        Variants in Second-Level Names Registered in Top-Level Domains

Abstract

    Internationalized Domain Names for Applications (IDNA) provides a
    method to map a subset of names written in Unicode into the DNS.
    Because of Unicode decisions, appearance, language and writing system
    conventions, and historical reasons, it often has been asserted that
    there is more than one way to write what competent readers and
    writers think of as the same host name; these different ways of
    writing are often called "variants". (The authors note that there
    are many conflicting definitions for the term "variant" in the IDNA
    community.) This document surveys the approaches that top-level
    domains have taken to the registration and provisioning of domain
    names that have variants. This document is not a product of the
    IETF, does not propose any method to make variants work "correctly",
    and is not an introduction to internationalization or IDNA.

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1. Introduction

   Internationalized Domain Names for Applications (IDNA) [RFC5890]
   allows host names in the DNS [RFC1035] to contain characters from the
   Unicode repertoire. Some Unicode characters are considered to be
   "variants" of one another. Because of the 20th century reform of
   Chinese writing, there is often more than one representation of what
   Chinese speakers think of as the same character. Some languages
   written in Latin characters with accents and diacritical marks, known
   as decorated characters, allow the decorations to be omitted in some
   situations; for example, French sometimes omits accents on capital
   letters, depending on country and culture. Due to the difficulty of
   representing decorated characters in ASCII systems, many users have
   informally used undecorated characters in DNS host names, even when
   they are not linguistically equivalent to the decorated versions.

   There is no single agreed-on definition of "variant". In 2012, ICANN
   said that variants "occur when a single conceptual character can be
   identified with two or more different Unicode Code Points with
   graphic representations that may be visually similar" (this
   definition was previously available at
   http://www.icann.org/en/resources/idn/variant-tlds). ICANN's IDN
   Variant Issues Project report [VIPREPORT] says that "[t]here is today
   no fully accepted definition for what may constitute a variant
   relationship between top-level labels". RFC 3743 [RFC3743] (an
   Informational RFC, not the product of the IETF) says that the idea of
   variants is "wherein one conceptual character can be identified with
   several different Code Points in character sets for computer use".

   The proper handing of variant names has been a topic of extensive
   debate and research, with little consensus reached on how to handle
   them or even what characters are variants of each other. Many people

would like variant names to behave "the same", for a diverse range of meanings of "same". In some cases, it is a textual similarity, such as variants having corresponding DNS records; in some, it is functional similarity, such as variant names resolving to the same web server; while in others, it is user experience similarity, such as names resolving to web sites that, while not identical, are perceived by human users as equivalent.

This document provides a snapshot of variant handling in the top-level domains (TLDs) contracted by ICANN, so-called gTLDs (generic TLDs) and sTLDs (sponsored TLDs), as of late 2012. We chose those domains because ICANN requires each TLD to describe its IDN and variant practices, and the TLD zone files are available for inspection, to verify what actually goes into the zones. This document also contains a small sampling of so-called ccTLDs (country code TLDs, the TLDs that consist of two ASCII letters) for which we could find information.

Since "variant" can mean vastly different things to different people, there is also no agreement about when two zones are supposed to "behave the same". Also, the gTLDs and sTLDs might have different views of what variants are and are not required to report to ICANN about their policies.

2. Terminology

We use some terminology that has become generally agreed to when discussing variant names, although we openly admit that such agreement is not complete and the terminology continues to change.

Bundle: The IDN practices documents (see below) can identify sets of code points that are considered variants of each other using Language Variant Tables, defined in [RFC3743]. A set of names in which the characters in each position are variants is known as a bundle or, more technically, as an "IDL Package". The variant rules vary among languages, and for the same language can vary among TLDs. Many languages do not define variant characters and hence do not have bundles.

Allocated: A name is allocated if sponsorship of that label in some zone has been granted. This is similar to what many people refer to as "registered".

Active: A name is active if it appears as an owner name in a zone. Most allocated names are active, but some are not.

Blocked: Some names cannot be registered at all. For example, some
   registries allow one name in a bundle to be registered and block
   the rest.

Withheld: Some names can only be allocated under certain conditions.
   For example, some registries permit only the registrant of one
   name in a bundle to register or activate other names in the same
   bundle.

Parallel NS: Multiple names in a bundle are provisioned in the TLD
   with identical NS records, so they all are handled by the same
   name servers.

DNAME aliasing: The DNAME [RFC6672] DNS record creates a shadow tree
   of DNS records, roughly as though there were a CNAME in the shadow
   tree pointing to each name in the target tree. DNAMEs have been
   used both to provide resolution for several names in a bundle and
   to provide resolution for every name under a TLD.

3. Base Documents

ICANN has published a variety of documents on variant management.
The most important are the "Guidelines for the Implementation of
Internationalized Domain Names" issued in Version 1.0 [G1] and
Version 3.0 [G3].

ICANN says that TLDs are supposed to register an IDN practices
document with IANA for each language and/or script in which the TLD
accepts IDN registrations, to be entered in the IANA Repository of
IDN Practices [IANAIDN]. The practices document lists the Unicode
characters allowed in names in the language or script, which
characters are considered equivalent, and which of an equivalent
group is preferred. Some TLDs have been more diligent than others at
keeping the registry up to date. Also, some TLDs have tables for a
few languages and scripts, while others (notably .COM, .NET, and
.NAME) have a large set of tables, including some for languages and
scripts that are no longer spoken or used, such as Runic and Ogham.
The authors also note that many of the tables in the IANA registry
are clearly out of date, containing URLs of policy pages that no
longer exist and contact information for people who have left the
registry.

Some of the ICANN agreements with each TLD [ICANNAGREE] describe the
TLD's IDN practices, but most don't.

4. Domain Practices of gTLDs

   This list covers most of the current set of gTLDs. In most cases,
   the authors have also checked the zone files for the gTLD to verify
   or augment the policy description.

4.1. AERO

   The .AERO TLD has no IDNs and no rules or practices for them.

4.2. ASIA

   The .ASIA domain accepts registrations in many Asian languages. They
   have IANA tables for Japanese, Korean, and Chinese. The IANA tables
   refer to their CJK IDN policies [ASIACJK], which say that applied-for
   and preferred IDN variants are "active and included in the zone". No
   IDN publication mechanism is described in the documentation, but
   since the zone file contains no DNAMEs, they must be using parallel
   NS for variants.

4.3. BIZ

   ICANN gave the registry (Neustar) non-specific permission to register
   IDNs in a letter in 2004 [TWOMEY04A]. The IDN rules were apparently
   discussed with ICANN but not defined; see Appendix 9 of the registry
   agreement [ICANNBIZ9].

   They have about a dozen IANA tables. No IDN publication mechanism is
   described, but from inspection, it appears that variants are blocked.

4.4. CAT

   The IDN rules are described in Appendix S, Part VII.2 [ICANNCATS] of
   the ICANN agreement. "Registry will take a very cautious approach in
   its IDN offerings. IDNs will be bundled with the equivalent ASCII
   domains". The only language is Catalan. No IDN publication
   mechanism is described.

   Appendix S includes "The list of non-ASCII-characters for Catalan
   language and their ASCII equivalent for the purposes of the defined
   service", which implicitly describes bundles. The bundles consist of
   names with accented and unaccented vowels, U+00E7 ("c with cedilla")
   and a plain c, and the Catalan "ela geminada" written as two l's
   separated by a U+00B7 ("middle dot") and the three characters "l-l".

When a registrant registers an IDN, the registry also includes the
ASCII version. From inspection of the zone file, the ASCII version
is provisioned with NS, and the IDN is a DNAME alias of the ASCII
version.

4.5. COM

ICANN and Verisign have extensive correspondence about IDNs and
variants, including letters to ICANN from Ben Turner [TURNER03] and
Russell Lewis [LEWIS03].

The IANA registry has tables for several dozen languages, including
archaic languages such as hieroglyphics and Aramaic. Verisign
publishes documents describing scripts and languages [VRSNLANG],
character variants [VRSNCHAR], registration rules [VRSNRULES], and
additional registration logic [VRSNADDL].

In Chinese, variants are blocked (see [VRSNADDL]). In other
languages, there is no bundling or blocking.

4.6. COOP

The .COOP TLD has no IDNs and no rules or practices for them.

4.7. INFO

The IANA registry has a table for German. The German table notes
that "the Eszet ... character used in the German script will be
mapped to a double 's' string (i.e. 'ss')". The domain also offers
names in Greek, Russian, Arabic, Korean, and other languages. The
list and IDN tables are on the registry's web site [INFOTABLES].

Afilias says (not in a published policy) that it does not allow
Korean characters with different widths and that there are no
variants in .INFO.

Appendix 9 of the registry agreement [ICANNINFO9] refers to a 2003
letter from Paul Twomey [TWOMEY03] that refers to blocking variants.

4.8. JOBS

The .JOBS TLD has no IDNs and no rules or practices for them.

4.9. MOBI

The zone file has about 22,000 IDNs. Afilias says (not in a
published policy) that .MOBI supports Simplified Chinese only and
that the language table for this is the same as that used by .CN.

Variant characters are blocked from registration. The domain has no
tables at IANA. Appendix S of the registry agreement [ICANNMOBIS],
says that IDNs are provisioned according to [G1].

4.10. MUSEUM

The zone file has many IDNs, but spot checks find that many are lame
or dead. A 2004 letter from Paul Twomey [TWOMEY04] refers to [G1].

The registry has a detailed policy page [MUSEUMPOLICY]. IDNs are
accepted in Latin and Hebrew scripts, with plans for Arabic, Chinese,
Japanese, Korean, Cyrillic, and Greek. They do no bundling or
blocking, but names that may be confusable due to visual similarity
are not allowed. These are apparently determined by manual
inspection, which is practical due to the very small size of the
domain.

4.11. NAME

The .NAME TLD is managed the same as .COM.

4.12. NET

The .NET TLD is managed the same as .COM.

4.13. ORG

A 2003 letter from Paul Twomey [TWOMEY03A] refers to [G1]. The
registry has a list of IDN languages [PIRIDN], several written in
Latin script, plus Chinese and Korean. A Questions page [PIRFAQ]
states that Chinese names have been accepted since January 2010 and
Cyrillic names in seven languages since February 2011. The practices
for some, but not all, of the Latin languages are registered with
IANA.

A Chinese language policy form on the Public Interest Registry (PIR)
web site says that the ZH-CN and ZH-TW IDNs use the corresponding
ccTLD tables from IANA, and check boxes say that Variant Registration
Polices and Variant Management Policies are applicable but don't say
what those policies are.

Private correspondence [CHANDIWALA12] describes not-yet-public rules
for variants in Chinese and Cyrillic in .ORG that restrict the number
of variants that a registration can have.

The Korean language policy form says that it uses the KRNIC table for
Korean from IANA and that there are no variants.

4.14. POST

   The .POST TLD appears to have no registrations at all yet.

4.15. PRO

   The .PRO TLD has no IDNs and no rules or practices for them.

4.16. TEL

   The zone has many IDNs. It is probably operating according to a 2004
   letter from Paul Twomey [TWOMEY04A] to Neustar, which did not mention
   specific TLDs. Its policy page [TELPOLICY] has links to IDN
   practices for 17 languages, all but one of which are registered with
   IANA. None of the Latin scripts do bundling or blocking. The
   Japanese practices say that variants are blocked. The Chinese
   practices document says:

      Therefore, in addition to the blocking mechanism, bundling is also
      implemented for the Chinese language IDNs. When registering a
      Chinese language IDN (primary domain name) up to two additional
      variant domain names will be automatically registered. The first
      variant will consist entirely of simplified Chinese characters
      that correspond to those comprising the primary domain name. The
      second variant will consist exclusively of traditional Chinese
      characters that correspond to those comprising the primary domain
      name.

      The primary domain name together with the requested variants
      constitutes a bundle on which all operations are atomic. For
      example, if the registrant adds a name server to the primary
      domain name, all names in the bundle will be associated with that
      new name server.

   The zone has no DNAME records, so the second paragraph strongly
   suggests parallel NS.

   The .TEL TLD, intended as an online directory, does not allow
   registrants to enter arbitrary Resource Records (RRs) in the zone.
   Nearly all names have NS records pointing to Telnic's own name
   servers. The A records all point to Telnic's own web server that
   shows directory information. NAPTR records provide telephone numbers
   of registrants if available. Users can only directly provision MX
   records. Currently, there are 16 domains, none of which are IDNs,
   that point to random other name servers and mostly appear to be
   parked.

4.17. TRAVEL

The .TRAVEL TLD has no IDNs and no rules or practices for them.

4.18. XXX

The .XXX TLD has no IDNs and no rules or practices for them.

5. Domain Practices of ccTLDs

Some ccTLDs publish their IDN policies. This section is a non-
exhaustive sampling of some of those policies. Note that few ccTLDs
make their zone files available, so the authors could not validate
the policies by looking in the zone files.

5.1. BG

The .BG TLD (for Bulgaria) publishes a policy page [BGPOLICY]. It
has published an IDN table for the Bulgarian and Russian languages in
[IANAIDN]. The policy does not mention variants.

5.2. BR

The .BR TLD (for Brazil) publishes a policy page [BRPOLICY]. It has
published an IDN table for the Portuguese language in [IANAIDN].
Although the IDN table does not describe variants, the policy page
says that bundles consist of names that are the same disregarding
accents on vowels, cedillas on letter "c", and inserted or deleted
hyphens. Only the registrant of a name in a bundle can register
other names from the same bundle.

5.3. CL

The .CL TLD (for Chile) publishes a policy page [CLPOLICY]. It has
published an IDN table for the Latin script in [IANAIDN]. The policy
says that variants are not considered for registration.

5.4. CN

The .CN TLD (for China) publishes its policy as [RFC4713]. It has
published an IDN table for the Chinese language in [IANAIDN]. The
policy says that variants are "added into the zone file", presumably
as NS records.

5.5. ES

The .ES TLD (for Spain) publishes an IDN Area page [ESIDN]. It
allows ten accented vowels, U+00E7 ("c with cedilla"), U+00F1 ("n
with tilde"), and the Catalan "ela geminada" written as two l's
separated by a U+00B7 ("middle dot"). There are no published IDN
tables, and there appears to be no variant policy.

5.6. EU

The .EU TLD (for Europe) publishes a policy page [EUPOLICY]. It has
published IDN tables for three scripts in [IANAIDN]. There appears
to be no variant policy.

5.7. GR

The .GR TLD (for Greece) publishes a policy page [GRPOLICY] and an
FAQ [GRFAQ]. The policy says that all variants of a name under .GR
are assigned to the domain owner, with the zone pointing the NS
records of all the variants to the name server of the "main form" of
the registered name. The FAQ says that domain names in Greek
characters are inserted in the zone using their non-punctuated form
in Punycode and that the punctuated form is associated with the non-
punctuated with a DNAME record. It does not publish IDN tables in
[IANAIDN].

5.8. IL

The .IL TLD (for Israel) publishes a policy page [ILPOLICY]. It has
published an IDN table for the Hebrew language in [IANAIDN]. There
is no variant policy.

5.9. IR

The .IR TLD (for Iran) publishes a policy page [IRPOLICY]. It has
published an IDN table for the Persian language in [IANAIDN]. The
IDN table says that it will block registration of variants. However,
the policy document says that no IDNs can be registered in .IR.

5.10. JP

The .JP TLD (for Japan) publishes a policy page [JPPOLICY]. It has
published an IDN table for the Japanese language in [IANAIDN]. Each
code point in that table defines no variants, which means there are
no variants in registration or resolution.

5.11. KR

   The .KR TLD (for South Korea) appears to only publish its policy as
   an IDN table for the Korean language in [IANAIDN]. The policy in
   that table does not discuss variants.

5.12. MY

   The .MY TLD (for Malaysia) appears to only publish its policy as an
   IDN table for the Jawi language in [IANAIDN]; however, IANA lists
   that as a table for "Malay (macrolanguage)". The policy in that
   table does not discuss variants.

5.13. NZ

   The .NZ TLD (for New Zealand) publishes a policy page [NZPOLICY]. It
   has published IDN tables for the Latin script in [IANAIDN]. The
   policy does not discuss variants.

5.14. PL

   The .PL TLD (for Poland) publishes a policy page [PLPOLICY]. It has
   published IDN tables for numerous European languages in [IANAIDN].
   The policy says that it will block registration of "look-alike"
   variants.

5.15. RS

   The .RS TLD (for Serbia) publishes a policy page [RSPOLICY]. It has
   published IDN tables for the Serbian language, and the Latin script,
   in [IANAIDN]. The policy does not discuss variants.

5.16. RU

   The .RU TLD (for Russia) appears to only publish its policy as an IDN
   table for the Russian language in [IANAIDN]. The policy in that
   table does not discuss variants.

5.17. SA

   The .SA TLD (for Saudi Arabia) publishes a policy page [SAPOLICY].
   It has published an IDN table for the Arabic language in [IANAIDN].
   The policy permits the registration of variants, but it is not clear
   whether others can register names with variants if the owner of a
   name has not registered them.

5.18. SE

   The .SE TLD (for Sweden) publishes a policy page [SEPOLICY]. It has
   published IDN tables for the Swedish and Yiddish languages, and the
   Latin script, in [IANAIDN]. The policy does not discuss variants.

5.19. TW

   The .TW TLD (for Taiwan) appears to only publish its policy as an IDN
   table for the Chinese language in [IANAIDN]. The policy in that
   table does not discuss variants.

5.20. UA

   The .UA TLD (for Ukraine) publishes a policy page [UAPOLICY]. It has
   published an IDN table for the Cyrillic script in [IANAIDN]. The
   policy does not discuss variants.

5.21. VE

   The .VE TLD (for Venezuela) appears to only publish its policy as an
   IDN table for the Spanish language in [IANAIDN]. The policy in that
   table does not discuss variants.

5.22. XN--90A3AC

   The .XN--90A3AC TLD (for Serbia) (U+0441 U+0440 U+0431) publishes a
   policy page [RSIDNPOLICY]. It has published IDN tables for the
   Cyrillic script in [IANAIDN]. The policy does not discuss variants.

5.23. XN--MGBERP4A5D4AR

   The .XN--MGBERP4A5D4AR TLD (for Saudi Arabia) (U+0627 U+0644 U+0633
   U+0639 U+0648 U+062F U+064A U+0629) appears to only publish its
   policy as an IDN table for the Arabic script in [IANAIDN]. The
   policy permits the registration of variants, but it is not clear
   whether others can register names with variants if the owner of a
   name has not registered them.

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7. Security Considerations

   There are many potential security considerations for various methods
   of dealing with IDN variants. However, this document is only a
   catalog of current variant policies and does not address whether they
   are good or bad ideas from a security standpoint. The documents
   cited in the Terminology section have a little discussion of security
   considerations for IDN variants.

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