	3,279	187	1,734	5,201
20	16	host	3,127	692	1,408	5,227
21	31	star	2,435	236	1,372	4,044
22	25	mail	2,383	25,339	32,878	60,599
23	19	ltd	1,990	337	64	2,392
24	23	google	1,859	463,797	155,926	621,582

25	169	sap	1,735	18,189	556	20,480
26	17	app	1,720	871	2,420	5,012
27	27	world	1,650	536	132	2,318
28	30	mnet	1,568	139	217	1,924
29	26	smart	1,331	509	339	2,179
30	33	web	1,126	3,028	3,612	7,766
31	32	orange	1,072	9,516	8,614	19,202
32	24	red	1,043	576	2,100	3,719
33	43	msd	956	146	247	1,349
34	37	school	872	1,266	350	2,489
35	39	bank	780	11,807	577	13,165
36	28	casa	771	559	57	1,387
37	45	telefonica	768	1,010	441	2,219
38	51	zone	701	3,958	658	5,317
39	118	movistar	660	448	444	1,552
40	82	search	657	565	7,117	8,339
41	41	abc	646	628	1,013	2,288
42	48	llc	592	98	78	769
43	34	youtube	576	6,955	1,947	9,478
44	219	samsung	569	4,049	2,017	6,635
45	68	tech	563	336	462	1,361
46	55	hot	554	103	1,076	1,733
47	44	you	541	119	153	813
48	46	ecom	534	36	36	606
49	52	hotel	530	498	98	1,126
50	54	off	526	40	38	604
51	119	cloud	514	989	4,042	5,546
52	62	foo	513	317	11	841
53	36	new	500	385	1,411	2,295
54	93	bcn	495	125	295	915
55	81	free	491	1,934	474	2,899
56	53	top	484	418	922	1,823
57	63	one	482	2,361	7,440	10,284
58	91	bet	479	54	33	566
59	949	kpmg	477	468	511	1,456

60	69	wow	459	811	161	1,431
61	47	yahoo	437	43,626	21,429	65,491
62	56	blog	432	756	4,502	5,691
63	49	work	404	1,009	305	1,718
64	110	chrome	384	56	169	609
65	84	data	382	1,741	2,507	4,630
66	22	link	375	537	969	1,882
67	40	comcast	369	5,511	3,284	9,165
68	80	cam	369	378	1,362	2,110
69	151	gold	369	114	147	629
70	67	medical	368	176	43	587
71	75	live	364	8,171	4,420	12,955
72	77	art	345	264	94	703
73	66	olympus	343	834	90	1,267
74	73	city	342	266	2,357	2,965
75	76	sew	339	18	22	379
76	60	lanxess	328	3	4	335
77	106	center	327	219	308	854
78	99	ifm	326	29	28	383
79	87	law	318	492	483	1,293
80	85	goo	315	94	1,264	1,673
81	141	plus	307	240	3,450	3,997
82	64	apple	292	26,975	7,088	34,355
83	96	zip	279	2,054	32	2,365
84	117	gmail	275	2,540	1,363	4,179
85	38	house	271	189	426	887
86	95	company	263	6,378	274	6,916
87	83	itau	263	164	571	998
88	131	thai	263	13	39	315
89	74	show	261	59	973	1,293
90	153	college	257	212	51	520
91	155	taobao	257	16,978	1,866	19,101
92	152	amazon	254	21,882	2,384	24,520
93	65	schule	254	741	59	1,055
94	127	pub	253	329	522	1,104

95	124	bom	251	64	348	663
96	50	ibm	250	6,136	798	7,184
97	105	ericsson	246	448	84	778
98	109	vet	243	52	32	326
99	101	here	243	44	31	317
100	112	man	237	492	3,294	4,023
101	57	sfr	235	2,134	598	2,967
102	58	family	234	125	44	403
103	98	services	227	889	4,394	5,509
104	121	delta	226	1,704	344	2,274
105	86	csc	225	1,167	574	1,966
106	72	matrix	223	502	333	1,058
107	79	media	218	897	3,506	4,621
108	209	page	215	129	359	704
109	113	nyc	211	417	992	1,620
110	42	unicorn	211	28	4	243
111	107	goog	205	48	13	265
112	111	hospital	204	266	45	515
113	78	maison	203	80	7	289
114	88	dell	198	14,792	422	15,412
115	137	llp	194	14	2	209
116	97	studio	192	687	50	929
117	104	aaa	190	320	73	584
118	120	sbs	190	744	669	1,603
119	132	online	189	1,962	11,469	13,621
120	135	sca	189	227	43	459
121	70	auto	187	431	3,403	4,021
122	123	hotmail	185	3,812	1,413	5,409
123	165	icbc	183	7	10,089	10,279
124	144	exchange	182	1,088	756	2,027
125	157	earth	177	90	789	1,055
126	618	clubmed	175	8	15	198
127	149	spa	174	556	51	781
128	138	aol	171	22,743	2,226	25,139
129	136	farm	171	41	57	268

130	188	sbi	170	74	33	277
131	128	natura	167	638	12	818
132	114	acer	165	934	106	1,204
133	161	bar	162	83	221	466
134	133	fish	161	35	106	302
135	126	mobile	159	2,440	2,091	4,690
136	116	hosting	157	5,945	7,481	13,584
137	163	shop	152	627	1,139	1,918
138	108	computer	152	268	38	458
139	71	xyz	151	260	36	448
140	150	sina	148	6,745	15,387	22,280
141	90	beer	144	111	12	267
142	89	philips	143	2,546	566	3,256
143	102	news	140	379	5,690	6,209
144	100	mit	136	1,499	129	1,765
145	146	design	135	198	125	458
146	235	systems	134	807	217	1,158
147	92	fox	131	202	70	403
148	94	ses	129	171	224	525
149	341	navy	126	4,904	242	5,271
150	159	digital	125	214	55	394
151	61	gmbh	125	20	75	220
152	213	est	121	74	62	258
153	122	cba	120	199	199	517
154	35	vip	120	974	4,100	5,195
155	134	sky	117	2,308	1,261	3,687
156	304	srt	117	157	31	306
157	158	management	116	166	211	493
158	173	email	115	292	8,063	8,470
159	156	now	115	94	71	280
160	154	lol	114	320	282	716
161	125	svr	113	77	519	709
162	353	army	112	4,882	201	5,196
163	330	tokyo	112	263	908	1,284
164	160	store	111	174	8,555	8,840

165	115	moe	110	179	391	680
166	145	terra	109	2,155	1,745	4,009
167	194	ing	108	389	592	1,089
168	148	team	107	191	84	383
169	177	cafe	107	168	66	341
170	166	toshiba	105	1,128	343	1,576
171	311	circle	104	46	35	185
172	142	and	104	61	151	316
173	197	baidu	99	64,819	3,017	67,935
174	168	sony	99	532	4,595	5,225
175	164	stc	98	291	385	773
176	196	academy	96	165	42	303
177	211	car	96	140	303	539
178	186	dental	96	729	14	839
179	335	bing	94	1,433	204	1,730
180	147	london	93	174	532	799
181	207	express	91	524	290	905
182	170	madrid	91	211	136	438
183	183	paris	90	250	387	727
184	178	club	90	85	448	622
185	220	hermes	88	118	156	361
186	255	ist	88	193	487	768
187	189	sas	88	710	200	998
188	172	cal	88	252	96	436
189	238	health	88	1,089	649	1,825
190	223	active	87	985	138	1,210
191	202	church	86	76	12	174
192	466	ski	85	62	7	154
193	201	open	85	768	1,839	2,692
194	200	taxi	84	42	56	183
195	222	srl	84	71	6	161
196	249	run	84	30	56	170
197	203	tax	84	29	621	734
198	181	energy	83	193	669	945
199	204	mov	82	17	5	105

200	103	windows	81	5,723	842	6,646
201	250	cab	81	91	791	962
202	232	map	80	119	1,671	1,871
203	285	support	80	400	1,277	1,757
204	139	kids	79	22	41	143
205	205	black	79	34	25,140	25,252
206	193	sex	78	163	47	288
207	191	town	78	23	381	482
208	267	anz	78	345	181	604
209	305	webs	77	1,128	307	1,512
210	185	security	77	308	710	1,095
211	174	love	76	55	119	251
212	215	finance	76	159	1,591	1,826
213	557	gop	76	36	17	128
214	226	training	75	342	102	520
215	261	moi	75	73	583	732
216	234	radio	75	230	415	719
217	406	tvs	74	41	11	126
218	206	best	74	196	434	704
219	298	camp	73	48	29	150
220	198	secure	69	509	1,219	1,798
221	167	cpa	69	232	68	369
222	130	video	68	169	4,814	5,052
223	252	prime	68	438	432	937
224	280	solutions	68	146	60	274
225	476	cbn	67	187	2,130	2,384
226	246	roma	67	152	49	268
227	338	toyota	67	94	278	439
228	175	blue	66	301	384	752
229	247	loreal	66	1,717	258	2,041
230	279	call	65	38	98	201
231	230	sport	65	205	349	618
232	240	dot	64	1,028	492	1,584
233	430	ong	64	11	2	77
234	643	tci	63	94	16	174

235	182	space	62	571	108	742
236	176	africa	61	52	1,229	1,342
237	210	airtel	61	635	162	858
238	237	bbt	61	59	196	317
239	195	berlin	61	157	174	392
240	281	canon	60	2,777	288	3,126
241	317	miami	60	577	157	794
242	321	wiki	59	54	324	437
243	180	microsoft	59	154,888	5,798	160,745
244	348	konami	59	11	70	140
245	312	monster	59	320	231	610
246	224	mom	58	56	43	157
247	265	pwc	57	441	57	555
248	225	bbb	57	215	67	339
249	397	moscow	57	114	237	408
250	233	game	57	1,101	1,165	2,323
251	241	ink	56	18	14	88
252	228	solar	56	172	27	255
253	324	ikano	55	164	31	250
254	231	nexus	55	258	145	459
255	299	partners	55	1,074	428	1,557
256	319	pet	54	39	618	711
257	270	honda	54	843	182	1,079
258	333	chat	54	45	372	472
259	208	games	54	61	710	825
260	705	starhub	54	6	6,114	6,174
261	243	wang	54	22	73	148
262	227	life	54	2,467	269	2,790
263	289	clinic	53	337	20	410
264	271	style	53	102	271	426
265	212	alibaba	53	994	1,176	2,223
266	229	omega	53	305	335	693
267	612	tiffany	52	18	9	79
268	162	green	52	467	811	1,329
269	143	sohu	52	11,774	2,566	14,391

270	340	uol	52	55	3,851	3,958
271	179	skype	52	9,993	1,299	11,344
272	293	bbc	51	356	4,990	5,397
273	373	frl	51	12	116	178
274	236	rogers	51	1,764	730	2,545
275	307	guardian	51	390	253	693
276	264	george	51	33	49	133
277	309	care	51	91	39	181
278	278	ltda	50	1	0	51
279	258	marketing	50	108	128	285
280	272	fashion	50	78	133	261
281	286	bio	50	76	537	663
282	214	engineering	49	194	643	887
283	217	tata	49	19	22	89
284	199	music	49	264	2,022	2,335
285	276	java	48	54	79	181
286	310	hotels	48	217	109	374
287	269	kia	47	147	107	302
288	245	fun	47	15	224	286
289	571	photos	47	13	145	205
290	294	spot	47	38	83	168
291	487	krd	47	36	30	113
292	216	gal	46	29	21	96
293	239	room	46	6	12	64
294	192	photo	46	153	6,203	6,402
295	284	ram	46	71	29	146
296	621	gea	46	74	13	133
297	486	safe	45	89	96	230
298	288	blanco	45	21	3	69
299	268	cbs	45	325	227	597
300	295	uno	45	68	17	130
301	190	forum	44	748	2,375	3,167
302	262	website	44	63	120	227
303	371	trade	44	826	316	1,186
304	242	dad	44	206	12	261

305	320	cool	44	21	55	120
306	436	intel	43	3,638	221	3,902
307	292	mini	43	44	652	739
308	277	land	43	134	38	216
309	352	market	42	44	314	401
310	218	kim	42	30	34	106
311	367	zero	42	43	33	118
312	140	hughes	42	79	23	143
313	275	day	42	399	82	523
314	296	fire	41	69	45	156
315	184	eco	41	204	107	352
316	474	catholic	41	96	403	540
317	273	amp	41	167	318	526
318	313	boo	41	41	8	90
319	380	aws	41	55	490	586
320	354	ford	41	825	90	956
321	129	fit	41	120	233	394
322	443	scb	40	87	328	455
323	413	smile	40	100	112	252
324	440	mls	40	232	108	379
325	376	community	39	370	463	872
326	393	play	39	569	679	1,287
327	301	bzh	39	8	3	50
328	493	fail	39	15	5	59
329	266	rio	39	47	137	222
330	297	vision	38	361	49	449
331	251	baby	38	187	100	326
332	343	bnl	38	56	130	224
333	331	education	38	216	125	378
334	287	international	38	90	44	171
335	290	crown	38	225	13	275
336	411	lds	37	1,546	246	1,829
337	254	band	37	29	32	98
338	263	vista	37	88	50	175
339	314	book	37	27	426	491

340	383	tube	37	20	29	87
341	521	gmo	37	72	8	117
342	303	nec	37	263	444	743
343	334	capital	37	357	157	550
344	629	juniper	36	524	16	577
345	456	consulting	36	40	6	82
346	244	sydney	36	24	303	363
347	326	porn	36	56	69	161
348	316	barcelona	36	71	65	172
349	318	bmw	36	2,005	326	2,367
350	372	next	36	107	165	308
351	428	delivery	36	54	217	306
352	346	salon	36	44	29	109
353	342	cfa	36	95	110	240
354	259	htc	36	1,780	175	1,990
355	349	shaw	35	164	33	233
356	410	abb	35	3,438	78	3,551
357	454	pioneer	35	126	44	205
358	478	money	35	661	404	1,099
359	356	bot	35	62	104	200
360	433	hamburg	34	32	113	178
361	359	directory	33	225	550	808
362	370	target	33	509	148	689
363	579	bingo	33	16	8	57
364	257	lpl	33	299	78	410
365	332	quest	33	899	20	952
366	398	how	33	63	17	113
367	660	unicom	33	111	19	162
368	400	sharp	32	56	702	790
369	345	construction	32	65	34	131
370	260	ooo	32	28	10	70
371	432	tab	32	47	150	229
372	325	lincoln	32	82	154	267
373	389	weir	32	1	1	34
374	379	mma	32	50	211	293

375	404	lat	31	37	116	183
376	329	garden	30	111	7	149
377	365	yandex	30	11,008	3,295	14,333
378	306	haus	30	27	3	60
379	392	mcd	30	149	43	222
380	381	fly	30	31	65	125
381	337	dog	30	39	67	135
382	763	weibo	30	2,765	636	3,430
383	171	dds	30	341	77	448
384	315	ntt	29	1,706	193	1,928
385	339	ren	29	31	157	218
386	375	taipei	29	41	99	169
387	448	bosch	29	217	53	300
388	328	lilly	29	974	54	1,057
389	472	press	29	376	73	477
390	970	loans	29	22	55	106
391	490	university	29	63	71	163
392	362	phone	29	48	111	188
393	415	storage	29	75	1,250	1,354
394	395	trust	29	78	40	147
395	361	swiss	28	293	16	337
396	473	maif	28	63	1	93
397	282	pay	28	20	133	181
398	409	ott	28	112	36	175
399	323	nico	28	17	4	48
400	390	axis	28	168	71	267
401	403	xerox	28	5,539	790	6,357
402	248	doha	27	3	32	62
403	386	oracle	27	6,439	772	7,237
404	446	frontier	27	107	53	186
405	613	softbank	26	391	587	1,005
406	369	fast	26	236	3,008	3,270
407	347	software	26	36	226	288
408	477	shopping	26	953	419	1,398
409	485	itv	26	99	62	187

410	351	golf	26	66	57	149
411	368	reliance	26	102	31	158
412	441	download	25	98	40,512	40,635
413	588	date	25	9	28	62
414	465	click	25	108	896	1,028
415	422	contact	25	72	354	451
416	363	works	25	79	15	119
417	378	mlb	25	118	110	253
418	457	osaka	25	201	236	462
419	461	mba	24	75	14	114
420	394	pin	24	374	19	417
421	358	legal	24	78	50	152
422	399	kpn	24	107,063	113	107,201
423	437	dvr	24	13	7	45
424	421	meo	24	12	18	55
425	427	flickr	24	292	466	782
426	467	properties	24	10	14	49
427	308	bms	24	369	92	485
428	434	total	24	89	38	151
429	366	xbox	24	9,538	65	9,627
430	458	lasalle	23	39	20	83
431	412	are	23	25	43	91
432	327	place	23	21	30	74
433	417	read	23	18	70	111
434	500	watch	23	10	101	134
435	419	polo	22	1,586	8	1,616
436	423	song	22	10	13	45
437	322	direct	22	52	300	374
438	350	chase	22	107	130	259
439	806	cards	22	8	70	100
440	453	kiwi	22	119	15	156
441	407	schmidt	22	71	18	111
442	396	boston	22	179	189	390
443	418	mtn	22	50	192	264
444	541	prof	22	13	2,237	2,272

445	416	ping	22	46	704	772
446	377	men	21	35	73	130
447	384	marriott	21	102	148	271
448	469	walter	21	39	6	66
449	494	weber	21	159	49	229
450	374	airbus	21	2,473	117	2,610
451	479	help	21	153	566	740
452	387	moto	21	24	29	73
453	515	xn--j1aef	21	2	0	23
454	401	expert	21	132	20	173
455	464	antivirus	21	99	124	243
456	452	social	21	128	255	403
457	300	wtf	20	14	13	47
458	442	casino	20	77	90	188
459	480	fujitsu	20	1,969	366	2,356
460	435	globo	20	1,011	477	1,508
461	357	gmx	20	536	377	934
462	460	gcc	20	181	93	294
463	385	fan	20	24	32	76
464	302	kitchen	20	19	10	49
465	746	loan	20	28	50	98
466	405	gmc	20	78	48	146
467	468	mcdonalds	20	48	51	118
468	523	technology	20	2,688	137	2,844
469	559	healthcare	19	1,641	208	1,868
470	221	pccw	19	37	4	60
471	562	caravan	19	100	13	132
472	489	safeway	19	162	5	187
473	382	build	19	70	75	164
474	488	pharmacy	19	76	51	146
475	576	nissan	19	115	572	706
476	589	insurance	19	162	44	224
477	429	homes	19	779	68	865
478	274	hilton	19	287	86	391
479	499	pizza	18	27	5	50

480	554	buzz	18	16	45	80
481	545	accenture	18	418	65	501
482	492	promo	18	130	65	213
483	425	ups	18	411	201	630
484	420	study	18	97	23	139
485	633	netflix	18	362	302	681
486	462	citi	18	76	44	139
487	539	camera	18	48	15	81
488	543	hyundai	18	131	49	198
489	506	crs	18	106	20	144
490	444	shell	18	400	200	618
491	481	weather	18	77,388	3,045	80,451
492	525	istanbul	18	13	80	111
493	439	ferrari	17	39	10	67
494	534	mii	17	28	37	82
495	424	gay	17	16	23	57
496	550	nike	17	238	54	309
497	455	holiday	17	57	28	102
498	495	arte	17	47	17	81
499	414	seven	17	814	66	897
500	336	joy	17	548	101	666
501	483	nba	17	8,380	142	8,539
502	565	sarl	17	8	1	26
503	686	loft	17	135	14	166
504	391	jnj	17	675	45	736
505	470	gallery	17	31	158	206
506	542	science	17	59	259	335
507	516	industries	17	20	2	39
508	561	cars	17	51	61	129
509	532	property	16	221	26	264
510	582	food	16	33	44	94
511	644	lexus	16	11	11	38
512	547	pink	16	21	24	61
513	498	nokia	16	2,662	1,057	3,734
514	507	walmart	16	140	123	278

515	619	ira	16	21	74	110
516	449	rich	16	50	13	79
517	447	virgin	16	45	25	86
518	451	cash	16	48	60	124
519	548	living	16	29	41	86
520	857	thd	16	19	1	36
521	608	fedex	16	6,033	165	6,213
522	570	immo	15	35	8	58
523	431	koeln	15	13	45	73
524	747	ipiranga	15	10	7	32
525	595	drive	15	85	724	824
526	607	android	15	183	3,547	3,746
527	522	like	15	10	77	102
528	503	citadel	15	177	10	202
529	606	docs	15	26	604	645
530	634	cfd	15	33	8	56
531	59	vivo	15	19	592	626
532	517	tour	15	8	52	75
533	497	ftr	15	45	6	66
534	508	vin	15	11	23	48
535	855	xn--55qx5d	15	2	0	17
536	463	flowers	15	170	5	190
537	291	wtc	14	71	36	122
538	628	sale	14	72	34	121
539	568	sports	14	107	1,016	1,137
540	388	ninja	14	9	114	138
541	491	gap	14	102	81	198
542	518	case	14	48	18	80
543	815	mobily	14	271	440	726
544	496	sakura	14	32	535	582
545	459	amsterdam	14	134	775	923
546	617	got	14	116	44	174
547	708	azure	14	22	16	52
548	513	buy	14	64	421	499
549	659	rent	14	12	11	37

550	544	movie	14	33	172	220
551	538	party	14	14	10	37
552	364	xn--42c2d9a	14	0	0	14
553	646	credit	14	19	131	164
554	537	viking	14	88	21	122
555	510	heart	13	714	24	752
556	484	sexy	13	13	11	37
557	601	fitness	13	20	17	50
558	408	voyage	13	5	15	33
559	994	boutique	13	8	19	41
560	519	associates	13	8	18	39
561	664	rocks	13	3	3	20
562	531	film	13	17	23	53
563	577	jaguar	13	38	70	120
564	649	visa	13	175	84	272
565	535	today	13	95	48	156
566	609	prudential	13	204	102	318
567	703	gratis	13	11	11	35
568	654	avery	13	33	6	51
569	837	rehab	13	37	6	55
570	504	qtel	12	10	119	141
571	799	parts	12	19	67	98
572	600	limited	12	5	34	50
573	781	tmall	12	1,440	208	1,660
574	598	emerson	12	1,090	20	1,122
575	573	audio	12	35	37	84
576	635	audi	12	1,357	75	1,443
577	553	tours	12	5	18	35
578	558	supply	12	7	12	31
579	584	dtv	12	54	30	95
580	502	able	12	45	14	70
581	540	suzuki	12	32	18	62
582	505	vegas	12	139	29	180
583	912	review	12	5	25	42
584	667	obi	11	22	12	45

585	594	financial	11	61	9	81
586	597	graphics	11	52	55	118
587	732	infiniti	11	18	7	36
588	692	talk	11	80	1,869	1,960
589	536	stream	11	1,101	588	1,700
590	527	cricket	11	2,792	52	2,855
591	603	brother	11	70	155	235
592	564	viva	11	75	631	716
593	672	sapo	11	2,380	94	2,485
594	1111	shouji	10	1	610	621
595	651	ngo	10	27	53	91
596	529	rip	10	18	186	214
597	680	save	10	44	20	74
598	678	patch	10	37	80	127
599	590	idn	10	32	17	58
600	1010	teva	10	2,510	210	2,730
601	661	onl	10	16	2	27
602	187	faith	10	34	95	139
603	524	bond	10	30	44	84
604	283	imdb	10	396	49	456
605	827	bbva	10	334	57	401
606	583	panasonic	10	509	128	647
607	610	surf	10	6,660	19	6,689
608	899	durban	10	5	19	33
609	567	domains	10	1,358	148,428	149,795
610	677	hyatt	10	452	77	539
611	551	kid	10	16	19	45
612	602	anthem	10	28	44	82
613	670	mint	10	73	30	113
614	665	guru	10	17	74	101
615	605	staples	9	253	83	345
616	563	xin	9	9	9	27
617	1074	origins	9	26	4	39
618	625	beauty	9	83	42	134
619	726	gree	9	116	41	167

620	552	mango	9	297	142	448
621	668	engineer	9	14	12	35
622	530	wien	9	18	68	95
623	835	raid	9	15	47	71
624	792	safety	9	74	15	97
625	581	baseball	9	7	31	47
626	511	foundation	9	62	29	100
627	509	coffee	9	36	5	49
628	614	pid	9	8	4	21
629	722	events	9	16	1,028	1,053
630	652	select	9	582	3,276	3,868
631	648	alstom	9	555	841	1,405
632	748	report	9	7	303	319
633	685	hbo	9	37	11	57
634	740	vig	9	59	4	72
635	650	nrw	9	381	109	499
636	673	icu	9	10	12	31
637	653	asda	9	28	11	48
638	930	xn--io0a7i	9	0	0	9
639	560	country	9	12	6	27
640	591	trading	9	35	77	120
641	402	dealer	9	128	62	198
642	575	enterprises	8	3	1	12
643	426	chk	8	15	30	53
644	720	gle	8	9	4	21
645	638	broker	8	92	160	260
646	622	infosys	8	275	114	397
647	578	dupont	8	31	256	296
648	669	cheap	8	12	10	31
649	616	clinique	8	111	27	146
650	785	volvo	8	1,444	74	1,527
651	355	docomo	8	9	231	249
652	770	wed	8	6	2	17
653	691	meet	8	3	25	37
654	512	dubai	8	26	92	126

655	514	agency	8	58	154	220
656	450	tools	8	70	9,684	9,762
657	715	rest	8	28	607	643
658	549	norton	8	863	888	1,759
659	761	ubs	8	4,495	89	4,593
660	647	archi	8	51	8	68
661	676	chevrolet	8	20	244	272
662	707	nagoya	8	173	51	231
663	793	dance	8	6	22	37
664	637	physio	8	18	1	27
665	630	dnb	8	410	25	442
666	811	hoteles	8	8	5	21
667	1027	fujixerox	8	7	55	70
668	615	epson	8	127	82	217
669	752	nab	8	31	71	110
670	642	ovh	7	27,564	514	28,086
671	627	xfinity	7	4	27	39
672	592	duck	7	11	2	21
673	640	ceb	7	63	38	109
674	819	jll	7	51	16	74
675	556	dhl	7	1,167	446	1,620
676	733	trv	7	10	107	124
677	721	ceo	7	27	14	48
678	658	lego	7	35	36	78
679	788	yokohama	7	43	25	75
680	809	jcp	7	17	8	31
681	826	dentist	7	59	3	68
682	445	gent	7	15	20	42
683	702	kyoto	7	144	48	199
684	596	axa	7	86	53	147
685	734	bid	7	47	90	145
686	731	hitachi	7	62	290	358
687	873	monash	7	120	179	306
688	716	menu	7	12	15	34
689	657	lifestyle	7	26	51	83

690	656	horse	7	30	13	50
691	768	kinder	7	9	3	19
692	593	schwarz	7	27	4	38
693	812	kred	7	5	0	12
694	833	aco	7	97	8	112
695	662	nfl	6	135	37	178
696	663	fls	6	42	424	473
697	729	gallo	6	9	1	16
698	767	juegos	6	27	32	65
699	555	channel	6	12	5,831	5,849
700	546	melbourne	6	41	1,998	2,046
701	756	catering	6	19	4	29
702	689	hockey	6	12	7	26
703	783	kddi	6	91	266	363
704	580	glass	6	47	23	76
705	699	aeg	6	46	3	55
706	526	phd	6	41	17	64
707	757	soccer	6	13	13	32
708	620	pnc	6	178	118	302
709	823	pars	6	25	5	37
710	701	tienda	6	9	33	48
711	645	allstate	6	1,185	64	1,255
712	776	moda	6	8	17	32
713	751	arab	6	6	4	16
714	599	zulu	6	9	5	20
715	766	abbott	6	529	18	553
716	822	citic	6	7	4	17
717	675	racing	6	15	8	29
718	816	heinz	6	13	6	25
719	520	doctor	6	27	11	43
720	775	pictures	6	20	78	104
721	929	jpmorgan	6	133	19	158
722	626	broadway	6	174	16	195
723	916	hkt	6	26	41	73
724	828	fyi	6	16	2	25

725	714	chloe	6	3	5	14
726	894	reisen	6	6	8	20
727	813	final	6	8	3	17
728	666	kosher	6	3	2	11
729	724	builders	6	14	2	22
730	611	bentley	6	210	42	258
731	842	transformers	6	9	2	17
732	475	islam	6	8	10	24
733	639	irish	6	5	2	12
734	709	vanguard	6	182	18	205
735	696	claims	6	79	3	88
736	739	zara	6	40	6	52
737	754	lighting	6	10	13	28
738	755	toray	6	15	38	58
739	728	fund	5	9	34	48
740	780	mortgage	5	146	119	270
741	727	astrium	5	407	35	447
742	712	cbre	5	64	29	99
743	501	eat	5	20	12	37
744	697	football	5	46	34	86
745	572	restaurant	5	8	12	26
746	765	tui	5	52	189	247
747	574	fiat	5	194	19	219
748	862	booking	5	224	114	343
749	938	bnpparibas	5	591	69	665
750	843	tennis	5	22	21	49
751	624	desi	5	3	3	10
752	789	pics	5	37	259	302
753	771	leclerc	5	46	2	54
754	631	nationwide	5	151	11	168
755	471	institute	5	15	6	26
756	604	bradesco	5	6	130	141
757	830	macys	5	40	23	68
758	256	diet	5	5	159	169
759	779	budapest	5	13	28	46

760	710	tips	5	12	250	268
761	360	apartments	5	6	6	16
762	641	ged	5	18	20	44
763	796	holdings	5	31	23	58
764	773	skin	5	11	41	57
765	566	discover	5	27	21	53
766	693	meme	5	11	4	19
767	782	forex	5	11	22	38
768	807	quebec	5	29	34	68
769	586	jeep	5	8	9	21
770	851	playstation	5	2,836	169	3,010
771	735	yun	5	2	131	138
772	683	deal	5	26	17	47
773	824	webcam	5	4	14	23
774	868	amex	5	14	13	32
775	786	pru	5	36	143	183
776	764	etisalat	5	30	180	215
777	744	sapphire	5	242	10	257
778	684	estate	5	92	4	100
779	872	toys	5	11	10	25
780	695	ricoh	5	1,563	88	1,656
781	706	protection	5	21	1,175	1,201
782	887	stockholm	5	81	86	172
783	814	rwe	5	77	246	328
784	866	lotto	4	11	20	35
785	711	mitsubishi	4	41	3	49
786	804	career	4	11	1,153	1,168
787	762	bike	4	11	24	39
788	585	discount	4	7	5	17
789	698	farmers	4	44	17	65
790	885	banamex	4	4	14	23
791	825	dwg	4	13	1	19
792	954	iwc	4	22	2	28
793	681	cologne	4	3	18	25
794	791	wedding	4	5	10	20

795	745	realty	4	21	90	115
796	803	homedepot	4	390	74	468
797	943	kfh	4	27	31	63
798	877	hiv	4	2	2	8
799	777	tdk	4	34	26	64
800	996	intuit	4	374	102	481
801	655	bcg	4	63	4	71
802	882	latino	4	8	20	31
803	904	helsinki	4	689	192	886
804	907	honeywell	4	178	99	281
805	717	wine	4	14	25	43
806	874	aig	4	781	92	877
807	690	theatre	4	41	18	63
808	723	mutual	4	43	2	49
809	687	limo	4	25	1	31
810	808	jlc	4	20	4	28
811	1005	cimb	4	68	24	95
812	839	boots	4	17	18	39
813	966	mih	4	9	4	16
814	846	eus	4	5	140	149
815	719	dodge	4	13	8	25
816	790	pets	4	4	8	15
817	569	mtr	4	44	13	61
818	834	repair	4	13	36	53
819	674	furniture	4	14	7	25
820	856	theater	4	17	9	30
821	847	bauhaus	4	17	2	23
822	817	adult	4	8	36	48
823	694	seat	4	130	40	173
824	891	gift	4	6	8	18
825	778	chanel	4	27	5	36
826	741	fishing	4	3	5	11
827	794	diy	4	38	30	71
828	587	esq	4	9	4	17
829	945	brussels	4	49	65	117

830	880	markets	4	3	53	59
831	795	realestate	4	19	91	113
832	679	chevy	4	3	2	9
833	832	xn--c1avg	4	1	0	5
834	713	yoga	4	3	3	9
835	736	bugatti	4	2	3	8
836	802	americanexpress	4	232	83	319
837	772	fido	4	183	8	194
838	718	hair	4	13	3	19
839	1071	xn--zfr164b	4	1	0	4
840	928	telecity	4	3,599	10	3,613
841	623	memorial	3	12	20	36
842	821	soy	3	7	2	12
843	798	afl	3	22	74	99
844	533	ril	3	63	5	72
845	863	scot	3	52	91	146
846	805	progressive	3	3,346	20	3,369
847	1028	pitney	3	0	0	4
848	910	careers	3	13	75	92
849	758	ventures	3	5	0	8
850	671	lancaster	3	59	26	88
851	972	analytics	3	13	729	746
852	844	ksb	3	177	7	188
853	952	architect	3	7	2	13
854	1033	rodeo	3	3	1	8
855	749	symantec	3	9,549	2,518	12,070
856	869	codes	3	4	3	10
857	852	shangrila	3	7	2	12
858	753	ally	3	42	11	56
859	636	bestbuy	3	60	69	132
860	801	surgery	3	39	11	53
861	881	jpmorganchase	3	9,651	32	9,686
862	769	poker	3	11	54	69
863	993	compare	3	6	11	20
864	850	coach	3	11	14	28

865	923	banque	3	2	9	14
866	1015	ferrero	3	38	5	47
867	841	gucci	3	9	26	37
868	738	photography	3	15	4	22
869	854	tattoo	3	3	3	9
870	853	gdn	3	21	4	27
871	800	sucks	3	1	0	5
872	482	bloomberg	3	139	101	243
873	1091	joburg	3	31	11	45
874	1001	statefarm	3	1,651	13	1,666
875	948	investments	3	6	289	298
876	886	lacaixa	3	181	44	228
877	944	dating	3	51	44	99
878	932	deloitte	3	2,286	301	2,589
879	878	iveco	3	31	10	44
880	975	contractors	3	13	2	17
881	933	lotte	3	8	1,147	1,158
882	253	dish	3	10	3	16
883	947	vote	3	2	84	89
884	915	dnp	3	21	83	106
885	836	seek	3	10	52	65
886	902	volkswagen	3	400	54	457
887	860	fans	3	59	9	71
888	888	cern	3	676	16	695
889	909	landrover	3	8	8	19
890	983	adac	3	44	18	64
891	704	wales	3	121	18	142
892	1002	tirol	3	23	29	55
893	1055	xn--55qw42g	3	0	0	3
894	1011	cymru	3	3,698	66	3,767
895	935	auction	3	67	898	968
896	883	chesapeake	3	40	8	51
897	875	productions	3	2	0	5
898	918	silk	3	13	8	24
899	861	shoes	3	49	51	102

900	962	aquarelle	3	17	1	21
901	1004	beats	3	4	1	8
902	859	redstone	3	13	20	36
903	730	jcb	3	157	10	169
904	848	tunes	3	5	0	8
905	774	goodyear	2	18	7	27
906	936	immobilien	2	16	5	24
907	831	nra	2	86	120	209
908	820	nhk	2	7	1,246	1,256
909	632	wme	2	6	3	11
910	961	tickets	2	62	28	92
911	838	fidelity	2	400	106	508
912	829	showtime	2	7	17	26
913	913	sncf	2	844	13	859
914	879	ruhr	2	2	1	5
915	725	bayern	2	191	8	201
916	960	godaddy	2	274	433	709
917	950	boehringer	2	2	375	379
918	1245	genting	2	315	8	326
919	876	feedback	2	13	166	181
920	939	metlife	2	99	57	158
921	917	chrysler	2	778	11	791
922	903	organic	2	22	3	28
923	867	qvc	2	152	17	172
924	1058	foodnetwork	2	24	9	35
925	946	doosan	2	1,157	12	1,171
926	898	capitalone	2	962	490	1,455
927	931	barclays	2	425	145	572
928	1092	latrobe	2	0	75	77
929	998	accountant	2	6	5	14
930	980	deals	2	8	64	74
931	743	linde	2	1,355	1,396	2,752
932	1073	luxe	2	6	3	11
933	797	diamonds	2	5	2	9
934	1037	cleaning	2	4	1	7

935	870	jmp	2	30	7	40
936	987	montblanc	2	6	2	10
937	927	accountants	2	6	2	10
938	810	bible	2	16	10	28
939	1018	dunlop	2	4	6	12
940	344	kone	2	5	7	14
941	1031	rmit	2	30	400	432
942	865	airforce	2	2	112	116
943	956	guide	2	5	25	32
944	957	lawyer	2	15	4	21
945	1013	newholland	2	3	3	8
946	849	luxury	2	14	8	24
947	787	capetown	2	6	56	63
948	924	lease	2	1	3	6
949	1032	cadillac	2	58	69	128
950	942	hdfc	2	11	3	16
951	992	alsace	2	0	2	4
952	760	charity	2	4	90	95
953	889	sandvik	2	841	141	984
954	1035	oldnavy	2	34	26	62
955	969	grainger	2	45	21	67
956	845	sanofi	2	134	32	168
957	977	fage	2	1	0	2
958	1268	tushu	2	0	1	3
959	984	kindle	2	5	4	10
960	934	rugby	2	11	8	21
961	1053	pfizer	2	1,950	53	2,005
962	926	supersport	2	18	9	29
963	892	vistaprint	2	398	71	471
964	979	hiphop	2	9	2	13
965	1107	cialis	2	3	32	37
966	1224	piaget	2	10	13	25
967	900	author	2	2	3	7
968	1017	glade	2	2	0	4
969	784	indians	2	4	2	7

970	988	reise	2	3	4	9
971	864	nikon	2	113	18	133
972	991	alipay	2	1,712	84	1,797
973	982	attorney	2	8	2	12
974	1130	verisign	2	11,276	835	12,113
975	1007	skydrive	2	5	65	72
976	963	autos	2	11	133	145
977	840	vodka	2	4	2	7
978	953	barclaycard	2	3	31	35
979	1064	coupons	1	17	21	39
980	1021	reviews	1	3	53	58
981	1183	ultrabook	1	2	1	5
982	919	woodside	1	6	106	113
983	1024	aetna	1	68	80	149
984	759	mopar	1	2	1	4
985	974	futbol	1	2	6	10
986	1326	pramerica	1	6	0	8
987	858	cruise	1	33	5	39
988	940	yellowpages	1	2,748	161	2,910
989	997	lamborghini	1	9	2	12
990	920	villas	1	4	1	6
991	1100	liaison	1	47	4	52
992	1046	okinawa	1	46	38	86
993	1029	jot	1	25	14	41
994	1012	vlaanderen	1	70	7	78
995	1000	lidl	1	17	76	94
996	871	jewelry	1	22	6	29
997	1069	marshalls	1	2	1	4
998	737	merck	1	137	756	894
999	1098	makeup	1	1	2	5
1000	965	christmas	1	2	2	5
1001	951	equipment	1	4	1	7
1002	1062	statoil	1	57	28	87
1003	967	pohl	1	4	0	6
1004	1284	rightathome	1	6	0	7

1005	1025	tatar	1	10	5	16
1006	973	hdfcbank	1	109	15	126
1007	750	realtor	1	49	48	98
1008	897	zippo	1	1	2	4
1009	999	ieee	1	1,212	51	1,264
1010	964	aquitaine	1	13	4	18
1011	1077	observer	1	68	13	82
1012	1115	motorcycles	1	0	2	4
1013	1026	fresenius	1	35	3	39
1014	925	supplies	1	6	1	8
1015	896	viajes	1	4	3	9
1016	901	basketball	1	10	11	22
1017	941	plumbing	1	12	1	14
1018	1008	samsclub	1	36	21	58
1019	893	patagonia	1	10	2	13
1020	438	aramco	1	10	11	22
1021	688	bharti	1	1	0	2
1022	908	spiegel	1	141	187	328
1023	1072	bridgestone	1	36	13	51
1024	985	hgtv	1	15	6	22
1025	1039	halal	1	1	1	3
1026	1165	jetzt	1	0	0	1
1027	922	abogado	1	7	1	9
1028	1094	courses	1	1	25	27
1029	1052	comsec	1	6	8	14
1030	1034	ladbrokes	1	210	22	232
1031	1043	clothing	1	7	7	15
1032	906	rentals	1	8	3	12
1033	958	lupin	1	2	0	4
1034	1079	commbank	1	2	1,714	1,716
1035	1019	cooking	1	5	31	37
1036	1006	scor	1	149	1	151
1037	1123	epost	1	45	92	137
1038	1067	aarp	1	173	18	192
1039	937	netbank	1	78	64	143

1040	1022	avianca	1	131	11	143
1041	959	wilmar	1	1	2	5
1042	1042	otsuka	1	4	42	47
1043	1016	zappos	1	75	40	116
1044	914	cartier	1	10	16	26
1045	1089	bloomingdales	1	153	12	166
1046	1127	actor	1	3	1	5
1047	1014	coupon	1	2	8	11
1048	1078	xn--80aswg	1	4	1	6
1049	1063	xn--80asehdb	1	0	0	1
1050	1020	jio	1	0	0	1
1051	1112	gallup	1	18	10	29
1052	1157	cyou	1	9	99	109
1053	1059	gifts	1	14	6	20
1054	1036	insure	1	7	2	10
1055	1106	dstv	1	41	9	51
1056	682	komatsu	1	43	84	127
1057	1148	singles	1	4	3	7
1058	905	ketchup	1	0	0	1
1059	1095	shia	1	1	1	2
1060	1041	finish	1	2	1	3
1061	1030	xn--fhbei	1	0	0	1
1062	1066	rocher	1	3	0	4
1063	528	translations	1	1	2	3
1064	1068	saarland	1	2	1	4
1065	1061	rsvp	1	10	10	21
1066	1048	alfaromeo	1	5	3	9
1067	1247	connectors	1	1	0	2
1068	971	firestone	1	5	2	8
1069	1103	swatch	1	3	2	5
1070	1056	flights	1	1	6	8
1071	1070	bway	1	27	2	29
1072	1093	weatherchannel	1	1	1	2
1073	884	jprs	1	32	12	45
1074	1116	fairwinds	1	1	0	2

1075	1161	mutuelle	1	4	1	6
1076	976	bofa	1	4	5	10
1077	1060	cruises	1	2	17	20
1078	1096	creditunion	1	31	2	33
1079	1143	eurovision	1	5	2	8
1080	1047	buick	1	2	159	161
1081	921	barefoot	1	11	1	13
1082	1075	tires	1	1	1	3
1083	1155	grocery	1	0	3	4
1084	978	zuerich	1	2	24	26
1085	1153	temasek	1	8	0	9
1086	1139	politie	1	46	19	66
1087	1023	cuisinella	1	20	0	21
1088	895	winners	1	18	3	22
1089	1097	aigo	1	11	1	12
1090	1129	versicherung	1	1	1	2
1091	1110	creditcard	1	1	204	205
1092	1009	audible	1	46	32	79
1093	981	boats	1	35	3	38
1094	1145	florist	1	10	5	15
1095	1085	recipes	1	4	17	22
1096	955	stroke	1	3	2	6
1097	1038	retirement	1	5	5	11
1098	1086	travelers	1	168	3	172
1099	1199	voting	1	0	1	2
1100	700	dvag	1	8	0	9
1101	1040	delmonte	1	2	2	4
1102	1118	deutschepost	1	103	5	109
1103	1057	warman	1	6	167	173
1104	1190	kaufen	1	1	3	4
1105	1166	xperia	0	1	1	3
1106	990	locus	0	12	2	15
1107	1082	degree	0	7	1	9
1108	1237	ismaili	0	0	0	1
1109	968	alcon	0	37	1	39

1110	890	infy	0	3	1	5
1111	1146	anquan	0	3	3	7
1112	1114	locker	0	1	2	3
1113	1151	theguardian	0	7	9	17
1114	1133	mattel	0	16	10	26
1115	1049	abudhabi	0	15	11	26
1116	1080	guge	0	0	0	1
1117	1117	frontdoor	0	10	5	15
1118	1187	amfam	0	275	2	278
1119	1065	blockbuster	0	5	11	16
1120	1149	chintai	0	5	4	9
1121	1124	ubank	0	6	2	8
1122	1099	flsmidth	0	3	18	21
1123	1171	giving	0	0	6	7
1124	1050	hangout	0	0	1	1
1125	1044	democrat	0	0	0	1
1126	1045	thehartford	0	2,636	182	2,819
1127	1108	transunion	0	4	16	20
1128	1144	saxo	0	2	1	4
1129	1193	mckinsey	0	221	10	231
1130	1160	tiaa	0	0	0	1
1131	1081	webjet	0	11	13	25
1132	1134	digikey	0	79	7	87
1133	1084	pamperedchef	0	2	1	3
1134	1051	livestrong	0	10	4	14
1135	1177	shriram	0	0	0	1
1136	1088	sling	0	10	39	49
1137	1076	stada	0	25	2	27
1138	911	edeka	0	5	2	8
1139	1126	erni	0	2	0	3
1140	1125	goodhands	0	0	0	0
1141	1141	watches	0	5	53	58
1142	1162	lundbeck	0	1	14	15
1143	1104	vana	0	5	0	5
1144	1136	bananarepublic	0	49	38	87

1145	1169	lancome	0	2	5	7
1146	1186	xn--80adxhks	0	0	0	1
1147	1180	forsale	0	7	2	9
1148	1182	reit	0	2	3	6
1149	1248	ryukyu	0	0	2	3
1150	1090	garnier	0	26	17	43
1151	1122	tjx	0	2	10	13
1152	1003	yachts	0	1	1	2
1153	1101	williamhill	0	66	37	103
1154	1223	voto	0	1	0	1
1155	1120	tatamotors	0	45	3	48
1156	1147	corsica	0	4	0	5
1157	989	mitek	0	14	0	15
1158	1131	canalplus	0	26	13	39
1159	1240	gives	0	0	0	1
1160	1152	abarth	0	1	1	2
1161	986	guitars	0	4	0	5
1162	1194	republican	0	0	0	1
1163	818	payu	0	6	7	13
1164	1184	neustar	0	33	2	35
1165	1172	maserati	0	9	5	14
1166	1132	cipriani	0	5	0	5
1167	1121	vons	0	1	0	1
1168	1310	africamagic	0	4	2	6
1169	1154	scholarships	0	1	2	4
1170	742	flir	0	25	3	28
1171	1198	gbiz	0	0	0	0
1172	1269	gripe	0	0	0	0
1173	1209	vuelos	0	13	3	16
1174	1102	hoteis	0	2	2	3
1175	995	condos	0	0	0	1
1176	1181	vacations	0	25	1	26
1177	n/a	xn--w4r85el8fhu5dnra	0	0	0	0
1178	1105	lancia	0	2	1	3
1179	1207	multichoice	0	0	13	13

1180	1227	duns	0	0	13	13
1181	1109	shiksha	0	19	2	21
1182	1113	akdn	0	1	0	2
1183	1135	ollo	0	1	70	71
1184	1163	amica	0	7	7	13
1185	1158	auspost	0	46	13	59
1186	1054	lamer	0	16	11	28
1187	1083	sener	0	2	2	4
1188	1087	mormon	0	1	1	2
1189	1159	tkmaxx	0	5	3	8
1190	1137	nowtv	0	2	2	4
1191	1192	xn--flw351e	0	0	0	0
1192	1176	netaporter	0	0	0	1
1193	1188	chatr	0	1	0	1
1194	1218	xn--5tzm5g	0	0	0	0
1195	1138	xn--p1acf	0	0	0	0
1196	1174	piperlime	0	5	6	11
1197	1241	xn--ses554g	0	0	0	0
1198	1179	financialaid	0	0	1	1
1199	1203	xn--unup4y	0	0	0	1
1200	1142	chartis	0	11	9	20
1201	1206	athleta	0	2	9	11
1202	1197	esurance	0	389	1	390
1203	1232	wolterskluwer	0	72	8	80
1204	1228	yamaxun	0	0	0	0
1205	1380	xn--fjq720a	0	0	0	0
1206	1242	firmdale	0	1	0	1
1207	1170	xn--11b4c3d	0	0	0	0
1208	1201	xn--tckwe	0	0	0	0
1209	1214	skolkovo	0	21	0	22
1210	1200	tjmaxx	0	14	0	14
1211	1222	xn--efvy88h	0	0	0	0
1212	1156	lifeinsurance	0	0	0	0
1213	1210	blackfriday	0	2	1	3
1214	1213	xn--ngbrx	0	0	0	0

1215	1256	xn--ngbc5azd	0	0	0	0
1216	1236	homegoods	0	11	0	11
1217	1168	schaeffler	0	11	2	13
1218	1230	xn--jlq480n2rg	0	0	0	0
1219	1185	exposed	0	0	0	1
1220	1350	xn--czrs0t	0	0	0	0
1221	1178	maybelline	0	5	6	11
1222	1211	xn--9krt00a	0	0	0	0
1223	1229	gotv	0	1	0	1
1224	1270	nextdirect	0	1	1	2
1225	1119	travelchannel	0	5	5	10
1226	1189	rockwool	0	260	5	265
1227	1221	vanish	0	0	0	1
1228	1244	xn--4gq48lf9j	0	0	0	0
1229	1271	praxi	0	1	0	1
1230	1195	swiftcover	0	0	0	1
1231	1219	calvinklein	0	1	0	1
1232	1217	lgbt	0	1	0	1
1233	1216	statebank	0	2	2	4
1234	1266	whoswho	0	1	3	4
1235	1208	yodobashi	0	24	2	26
1236	1254	kiehls	0	3	2	5
1237	1215	lplfinancial	0	2	0	2
1238	1167	datsun	0	0	0	0
1239	1308	xn--mgbab2bd	0	0	0	0
1240	1233	carinsurance	0	1	0	1
1241	1205	lipsy	0	0	1	2
1242	1128	autoinsurance	0	0	0	0
1243	1235	catalonia	0	4	0	5
1244	1258	everbank	0	1	16	16
1245	1249	mtpc	0	1	0	1
1246	1264	ggee	0	0	0	1
1247	1196	panerai	0	0	0	1
1248	1259	xn--kput3i	0	0	0	0
1249	1277	scjohnson	0	0	0	1

1250	1294	xn--6qq986b3xl	0	0	0	0
1251	1369	abbvie	0	2	3	5
1252	1273	bargains	0	1	1	2
1253	1238	cookingchannel	0	0	0	0
1254	1251	xn--cckwcxetd	0	0	0	0
1255	1285	xn--6frz82g	0	0	0	0
1256	1275	xn--8y0a063a	0	0	0	0
1257	1220	dabur	0	2	0	3
1258	1173	redken	0	0	0	1
1259	1246	travelguard	0	9	4	13
1260	1239	xn--4gbrim	0	0	0	1
1261	1276	xn--mgbca7dzdo	0	0	0	0
1262	1140	mozaic	0	1	0	2
1263	1226	naspers	0	934	32	966
1264	1191	xn--d1acj3b	0	0	0	0
1265	1293	wanggou	0	0	0	0
1266	1225	caseih	0	3	1	3
1267	1261	mrporter	0	1	2	3
1268	1263	passagens	0	0	2	2
1269	1260	xn--mgbb9fbpob	0	0	0	0
1270	1351	xn--pgb3ceoj	0	0	0	0
1271	1252	homesense	0	6	0	6
1272	1344	xn--rhqv96g	0	0	0	0
1273	1265	xihuan	0	10	64	74
1274	1250	changiairport	0	0	1	1
1275	1290	glean	0	0	11	11
1276	1231	kerastase	0	0	0	1
1277	1283	mutualfunds	0	0	0	0
1278	1312	lixil	0	0	5	5
1279	1288	rexroth	0	0	0	0
1280	1287	xn--otu796d	0	0	0	0
1281	1272	shopyourway	0	1	6	7
1282	1255	cancerresearch	0	2	0	2
1283	1234	northwesternmutual	0	746	1	747
1284	1335	persiangulf	0	1	0	1

1285	1267	kyknet	0	0	0	0
1286	1325	olayan	0	2	0	2
1287	1257	qpon	0	0	1	1
1288	1274	caremore	0	0	0	1
1289	1309	justforu	0	0	0	0
1290	1253	nissay	0	0	1	1
1291	1282	americanfamily	0	0	0	0
1292	1212	dclk	0	1	3	3
1293	1313	xn--fes124c	0	0	0	0
1294	1204	xn--mk1bu44c	0	0	0	0
1295	1164	uconnect	0	1	2	3
1296	1291	xn--qcka1pmc	0	0	0	0
1297	1379	guardianlife	0	0	0	1
1298	1295	xn--fiq228c5hs	0	0	0	0
1299	1316	xn--g2xx48c	0	0	0	0
1300	1349	xn--hxt814e	0	0	0	0
1301	1243	xn--mxtq1m	0	0	0	0
1302	1322	xn--xhq521b	0	0	0	0
1303	1280	pictet	0	0	1	1
1304	1302	xn--estv75g	0	0	0	0
1305	1329	xn--kpu716f	0	0	0	0
1306	1359	spreadbetting	0	0	0	0
1307	1278	xn--jlq61u9w7b	0	0	0	0
1308	1328	xn--vuq861b	0	0	0	0
1309	1336	ansons	0	0	0	0
1310	1303	bostik	0	7	1	8
1311	1279	iselect	0	0	2	3
1312	1289	orientexpress	0	0	0	0
1313	1296	travelersinsurance	0	0	0	0
1314	1297	xn--mgbaakc7dvf	0	0	0	0
1315	1317	xn--q9jyb4c	0	0	0	0
1316	1292	globalx	0	0	1	1
1317	1305	overheidnl	0	0	0	0
1318	1298	afamilycompany	0	0	0	0
1319	1324	cityeats	0	1	1	2

1320	1281	gecompany	0	3	0	3
1321	1319	tradershotels	0	0	0	0
1322	1286	xn--6rtwn	0	0	0	0
1323	1363	xn--gckr3f0f	0	0	0	0
1324	1389	xn--mgbt3dhd	0	0	0	0
1325	1304	extraspace	0	1	0	1
1326	1202	goldpoint	0	0	0	0
1327	1339	hisamitsu	0	0	0	1
1328	1262	ummah	0	1	1	2
1329	1321	nadex	0	0	0	0
1330	1307	xn--czru2d	0	0	0	0
1331	1314	agakhan	0	0	0	0
1332	1315	beknown	0	0	0	1
1333	1360	mrmuscle	0	0	0	0
1334	1150	xn--c2br7g	0	0	0	0
1335	1385	xn--ngbe9e0a	0	0	0	0
1336	1320	xn--nyqy26a	0	0	0	0
1337	1370	emerck	0	0	0	0
1338	n/a	merckmsd	0	0	0	0
1339	1357	nowruz	0	0	0	0
1340	1311	sandvikcoromant	0	0	0	0
1341	n/a	xn--3bst00m	0	0	0	0
1342	1387	xn--3ds443g	0	0	0	0
1343	1333	xn--5su34j936bgsg	0	0	0	0
1344	1381	xn--cg4bki	0	0	0	0
1345	1300	xn--eckvdtc9d	0	0	0	0
1346	1371	xn--fct429k	0	0	0	0
1347	1330	xn--gk3at1e	0	0	0	0
1348	1362	frogans	0	0	0	0
1349	1376	mzansimagic	0	0	0	0
1350	1301	olayangroup	0	0	0	0
1351	1334	xn--1qqw23a	0	0	0	0
1352	1347	xn--czr694b	0	0	0	0
1353	1338	xn--fiq64b	0	0	0	0
1354	n/a	xn--i1b6b1a6a2e	0	0	0	0

1355	n/a	allfinanzberatung	0	0	0	0
1356	1352	imamat	0	0	0	0
1357	1343	richardli	0	0	0	0
1358	1372	xn--1ck2e1b	0	0	0	0
1359	n/a	xn--3pxu8k	0	0	0	0
1360	1323	xn--45q11c	0	0	0	0
1361	n/a	xn--80aqecdr1a	0	0	0	0
1362	n/a	xn--imr513n	0	0	0	0
1363	1366	xn--kcrx7bb75ajk3b	0	0	0	0
1364	1367	xn--mgba7c0bbn0a	0	0	0	0
1365	n/a	xn--mgbi4ecexp	0	0	0	0
1366	1345	xn--t60b56a	0	0	0	0
1367	1377	xn--tiq49xqyj	0	0	0	0
1368	1306	allfinanz	0	3	0	3
1369	n/a	allfinanzberater	0	0	0	0
1370	1373	cashbackbonus	0	0	0	0
1371	1299	dotafrica	0	0	0	0
1372	1340	guardianmedia	0	0	0	0
1373	1374	kerryhotels	0	0	0	0
1374	1348	kerrylogisitics	0	0	0	0
1375	1386	kerryproperties	0	0	0	0
1376	1175	kuokgroup	0	2	0	2
1377	1364	lefrak	0	2	1	3
1378	1365	onyourside	0	0	0	0
1379	1341	redumbrella	0	0	0	0
1380	1356	schwarzgroup	0	0	0	0
1381	1318	stcgroup	0	4	1	5
1382	1346	xn--3oq18vl8pn36a	0	0	0	0
1383	1331	xn--9et52u	0	0	0	0
1384	1390	xn--bck1b9a5dre4c	0	0	0	0
1385	n/a	xn--c1yn36f	0	0	0	0
1386	1378	xn--dkwm73cwpn	0	0	0	0
1387	n/a	xn--fzys8d69uvgm	0	0	0	0
1388	1355	xn--jvr189m	0	0	0	0
1389	1342	xn--kcrx77d1x4a	0	0	0	0

1390	1388	xn--mgba3a3ejt	0	0	0	0
1391	1337	xn--nqv7f	0	0	0	0
1392	1354	xn--pbt977c	0	0	0	0
1393	1327	xn--rovu88b	0	0	0	0
1394	1384	xn--vermgensberater-ctb	0	0	0	0
1395	1383	xn--vhquv	0	0	0	0

Appendix C—Internal Name Certificates

The table in this Appendix shows the number of internal name certificates, for each certificate expiration year, issued by a representative sample of widely trusted CAs with a proposed TLD in either the subjectName or the subjectAlternativeName field. The list is sorted in order of total internal name certificates (the "Grand Total" column), and omits TLDs for which the total number is lower than 3. The columnn "2013 Ranking" shows the rank of the Proposed TLD in the occurrence frequency list for the 2013 DITL data (Appendix B).

Proposed TLD	2013	2014	2015	2016	2017	2018	2019	Grand Total	2013 Ranking
corp	947	974	591	78	52	5	0	2647	2
mail	431	554	421	72	36	1	2	1517	22
exchange	365	515	333	48	37	2	2	1302	124
hsbc	390	519	177	0	0	0	0	1086	14
cba	575	346	31	0	0	0	0	952	153
itau	326	41	75	0	0	0	0	442	87
sbs	111	150	116	9	10	0	0	396	118
ads	75	97	89	14	6	0	0	281	7
inc	52	61	56	4	2	0	0	175	15
office	39	63	62	6	2	1	0	173	18
global	39	74	53	1	0	2	0	169	4
email	45	57	41	6	7	0	1	157	158
group	48	52	27	2	2	0	0	131	9
network	19	50	35	5	3	0	0	112	8
dev	51	29	24	3	2	0	0	109	17
home	25	37	32	0	3	0	0	97	1
telefonica	32	46	7	0	0	6	0	91	37
bank	14	54	6	0	4	0	0	78	35
hermes	19	30	23	4	1	0	0	77	185
storage	22	17	37	0	0	0	0	76	393
media	2	20	36	0	1	0	0	59	107
secure	22	22	7	2	1	0	0	54	220
tech	0	44	8	1	1	0	0	54	45
prod	25	8	14	0	3	1	0	51	12
cloud	16	22	10	0	0	0	0	48	51

Proposed TLD	2013	2014	2015	2016	2017	2018	2019	Grand Total	2013 Ranking
llc	16	21	6	3	1	0	0	47	42
red	32	4	9	1	0	0	0	46	32
services	32	5	3	1	1	0	0	42	103
law	6	14	16	4	0	0	0	40	79
star	23	12	4	0	0	0	0	39	21
ltd	14	12	7	0	0	0	0	33	23
life	6	8	5	13	0	0	0	32	262
site	8	5	18	0	0	1	0	32	6
anz	13	9	9	0	0	0	0	31	208
farm	9	9	5	7	0	0	0	30	129
llp	6	5	19	0	0	0	0	30	115
school	5	12	10	2	0	0	0	29	34
city	3	6	13	1	4	0	0	27	74
green	20	3	4	0	0	0	0	27	268
zone	9	11	3	0	1	0	0	24	38
web	9	6	5	1	1	0	0	22	30
college	6	5	10	0	0	0	0	21	90
family	0	19	2	0	0	0	0	21	102
meet	2	8	8	0	0	0	0	18	653
oracle	0	14	2	1	0	0	0	17	403
sydney	3	12	2	0	0	0	0	17	346
data	3	2	11	0	0	0	0	16	65
earth	1	5	8	0	1	0	0	15	125
gold	5	8	2	0	0	0	0	15	69
hosting	7	7	1	0	0	0	0	15	136
london	4	6	4	0	1	0	0	15	180
mobile	4	3	5	2	0	0	0	14	135
support	4	5	4	1	0	0	0	14	203
host	8	3	2	0	0	0	0	13	20
olympus	0	8	4	1	0	0	0	13	73
company	1	9	1	0	1	0	0	12	86
nexus	0	6	6	0	0	0	0	12	254
matrix	1	6	4	0	0	0	0	11	106

Proposed TLD	2013	2014	2015	2016	2017	2018	2019	Grand Total	2013 Ranking
store	4	4	2	0	0	0	0	10	164
one	3	3	3	0	0	0	0	9	57
orange	7	0	2	0	0	0	0	9	31
shaw	2	0	7	0	0	0	0	9	355
vision	1	0	8	0	0	0	0	9	330
wiki	3	4	1	0	1	0	0	9	242
app	2	2	4	0	0	0	0	8	26
directory	2	5	0	0	1	0	0	8	361
svr	3	4	1	0	0	0	0	8	161
top	2	1	5	0	0	0	0	8	56
wow	1	4	2	0	0	1	0	8	60
delta	2	2	2	0	1	0	0	7	104
george	0	5	2	0	0	0	0	7	276
phone	1	2	2	2	0	0	0	7	392
prime	0	6	1	0	0	0	0	7	223
win	2	3	2	0	0	0	0	7	16
blue	2	2	1	0	1	0	0	6	228
center	0	5	1	0	0	0	0	6	77
dealer	1	5	0	0	0	0	0	6	641
kiwi	0	6	0	0	0	0	0	6	440
lds	4	0	2	0	0	0	0	6	336
live	4	1	1	0	0	0	0	6	71
med	1	2	3	0	0	0	0	6	5
sapphire	4	0	2	0	0	0	0	6	777
sbi	1	0	5	0	0	0	0	6	130
swiss	2	3	1	0	0	0	0	6	395
theatre	0	6	0	0	0	0	0	6	807
abc	1	3	1	0	0	0	0	5	41
fitness	0	5	0	0	0	0	0	5	557
omega	0	4	0	1	0	0	0	5	266
town	3	0	0	1	1	0	0	5	207
tvs	0	5	0	0	0	0	0	5	217
walter	3	1	0	1	0	0	0	5	448

Proposed TLD	2013	2014	2015	2016	2017	2018	2019	Grand Total	2013 Ranking
business	1	2	1	0	0	0	0	4	19
cal	0	2	2	0	0	0	0	4	188
astrium	2	0	2	0	0	0	0	4	741
case	2	2	0	0	0	0	0	4	542
docs	0	2	1	1	0	0	0	4	529
ist	0	1	3	0	0	0	0	4	186
miami	1	3	0	0	0	0	0	4	241
mit	2	2	0	0	0	0	0	4	144
moe	0	1	2	1	0	0	0	4	165
monster	0	2	2	0	0	0	0	4	245
natura	0	4	0	0	0	0	0	4	131
nyc	1	2	1	0	0	0	0	4	109
observer	0	4	0	0	0	0	0	4	1011
off	1	0	3	0	0	0	0	4	50
paris	3	0	1	0	0	0	0	4	183
pet	0	3	1	0	0	0	0	4	256
rogers	0	4	0	0	0	0	0	4	274
smart	2	1	1	0	0	0	0	4	29
wine	1	2	1	0	0	0	0	4	805
world	0	4	0	0	0	0	0	4	27
academy	0	2	1	0	0	0	0	3	176
africa	3	0	0	0	0	0	0	3	236
amazon	1	0	2	0	0	0	0	3	92
baby	0	1	2	0	0	0	0	3	331
blog	2	1	0	0	0	0	0	3	62
car	3	0	0	0	0	0	0	3	177
church	1	0	1	0	1	0	0	3	191
community	1	2	0	0	0	0	0	3	325
cpa	1	2	0	0	0	0	0	3	221
fit	0	3	0	0	0	0	0	3	321
bbt	0	2	0	0	1	0	0	3	238
cam	1	2	0	0	0	0	0	3	68
banamex	0	3	0	0	0	0	0	3	790

Proposed TLD	2013	2014	2015	2016	2017	2018	2019	Grand Total	2013 Ranking
eco	0	1	2	0	0	0	0	3	315
epost	0	1	2	0	0	0	0	3	1037
heart	0	3	0	0	0	0	0	3	555
ice	1	0	2	0	0	0	0	3	3
ikano	0	3	0	0	0	0	0	3	253
jaguar	3	0	0	0	0	0	0	3	563
kim	0	3	0	0	0	0	0	3	310
lasalle	3	0	0	0	0	0	0	3	430
lincoln	2	1	0	0	0	0	0	3	372
melbourne	1	0	2	0	0	0	0	3	700
online	1	2	0	0	0	0	0	3	119
rest	3	0	0	0	0	0	0	3	657
roma	0	3	0	0	0	0	0	3	226
showtime	3	0	0	0	0	0	0	3	912
spot	0	3	0	0	0	0	0	3	290
team	2	0	1	0	0	0	0	3	168
work	2	0	1	0	0	0	0	3	63

Appendix D—Top 25 by Root Server (2012)

This Appendix shows counts (in thousands) by individual root for the 25 proposed TLD strings that occur most frequently overall in the 2012 DITL data. Shaded cells highlight anomalously large counts for some strings at particular roots.

Rank	Proposed TLD	all	a-root	c-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
1	home	594,453	29,161	95,590	7,173	95,687	31,986	90,431	68,110	61,447	77,834	37,034
2	corp	123,165	11,251	21,216	3,014	14,601	10,068	11,670	10,389	11,769	19,984	9,203
3	site	13,032	941	1,255	349	1,817	807	1,678	1,258	1,345	1,266	2,316
4	global	10,735	801	1,361	224	1,047	686	1,395	1,707	1,110	1,550	854
5	ads	7,729	766	1,284	249	757	671	852	666	831	985	668
6	iinet	7,673	20	16	3	44	16	3,998	654	67	2,840	15
7	group	6,440	461	906	113	576	318	1,043	671	938	780	634
8	box	6,103	550	818	204	580	411	666	700	859	785	530
9	cisco	5,159	435	727	104	710	394	392	992	424	643	338
10	hsbc	4,995	338	1,010	128	667	360	729	367	452	699	245
11	inc	4,632	396	904	147	563	463	441	358	392	641	327
12	network	4,385	273	454	40	420	229	840	486	887	456	300
13	dev	4,345	366	751	100	480	341	525	395	467	594	326
14	prod	4,031	413	897	84	373	400	394	310	333	582	245
15	office	3,828	341	626	95	427	312	455	335	434	528	275
16	host	2,962	321	393	49	132	317	356	452	310	332	300
17	app	2,564	346	253	110	218	208	228	361	296	316	228
18	win	2,441	81	148	31	515	75	125	165	203	1,013	85
19	ltd	2,012	190	445	41	253	186	130	159	133	378	97
20	business	1,955	12	23	2	205	9	23	130	41	9	1,501
21	ice	1,849	50	363	6	229	79	217	317	332	225	31
22	link	1,754	36	78	5	62	33	58	45	47	1,348	42
23	google	1,653	129	224	36	207	132	173	178	224	209	141
24	red	1,625	46	436	17	46	120	48	630	101	84	97
25	world	1,496	156	224	41	139	94	195	134	197	194	122

Appendix E—Top 25 by Root Server (2013)

This Appendix shows counts (in thousands) by individual root for the 25 proposed TLD strings that occur most frequently overall in the 2013 DITL data. Shaded cells highlight anomalously large counts for some strings at particular roots.

Rank	Proposed TLD	all	a-root	c-root	d-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
1	home	954,650	124,496	110,795	39,885	8,281	95,182	49,745	177,762	32,549	108,937	137,268	69,750
2	corp	144,407	28,101	17,712	8,817	2,157	11,610	10,446	18,128	5,912	13,632	18,961	8,931
3	ice	19,600	3,352	2,661	1,151	8	2,240	528	3,113	2,067	2,019	2,291	170
4	global	12,393	1,914	1,287	879	177	857	762	1,953	809	1,252	1,660	843
5	site	10,848	1,968	1,168	439	144	981	532	1,589	300	1,185	889	1,653
6	med	10,747	297	2,863	79	19	423	102	1,981	18	172	4,661	132
7	ads	10,670	1,852	1,396	706	210	982	811	1,398	390	1,089	1,153	683
8	network	8,733	859	947	607	38	359	255	943	738	820	2,925	242
9	group	8,564	1,107	809	523	71	791	466	1,574	367	1,276	899	681
10	cisco	8,390	1,433	1,218	446	106	713	608	1,070	418	839	1,085	454
11	box	7,573	1,002	1,111	480	151	464	402	1,510	196	1,180	594	483
12	prod	7,056	1,798	1,034	527	88	475	570	699	223	592	767	283
13	iinet	5,582	45	77	2,374	1	40	22	810	197	40	1,943	33
14	win	5,305	347	210	345	11	1,165	115	255	429	139	2,147	142
15	hsbc	5,297	1,101	732	296	54	464	407	639	327	497	514	266
16	inc	5,130	1,214	731	317	78	370	419	526	220	340	656	259
17	dev	4,972	912	599	331	72	348	364	644	215	520	671	296
18	office	4,110	610	515	288	49	293	265	577	194	476	594	249
19	business	3,262	423	142	33	9	22	25	84	521	81	48	1,874
20	host	3,088	964	347	149	15	111	244	402	37	435	159	225
21	star	2,497	376	282	103	34	230	169	368	89	260	381	205
22	mail	2,388	449	262	145	24	171	170	328	118	278	262	181
23	ltd	1,941	450	251	128	18	149	144	160	120	164	263	94
24	google	1,874	350	209	113	13	176	98	266	73	167	285	124
25	sap	1,790	302	198	128	26	142	101	222	121	178	273	99

Appendix F—SLD is an Existing TLD (2012)

This Appendix shows counts (in thousands) for the top 25 proposed TLD strings for which the SLD is an existing TLD:

Rank	Proposed TLD	all	a-root	c-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
1	home	133,476	8,482	22,197	2,156	15,631	8,156	19,852	13,823	15,527	16,993	10,659
2	site	10,459	679	937	266	1,586	630	1,404	971	958	973	2,055
3	corp	4,472	405	781	102	484	349	417	426	423	697	388
4	hsbc	2,514	186	571	82	282	195	440	157	156	359	86
5	iinet	1,421	6	2	0	10	1	463	143	23	771	2
6	smart	1,215	120	135	65	227	82	149	77	71	184	105
7	cisco	840	90	118	14	96	82	86	63	81	134	76
8	business	499	0	11	0	81	0	10	44	12	1	340
9	group	496	33	84	10	60	30	44	41	37	137	20
10	office	390	28	46	8	39	31	50	48	37	64	39
11	unicorn	360	22	13	0	91	10	3	105	52	18	46
12	off	282	53	33	0	17	66	10	11	28	44	20
13	orange	267	16	27	0	26	10	35	57	35	21	40
14	sew	254	28	22	6	23	17	37	32	32	30	27
15	network	211	10	31	2	35	12	17	15	16	62	11
16	mail	210	15	24	2	28	33	21	19	19	27	22
17	ibm	197	21	29	4	11	18	21	19	36	12	26
18	inc	193	11	19	5	26	11	27	28	21	37	8
19	ericsson	174	16	12	0	59	15	29	11	22	0	10
20	ads	164	17	20	10	12	10	21	18	12	32	12
21	world	156	16	17	4	10	8	27	17	25	24	8
22	natura	149	13	12	6	34	7	10	18	7	37	5
23	ifm	148	10	26	0	20	14	13	14	8	31	12
24	win	146	6	2	0	51	3	3	6	20	55	0
25	house	145	10	13	0	35	5	10	11	13	39	9

Appendix G—SLD is an Existing TLD (2013)

This Appendix shows counts (in thousands) for the top 25 proposed TLD strings for which the SLD is an existing TLD:

Rank	Proposed TLD	all	a-root	c-root	d-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
1	home	168,149	20,459	18,397	7,342	2,019	15,708	9,144	31,218	7,206	18,562	25,113	12,981
2	site	8,624	1,668	860	304	104	796	410	1,208	206	917	651	1,500
3	corp	5,334	1,080	640	353	71	436	354	688	239	474	628	371
4	hsbc	2,570	587	396	154	32	221	210	234	173	172	285	106
5	cisco	1,364	205	203	71	11	99	98	188	77	157	182	73
6	iinet	1,169	9	11	502	0	11	3	164	55	4	402	8
7	business	917	125	30	12	6	4	5	26	160	22	7	520
8	ads	899	85	232	43	6	100	77	93	4	84	71	104
9	smart	876	214	74	45	47	96	80	60	1	91	67	101
10	group	599	136	50	41	4	41	54	72	24	57	95	25
11	kpmg	448	125	27	9	0	31	22	71	0	63	0	100
12	mail	414	139	28	21	0	10	45	49	4	48	40	30
13	global	364	47	30	23	3	24	23	66	27	46	42	33
14	sew	339	51	32	12	3	34	24	59	24	34	43	23
15	office	308	37	30	18	5	17	11	54	17	34	66	19
16	off	295	53	23	15	0	13	29	26	16	18	95	7
17	telefonica	289	11	51	6	0	10	17	66	3	39	9	77
18	samsung	272	20	18	3	0	10	8	18	121	16	8	50
19	ifm	246	33	39	9	2	20	15	36	22	24	31	15
20	ericsson	211	78	8	1	0	36	6	49	2	7	6	18
21	abc	187	21	13	4	5	28	8	28	6	17	27	30
22	casa	181	20	58	1	0	15	21	14	14	9	19	10
23	dev	177	31	19	10	1	8	20	28	8	25	19	8
24	inc	176	24	15	5	0	10	11	54	9	16	27	5
25	orange	173	27	17	2	1	6	2	16	35	15	3	49

Appendix H—TLD and SLD are both applied-for strings (2012)

This Appendix shows counts (in thousands) for the top 25 proposed TLD strings for which the SLD is also a proposed TLD:

Rank	Proposed TLD	all	a-root	c-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
1	sap	21,526	1,881	2,996	493	2,472	1,550	2,358	1,954	2,713	3,363	1,746
2	bank	11,693	1,256	2,672	423	1,430	1,352	651	678	634	2,066	531
3	home	2,189	121	212	8	144	117	554	220	561	127	125
4	teva	2,052	154	333	38	190	151	257	210	261	270	188
5	airbus	1,929	147	302	31	145	111	244	170	297	261	221
6	bmw	1,824	206	257	58	170	149	199	203	202	239	141
7	corp	1,801	183	352	81	227	181	128	113	129	248	159
8	global	1,222	88	175	7	131	86	181	129	173	150	102
9	joy	779	56	155	11	80	74	75	57	50	181	40
10	work	709	19	29	25	399	24	107	69	22	3	12
11	network	599	58	83	14	57	49	63	59	48	113	55
12	quest	509	58	84	20	64	30	38	35	50	92	38
13	hosting	470	40	43	1	38	38	66	77	93	43	31
14	ads	395	53	37	7	41	26	58	58	50	40	25
15	cam	337	19	53	13	54	20	50	24	33	47	24
16	rockwool	332	29	42	9	24	19	72	37	28	43	29
17	stream	325	32	53	11	33	38	24	36	31	52	15
18	casa	288	11	81	10	17	9	29	22	36	29	44
19	astrium	281	19	49	4	24	10	25	40	46	40	24
20	mail	267	33	32	6	39	21	28	19	32	30	27
21	delta	229	20	11	3	54	5	26	15	21	17	57
22	broker	202	22	54	12	22	15	11	5	9	43	9
23	skype	200	15	31	7	16	11	29	22	29	21	19
24	yahoo	197	12	37	5	25	13	22	20	18	30	15
25	olympus	197	15	15	7	24	10	35	16	26	20	29

Appendix I—TLD and SLD are both applied-for strings (2013)

This Appendix shows counts (in thousands) for the top 25 proposed TLD strings for which the SLD is also a proposed TLD:

Rank	Proposed TLD	all	a-root	c-root	d-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
1	sap	17,775	2,815	1,745	1,081	349	1,567	1,135	2,495	1,049	1,871	2,558	1,110
2	bank	11,558	3,110	1,709	710	243	656	964	896	452	649	1,670	499
3	home	6,530	642	733	481	22	123	159	570	603	514	2,595	88
4	corp	4,269	725	503	287	70	346	335	486	247	362	627	281
5	teva	2,536	388	315	183	24	181	145	394	117	338	269	182
6	airbus	2,398	452	267	153	20	168	121	379	104	337	170	227
7	bmw	1,838	292	199	177	47	142	134	287	78	207	172	103
8	global	1,655	178	147	79	9	141	87	373	110	159	289	83
9	quest	719	187	76	45	9	41	58	73	21	69	96	44
10	network	650	108	71	42	8	46	52	78	27	71	102	45
11	stream	570	144	76	35	10	60	40	59	10	51	48	37
12	delta	506	96	51	36	7	35	29	73	20	57	32	70
13	joy	497	95	71	30	3	60	37	50	23	26	81	21
14	ads	468	104	37	34	14	42	31	72	12	49	47	26
15	hosting	434	32	29	80	0	37	36	72	15	57	42	34
16	astrium	400	65	45	15	5	34	17	61	13	77	24	44
17	mail	363	58	39	18	2	30	20	56	19	44	54	23
18	cam	315	42	23	23	3	35	23	62	11	35	49	9
19	casa	310	56	66	10	1	9	8	56	10	31	19	44
20	google	306	45	37	16	3	24	13	91	17	22	17	21
21	telefonica	295	35	37	18	2	28	22	33	6	31	41	42
22	rockwool	270	30	25	26	1	20	21	45	20	29	28	25
23	yahoo	260	49	32	17	0	21	17	42	19	33	17	13
24	olympus	240	23	16	7	3	22	14	50	13	37	27	28
25	services	240	72	23	7	18	22	19	24	5	20	22	8

Appendix J—QNAME is `www.ProposedTLD` (2012)

This Appendix shows counts (in thousands) for the top 25 proposed TLD strings for which the full QNAME is www.ProposedTLD:

Rank	Proposed TLD	all	a-root	c-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
1	youtube	779	53	107	14	81	69	91	95	98	86	85
2	google	491	38	67	15	51	46	48	56	76	42	52
3	you	366	33	41	10	31	30	42	49	40	45	45
4	goo	147	10	13	7	25	12	16	16	21	17	10
5	yahoo	115	13	14	6	21	7	7	12	11	17	7
6	goog	113	9	16	1	10	10	19	11	12	16	9
7	amazon	91	6	12	3	12	7	10	9	13	13	6
8	home	68	1	12	3	6	3	9	9	7	7	11
9	gmail	57	4	13	0	11	3	4	3	9	7	3
10	dish	49	3	6	1	12	1	6	5	5	5	5
11	media	47	4	12	0	4	2	6	5	4	6	4
12	baidu	45	6	2	3	7	0	6	4	4	2	11
13	hotmail	45	1	6	2	4	2	9	4	2	11	4
14	med	45	1	11	1	5	2	4	6	6	7	2
15	hot	43	8	7	1	0	2	4	6	7	6	2
16	imdb	42	4	5	2	3	5	5	9	3	5	1
17	games	25	1	3	0	5	2	4	4	4	2	0
18	flickr	22	3	5	1	1	1	5	2	2	2	0
19	porn	22	1	2	0	3	1	2	4	3	5	1
20	photo	20	2	3	0	1	2	5	2	3	0	2
21	sex	18	0	1	1	4	0	4	2	1	4	1
22	mail	18	0	2	0	0	0	2	3	4	4	3
23	fox	18	1	3	1	1	2	4	4	0	0	2
24	active	18	1	4	0	5	4	2	1	0	0	1
25	new	15	1	2	0	2	2	3	1	1	1	2

Appendix K—QNAME is `www.ProposedTLD` (2013)

This Appendix shows counts (in thousands) for the top 25 proposed TLD strings for which the full QNAME is www.ProposedTLD:

Rank	Proposed TLD	all	a-root	c-root	d-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
1	youtube	539	108	49	56	8	43	40	67	29	49	53	37
2	google	512	149	43	35	5	45	23	59	24	36	58	35
3	you	359	56	29	27	4	40	25	54	20	43	39	22
4	goo	165	32	14	12	3	13	8	22	10	16	20	15
5	goog	117	23	10	5	0	11	12	17	6	12	17	4
6	yahoo	105	20	8	5	1	9	5	10	7	14	15	11
7	home	67	7	9	6	1	7	6	5	4	8	8	6
8	gmail	58	10	9	4	1	3	4	4	4	9	10	0
9	college	55	11	5	3	1	4	1	8	2	7	7	6
10	baidu	52	8	2	1	3	9	1	7	4	4	7	6
11	hotmail	49	7	6	4	0	6	4	1	2	5	9	5
12	tech	48	5	3	2	1	8	1	6	3	9	6	4
13	hot	44	7	2	2	0	7	1	5	1	6	12	1
14	amazon	35	9	3	4	0	2	1	4	2	3	7	0
15	med	33	6	2	1	0	1	4	1	4	4	6	4
16	bing	21	7	2	3	0	3	0	2	1	1	1	1
17	media	19	3	1	2	0	2	1	3	1	1	4	1
18	sex	18	5	3	1	0	3	1	2	0	0	2	1
19	mail	17	0	1	2	0	3	1	1	1	1	6	1
20	bbc	17	4	1	1	0	1	0	4	2	2	2	0
21	flickr	15	4	3	0	0	2	0	1	2	2	1	0
22	red	13	5	0	1	0	1	0	0	1	1	4	0
23	fun	13	6	1	0	0	1	1	2	0	1	0	1
24	web	12	2	2	1	0	1	1	3	1	0	1	0
25	shop	12	3	2	1	0	1	1	1	0	2	0	1

Appendix L—LDAP and Kerberos names (2012)

This Appendix shows counts (in thousands) for the top 25 proposed TLD strings for which the label in the low-order position in the QNAME is either `_ldap` or `_kerberos`:

Rank	Proposed TLD	all	a-root	c-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
1	corp	15,845	1,502	2,717	401	1,921	1,375	1,431	1,428	1,384	2,417	1,269
2	global	1,533	122	218	31	171	107	221	173	163	205	122
3	ads	1,467	161	230	57	163	105	128	131	180	194	118
4	group	981	89	154	16	100	67	125	106	121	110	93
5	inc	721	65	155	17	96	74	44	52	55	120	43
6	office	702	72	132	14	95	67	73	42	62	91	54
7	home	683	55	116	18	68	57	83	64	69	107	46
8	win	561	12	28	7	120	11	19	40	50	259	15
9	network	411	32	49	5	55	24	50	38	68	51	39
10	hsbc	261	25	44	8	34	12	24	31	36	27	20
11	dev	260	24	41	6	25	25	27	26	28	29	29
12	prod	253	20	48	3	29	31	23	32	13	40	14
13	mnet	218	14	20	5	24	13	25	31	30	33	23
14	red	166	7	46	2	5	11	9	23	19	19	25
15	world	161	21	26	6	10	14	13	12	18	22	19
16	school	160	10	37	5	11	5	37	7	17	20	11
17	ltd	137	10	24	3	17	10	10	15	14	16	18
18	star	115	10	23	3	18	15	9	7	11	14	5
19	medical	100	3	11	2	12	15	11	11	8	18	9
20	box	91	8	19	1	7	9	9	10	14	9	5
21	site	89	11	10	3	7	4	9	10	16	10	9
22	llc	88	8	20	0	9	11	6	5	3	19	7
23	top	87	13	10	2	9	8	12	8	12	8	5
24	med	81	7	14	2	9	8	7	8	7	16	3
25	sbs	70	6	6	5	4	6	11	5	9	10	8

Appendix M—LDAP and Kerberos names (2013)

This Appendix shows counts (in thousands) for the top 25 proposed TLD strings for which the label in the low-order position in the QNAME is either `_ldap` or `_kerberos`:

Rank	Proposed TLD	all	a-root	c-root	d-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
1	corp	20,166	4,045	2,329	1,268	319	1,815	1,480	2,295	875	1,639	2,823	1,278
2	global	2,154	353	238	142	50	148	132	323	142	221	271	134
3	ads	1,948	359	218	148	51	143	154	267	69	190	233	116
4	group	1,367	192	122	78	9	123	77	248	75	175	163	105
5	inc	928	210	141	55	16	73	70	75	53	60	123	52
6	home	856	132	97	69	14	54	63	128	32	95	109	63
7	win	837	63	43	40	2	205	19	35	62	18	330	20
8	office	822	134	88	52	13	73	55	105	36	91	125	50
9	network	525	45	45	28	7	68	26	85	33	65	94	29
10	dev	370	49	46	30	6	26	26	46	27	45	43	26
11	mnet	359	48	32	25	5	30	15	51	25	48	56	24
12	hsbc	344	71	46	19	8	29	26	44	15	33	36	17
13	prod	281	68	41	28	7	13	20	24	15	29	29	7
14	world	229	34	25	20	5	16	19	36	10	34	19	11
15	star	209	41	26	9	3	20	13	22	10	22	36	7
16	ltd	182	29	20	7	1	20	12	17	8	28	29	11
17	red	182	36	33	8	0	4	15	22	9	27	9	19
18	school	154	22	11	19	3	14	6	22	0	22	19	16
19	site	135	33	13	8	6	11	7	27	4	7	12	7
20	medical	134	28	18	10	3	7	12	13	7	11	19	6
21	box	128	25	17	13	2	7	7	23	2	17	9	6
22	center	104	20	4	3	0	10	4	22	1	18	8	14
23	llc	102	24	17	4	1	10	3	8	6	7	15	7
24	msd	101	22	11	5	1	9	4	16	9	7	8	9
25	top	97	9	9	2	4	11	8	15	6	13	10	10

Appendix N—_dns-sd DNS names (2012)

This Appendix shows counts (in thousands) for the top 25 proposed TLD strings for which the string _dns-sd occurs somewhere in the QNAME:

Rank	Proposed TLD	all	a-root	c-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
1	home	4,903	426	663	102	533	357	617	638	546	493	528
2	cisco	594	55	73	18	64	44	79	69	71	83	38
3	network	280	23	40	8	34	18	31	30	32	45	19
4	google	203	25	28	4	17	19	22	17	15	36	20
5	casa	170	18	44	1	19	5	10	22	12	21	18
6	office	156	11	21	5	28	17	15	16	14	20	9
7	house	138	17	16	2	13	16	8	15	12	31	8
8	family	122	7	15	1	18	15	15	12	5	28	6
9	hotel	73	4	9	1	7	5	6	11	7	12	11
10	maison	72	5	22	1	5	2	12	5	5	8	7
11	and	71	6	10	1	10	5	5	6	8	14	6
12	matrix	65	3	11	1	8	8	7	4	2	17	4
13	orange	63	5	10	5	2	1	6	14	5	9	6
14	apple	52	4	7	0	6	2	10	6	2	7	8
15	iinet	52	1	1	1	3	0	14	8	2	22	0
16	corp	44	2	5	4	8	6	0	5	4	8	2
17	yahoo	43	3	4	1	10	0	5	5	2	7	6
18	comcast	42	1	10	1	9	2	1	2	2	13	1
19	red	42	1	10	1	7	2	1	3	8	6	3
20	studio	41	1	8	0	3	5	2	7	6	5	4
21	unicorn	39	3	1	1	6	0	2	10	3	2	11
22	global	38	2	4	1	8	2	2	2	6	9	2
23	free	38	2	11	1	5	1	2	3	3	5	5
24	philips	37	4	2	0	10	2	5	1	8	4	1
25	vip	35	2	3	1	8	3	1	6	2	9	0

Appendix O—_dns-sd DNS names (2013)

This Appendix shows counts (in thousands) for the top 25 proposed TLD strings for which the string `_dns-sd` occurs somewhere in the QNAME:

Rank	Proposed TLD	all	a-root	c-root	d-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
1	home	4,576	585	492	389	33	540	263	671	428	402	427	346
2	cisco	483	85	59	31	8	46	33	55	22	41	73	30
3	network	128	24	19	11	2	11	12	7	8	7	23	4
4	google	106	13	16	6	0	10	5	14	5	12	20	5
5	casa	95	19	15	3	0	16	3	5	5	4	22	3
6	office	88	25	9	7	3	6	4	7	7	10	8	2
7	house	49	11	9	1	2	2	3	4	3	2	12	0
8	family	44	8	11	3	0	4	4	0	4	3	5	2
9	orange	42	4	6	5	2	2	4	4	5	4	0	6
10	maison	41	4	5	3	0	1	0	8	3	8	3	6
11	hotel	39	5	2	2	0	1	4	7	1	12	2	3
12	comcast	39	6	7	3	0	1	3	2	3	1	13	0
13	global	39	6	4	3	0	3	1	3	3	2	9	5
14	apple	38	1	6	2	1	3	1	7	0	4	8	5
15	iinet	32	2	2	10	0	0	2	3	2	0	11	0
16	corp	30	1	6	4	1	2	3	5	0	2	4	2
17	sfr	26	7	4	3	0	2	0	3	0	7	0	0
18	matrix	25	3	7	1	0	3	3	0	2	1	3	2
19	and	21	3	2	3	1	2	2	2	2	2	2	0
20	studio	21	3	3	3	0	0	2	3	1	2	4	0
21	philips	18	2	2	8	0	1	0	0	1	1	2	1
22	unicorn	17	1	1	0	0	1	1	1	6	0	3	3
23	box	17	2	3	1	0	1	0	2	0	2	4	2
24	yahoo	15	2	4	1	0	0	0	2	1	4	0	1
25	business	15	2	0	0	0	0	1	1	0	1	1	9

Appendix P—String occurrence at different levels (2012)

This Appendix shows counts (in thousands) for the top 30 proposed TLD strings at each of the top 9 levels in the QNAME:

	home	corp	site	global	ads	iinet	group	box	cisco	hsbc
All	622,865	193,864	13,637	33,571	15,935	11,320	12,804	8,141	7,891	6,482
TLD	595,024	122,794	13,013	10,838	7,799	7,668	6,505	6,152	5,231	4,924
SLD	24,117	31,084	212	8,895	1,501	236	4,374	860	2,317	398
3LD	2,147	22,505	266	11,474	4,166	3,116	1,342	999	133	1,062
4LD	1,034	7,984	102	1,242	1,831	236	342	106	179	33
5LD	199	7,539	25	793	521	37	125	13	9	7
6LD	291	1,757	7	272	61	9	37	6	6	42
7LD	40	157	12	50	36	18	77	1	15	8
8LD	7	27	0	5	12	1	1	0	0	8
9LD	4	13	0	2	4	0	0	0	0	0
>9	1	3	0	1	4	0	0	3	0	0

	inc	network	dev	prod	office	host	app	win	ltd	business
All	5,094	8,950	8,457	11,343	9,439	9,145	5,056	4,171	2,492	4,045
TLD	4,622	4,417	4,344	4,107	3,833	2,965	2,573	2,511	1,962	1,920
SLD	341	2,593	1,614	754	2,503	4,399	416	376	454	188
3LD	84	952	1,946	4,454	2,471	621	1,070	857	48	1,187
4LD	24	244	360	1,063	509	505	712	162	9	526
5LD	6	94	130	510	73	486	224	139	11	128
6LD	3	42	35	180	36	119	28	43	5	51
7LD	1	607	14	160	4	29	23	76	3	41
8LD	1	1	7	98	5	15	8	4	0	3
9LD	11	0	1	15	3	4	1	1	0	1
>9	0	0	5	1	1	2	1	0	0	0

	ice	link	google	red	mail	smart	world	casa	med	mnet
All	3,523	4,009	241,861	3,370	70,653	2,371	2,009	1,820	4,649	1,743
TLD	1,837	1,776	1,644	1,603	1,505	1,475	1,441	1,283	1,262	1,132
SLD	547	829	209,697	359	26,137	532	409	432	246	222
3LD	1,050	960	22,966	534	23,628	278	97	90	1,943	194
4LD	69	373	3,412	718	13,599	34	42	7	1,019	192
5LD	16	58	1,410	73	3,416	37	16	2	119	3
6LD	1	7	2,101	34	805	6	3	2	33	0
7LD	2	4	347	32	325	2	1	1	15	0
8LD	0	1	139	10	914	3	0	0	1	0
9LD	0	0	20	5	295	1	0	0	11	0
>9	0	0	125	2	29	1	0	1	0	0

Appendix Q—String occurrence at different levels (2013)

This Appendix shows counts (in thousands) for the top 30 proposed TLD strings at each of the top 9 levels in the QNAME:

	home	corp	ice	global	med	site	ads	network	group	cisco
All	985,252	230,045	21,249	41,061	13,788	11,204	24,690	12,470	16,171	13,124
TLD	952,944	144,507	19,789	12,352	10,801	10,716	10,563	8,711	8,580	8,284
SLD	29,430	41,746	269	11,081	251	302	2,045	2,823	5,570	4,525
3LD	1,413	27,552	1,109	15,853	1,838	97	9,489	404	1,599	113
4LD	1,116	9,105	66	936	764	38	1,989	214	123	170
5LD	175	5,827	11	690	60	12	469	211	96	12
6LD	143	1,204	2	104	63	5	89	41	195	4
7LD	23	54	1	17	8	33	27	65	6	13
8LD	6	19	1	26	1	1	15	1	2	0
9LD	2	16	0	1	0	0	2	0	1	0
>9	*2*	*15*	*0*	*1*	*0*	*0*	*2*	*0*	*0*	*0*

	box	prod	iinet	hsbc	inc	win	dev	office	business	host
All	9,437	15,300	7,217	6,864	5,511	7,093	10,259	10,162	5,201	5,227
TLD	7,694	7,004	5,427	5,249	5,208	5,199	5,058	4,006	3,279	3,127
SLD	940	1,447	129	407	194	340	2,271	3,125	187	692
3LD	694	5,222	1,414	1,103	74	1,215	2,320	2,251	1,095	505
4LD	47	887	212	62	17	107	353	561	456	424
5LD	48	436	21	8	11	153	188	118	111	361
6LD	6	193	4	7	3	26	50	70	38	90
7LD	6	81	3	11	3	52	12	22	24	17
8LD	1	19	6	17	0	1	5	8	7	8
9LD	0	10	0	0	0	0	1	1	3	2
>9	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*1*	*1*	*1*

	star	mail	ltd	google	sap	app	world	mnet	smart	web
All	4,044	60,599	2,392	621,582	20,480	5,012	2,318	1,924	2,179	7,766
TLD	2,435	2,383	1,990	1,859	1,735	1,720	1,650	1,568	1,331	1,126
SLD	236	25,339	337	463,797	18,189	871	536	139	509	3,028
3LD	1,177	11,919	34	151,144	449	922	55	78	279	2,089
4LD	159	16,608	10	2,562	56	775	50	136	42	979
5LD	20	2,772	9	609	34	568	21	1	8	391
6LD	3	653	4	501	9	41	4	0	5	88
7LD	6	294	7	978	7	47	1	0	3	53
8LD	7	393	0	78	0	15	1	0	2	8
9LD	0	215	0	21	0	17	0	0	0	3
>9	*0*	*23*	*0*	*33*	*0*	*36*	*0*	*0*	*1*	*1*

Appendix R—10-character SLD with Proposed TLD (2012)

Rank	Proposed TLD	all	a-root	c-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
1	home	191,107	9,007	36,219	2,249	25,063	9,463	32,933	19,758	19,587	25,556	11,272
2	corp	3,193	366	534	90	423	226	306	250	234	531	233
3	iinet	1,260	5	3	2	14	5	395	118	9	701	8
4	inc	694	67	188	23	85	96	34	46	27	110	18
5	site	635	69	78	14	53	41	69	83	100	76	52
6	cisco	589	44	86	18	69	51	53	68	58	84	58
7	box	529	40	54	32	77	26	59	49	62	66	64
8	business	339	1	4	0	56	2	3	37	5	1	230
9	orange	295	27	19	1	43	13	27	66	28	23	48
10	group	289	13	29	2	25	8	30	69	35	37	41
11	global	224	26	24	14	20	17	24	19	17	28	35
12	ads	222	18	22	10	35	16	28	17	24	28	24
13	casa	212	9	26	5	42	10	16	28	15	51	10
14	office	183	22	34	6	18	13	24	15	21	20	10
15	prod	141	5	27	2	16	7	21	11	11	29	12
16	sfr	138	23	27	0	0	19	10	12	21	19	7
17	wow	125	23	48	2	3	5	10	3	10	10	11
18	bank	122	9	17	0	17	16	8	11	19	8	17
19	network	86	4	14	1	10	12	5	9	8	14	9
20	dev	83	6	13	5	6	7	9	8	13	12	4
21	smart	66	7	14	0	14	3	5	6	5	9	3
22	philips	61	0	7	0	3	2	13	7	14	6	9
23	app	49	6	3	5	4	3	4	4	11	6	3
24	red	47	4	11	1	4	7	2	3	7	5	3
25	telefonica	46	0	18	0	4	6	2	2	2	5	7

Appendix S—10-character SLD with Proposed TLD (2013)

Rank	Proposed TLD	all	a-root	c-root	d-root	e-root	f-root	h-root	i-root	j-root	k-root	l-root	m-root
1	home	585,900	77,854	67,534	20,401	4,854	61,021	30,190	106,501	19,248	69,071	86,037	43,189
2	corp	4,067	895	460	211	76	357	279	452	136	423	512	266
3	iinet	2,155	19	33	909	0	9	9	291	75	24	772	14
4	cisco	1,994	285	263	92	27	183	131	258	130	218	297	110
5	business	1,196	190	69	7	2	8	11	32	221	28	14	614
6	inc	749	232	117	42	6	39	72	49	49	38	87	18
7	box	465	88	60	22	23	43	37	70	0	46	25	51
8	orange	375	59	38	9	2	14	12	37	87	34	4	79
9	office	349	40	50	23	6	30	20	58	24	36	45	17
10	site	284	40	29	20	5	21	12	40	15	42	46	14
11	ads	277	54	30	25	9	14	15	32	18	35	29	16
12	group	252	25	22	9	1	24	15	40	33	36	29	18
13	casa	239	31	27	4	2	46	9	19	14	25	51	11
14	global	235	32	13	24	7	16	12	39	8	22	43	19
15	wow	199	42	34	20	8	18	24	19	0	12	10	12
16	gold	196	22	22	4	5	31	9	18	14	19	45	7
17	hotel	186	14	17	15	3	12	6	29	0	56	23	11
18	dev	145	26	25	7	1	10	14	16	1	19	20	6
19	app	132	21	13	13	2	5	9	21	4	20	14	10
20	school	129	12	6	8	3	13	9	23	5	8	36	6
21	smart	108	3	19	3	0	19	9	15	3	18	17	2
22	delta	99	16	14	4	0	10	4	27	0	17	5	2
23	prod	97	24	9	7	0	4	3	19	6	8	12	5
24	samsung	92	7	8	2	0	7	6	12	22	6	7	15
25	network	86	19	5	6	0	6	4	13	2	7	17	7