Designing Secure and Stable Rules for Internationalized Domain Names

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Agenda

- Internationalized Domain Names for Applications (IDNA) 2008
- Label Generation Rules
- Designing Secure and Stable IDNs Under Your TLD

Internationalized Domain Names for Applications (IDNA) 2008

IDNA 2008

- Internationalized Domain Names for Applications (IDNA) is a set of standards for handling Internationalized Domain Names (IDNs).
- Developed by the Internet Engineering Task Force (IETF).
- The current version is IDNA 2008, consisting of:

  Standard Track:

  - RFC 5890 IDNA: Definitions and Document Framework
  - RFC 5891 IDNA: Protocol
  - RFC 5892 The Unicode Code Points and IDNA
  - RFC 5893 Right-to-Left Scripts for IDNA

  Informational Track:

  - RFC 5894 Background, Explanation, and Rationale
  - RFC 5895 Mapping Characters for IDNs in Applications (IDNA) 2008

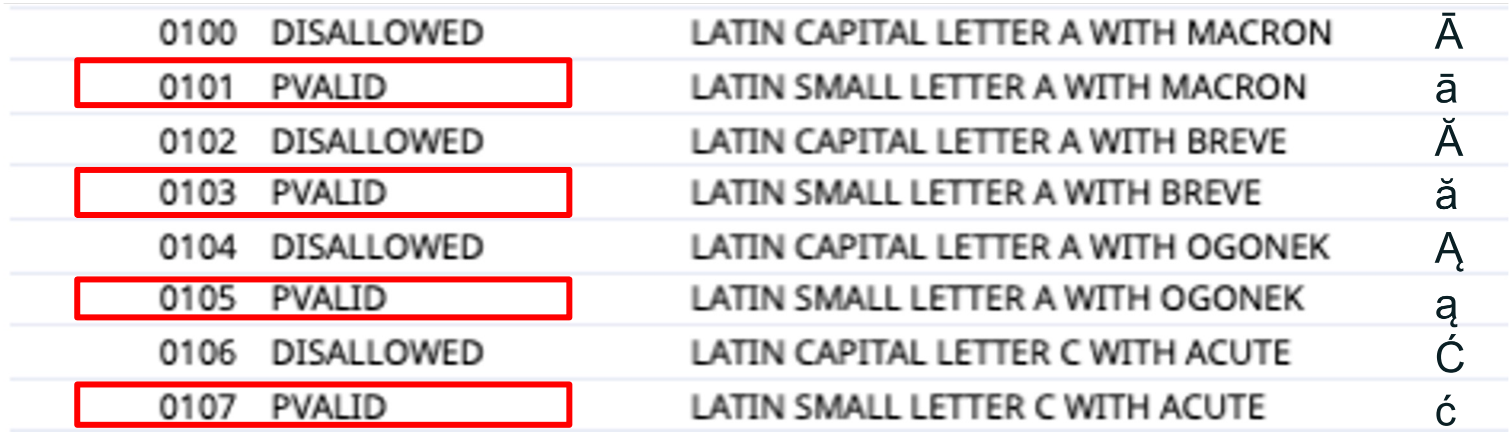
- All IDNs must be IDNA 2008 compliant.

Example: Latin Script

- RFC 5892, Introduction section states: *“PROTOCOL VALID [PVALID]: Those that are allowed to be used in IDNs. Code points with this property value are permitted for general use in IDNs.”*

- Latin Extended-A code point range: 0100–017F.

- Based on the IDNA2008 Derived Property Values, only code points with PVALID property can be considered for IDNs.



0100	DISALLOWED	LATIN CAPITAL LETTER A WITH MACRON	Ā
0101	PVALID	LATIN SMALL LETTER A WITH MACRON	ā
0102	DISALLOWED	LATIN CAPITAL LETTER A WITH BREVE	Ă
0103	PVALID	LATIN SMALL LETTER A WITH BREVE	ă
0104	DISALLOWED	LATIN CAPITAL LETTER A WITH OGONEK	Ą
0105	PVALID	LATIN SMALL LETTER A WITH OGONEK	ą
0106	DISALLOWED	LATIN CAPITAL LETTER C WITH ACUTE	Ć
0107	PVALID	LATIN SMALL LETTER C WITH ACUTE	ć

Additional Requirements in IDNA2008

- RFC 5892, Introduction section states:

  "… However, that a label consists only of code points that have this property value [PVALID] does not imply that the label can be used in DNS. See the Protocol document [RFC5981] for algorithms to make decisions about labels in domain names."

- RFC 5890, Section 2.3.2.3 states:

  "Because of the diversity of characters that can be used in a U-label and the confusion they might cause, such restrictions ["variant definitions and rules beyond those imposed by DNS or IDNA"] ***are mandatory*** *[emphasis added] for IDN registries and zones even though the particular restrictions are not part of these specifications (the issue is discussed in more detail in Section 4.3 of the Protocol document [RFC5891]."*

- Additional restrictions beyond IDNA are mandatory, therefore, the Label Generation Rules (LGRs) are needed.

Label Generation Rules

IDN Tables as Label Generation Rules

- IDN Implementation Guidelines

  Version 3.0 states: “All such code point listings will be placed in the IANA Repository for IDN TLD Practices in tabular format together with any rules applied to the registration of names containing those code points, before any such registration may be accepted.”

  Version 4.1 states: “The IDN Table must include the complete repertoire of code points, any IDN variant code points and any applicable contextual rules which the TLD registry uses to determine if an IDN label is acceptable for registration.”

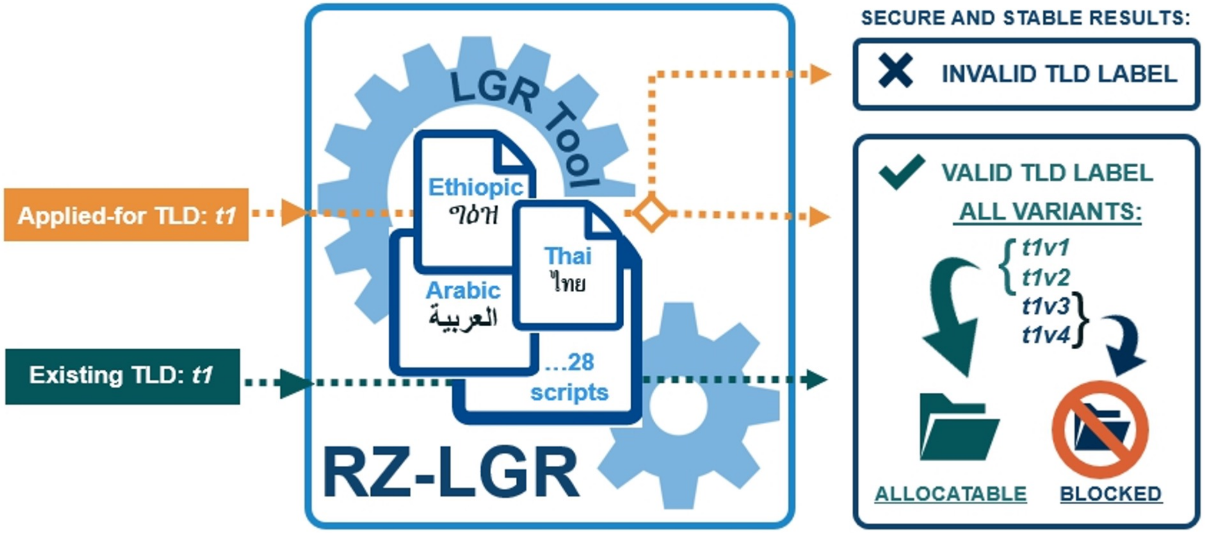
- For a TLD registry operator to offer IDNs at the second level, the rules governing which IDN labels are allowed for registration must be defined to ensure the secure and stable solution for the Domain Name System.

- Each language or script required a set of rules. The ruleset is called IDN Table or Label Generation Rules.

Consistency with the Root Zone LGRs

- The Root Zone Label Generation Rules (RZ-LGR) are developed by various script communities to ensure secure and stable IDN TLDs.

- RZ-LGR Version 5 is available for 26 scripts covering more than 386 languages.



- SAC060 recommended “ICANN should coordinate and encourage adoption of these rules [RZ-LGR] at the second and higher levels…”

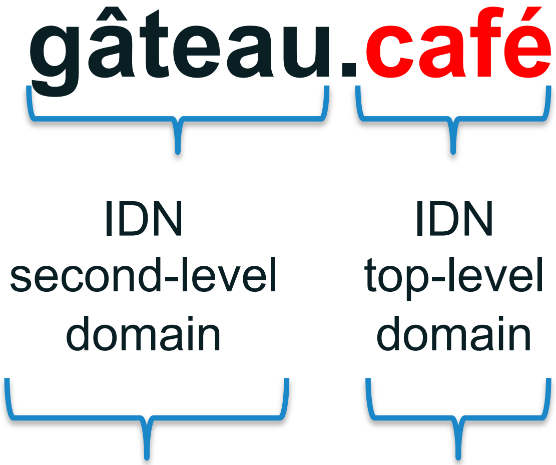
Label Generation Rules

- Consist of three main aspects:
  - Repertoire
  - Variants
  - Rules

What is the Goal?

- Goal is to create a mnemonic system for use in the Domain Name System (DNS).
  - A mechanism to remember IP address.
  - Must remain secure and stable in use – if the DNS is confusing to users, then the motivation is not met.
  - Not required to completely cover a language or a script.
  - May not form labels that are words in a language.
    - Not restricted to “correct” spellings.
    - May not carry a meaning in the “lexical” sense.

Internationalized Domain Name (IDN) Labels



gâteau.café

IDN second-level domain

IDN top-level domain

<u>Syntax of IDN Labels</u>

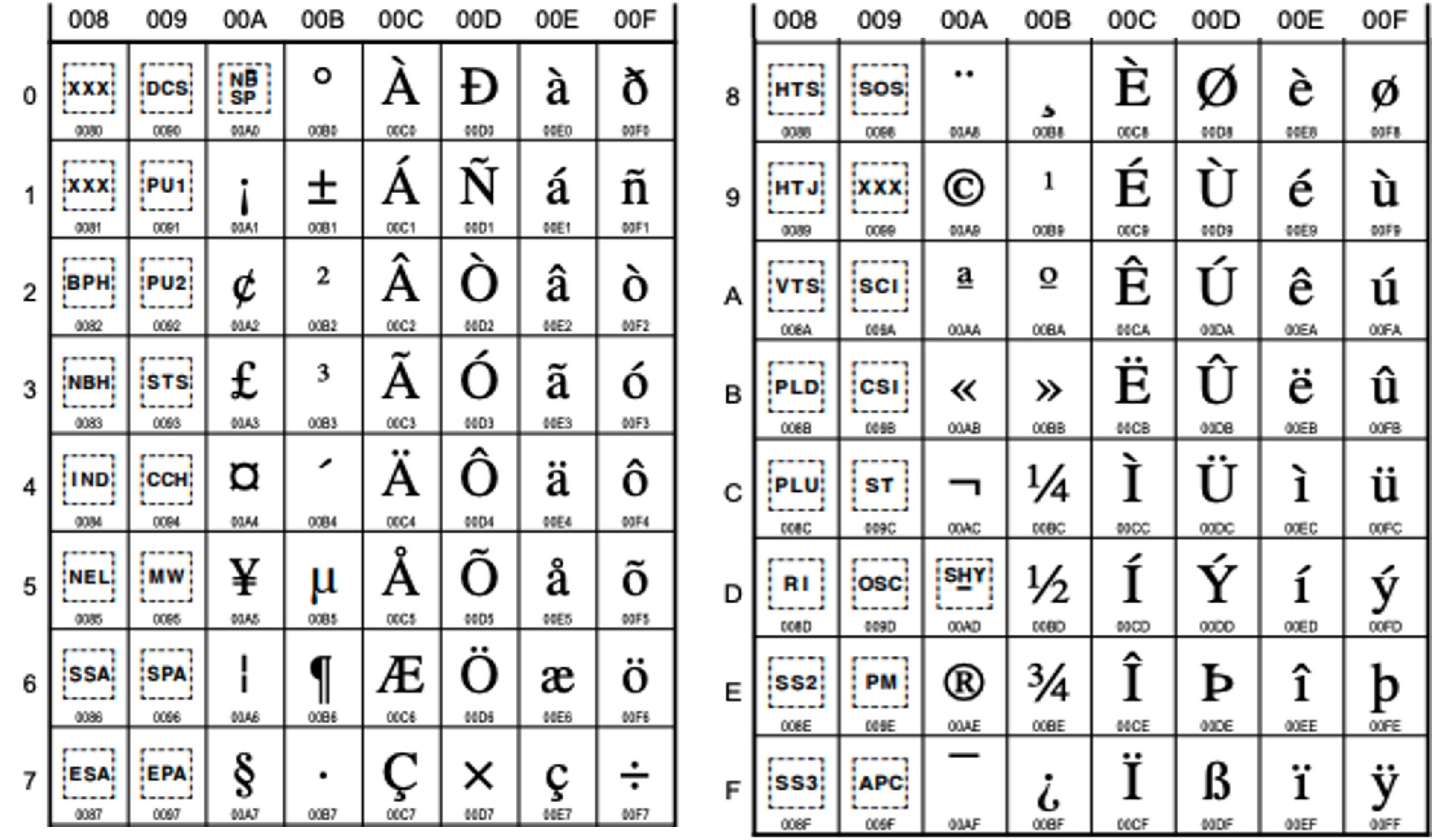
Valid U-Label: Unicode code points as constrained by the “LDH” scheme within IDNA 2008

<u>Syntax of IDN Labels</u>

Valid U-label, further constrained by the “letter” principle for TLDs

IDN Mnemonics

C1 Controls and Latin-1 Supplement Code Chart



	008	009	00A	00B	00C	00D	00E	00F
0	XXX 0080	DCS 0090	NB SP 00A0	° 00B0	À 00C0	Ð 00D0	à 00E0	ð 00F0
1	XXX 0081	PU1 0091	¡ 00A1	± 00B1	Á 00C1	Ñ 00D1	á 00E1	ñ 00F1
2	BPH 0082	PU2 0092	¢ 00A2	² 00B2	Â 00C2	Ò 00D2	â 00E2	ò 00F2
3	NBH 0083	STS 0093	£ 00A3	³ 00B3	Ã 00C3	Ó 00D3	ã 00E3	ó 00F3
4	IND 0084	CCH 0094	¤ 00A4	´ 00B4	Ä 00C4	Ô 00D4	ä 00E4	ô 00F4
5	NEL 0085	MW 0095	¥ 00A5	µ 00B5	Å 00C5	Õ 00D5	å 00E5	õ 00F5
6	SSA 0086	SPA 0096	¦ 00A6	¶ 00B6	Æ 00C6	Ö 00D6	æ 00E6	ö 00F6
7	ESA 0087	EPA 0097	§ 00A7	· 00B7	Ç 00C7	× 00D7	ç 00E7	÷ 00F7

	008	009	00A	00B	00C	00D	00E	00F
8	HTS 0088	SOS 0098	¨ 00A8	¸ 00B8	È 00C8	Ø 00D8	è 00E8	ø 00F8
9	HTJ 0089	XXX 0099	© 00A9	¹ 00B9	É 00C9	Ù 00D9	é 00E9	ù 00F9
A	VTS 008A	SCI 009A	ª 00AA	º 00BA	Ê 00CA	Ú 00DA	ê 00EA	ú 00FA
B	PLD 008B	CSI 009B	« 00AB	» 00BB	Ë 00CB	Û 00DB	ë 00EB	û 00FB
C	PLU 008C	ST 009C	¬ 00AC	¼ 00BC	Ì 00CC	Ü 00DC	ì 00EC	ü 00FC
D	RI 008D	OSC 009D	SHY 00AD	½ 00BD	Í 00CD	Ý 00DD	í 00ED	ý 00FD
E	SS2 008E	PM 009E	® 00AE	¾ 00BE	Î 00CE	Þ 00DE	î 00EE	þ 00FE
F	SS3 008F	APC 009F	¯ 00AF	¿ 00BF	Ï 00CF	ß 00DF	ï 00EF	ÿ 00FF

Designing Repertoire

- Starting from RFC6912 - Principles for Unicode Code Point Inclusion in Labels in the DNS:
  - Longevity – stable across Unicode versions
  - Least Astonishment– take into account the population using a code point
  - Contextual Safety – sensitive to ways in which code point may be used in malicious ways
  - Conservatism – any code point inclusion decision is as conservative as practicable
  - Inclusion – default is excluded, then add code point which is safe based on usability and confusability
  - Simplicity – rules determining use should be simple to understand
  - Predictability – rules determining whether a code point is included are predictable for others to reach the same conclusion
  - Stability – if a code point is permitted, taking it out is very hard

Label Generation Rules

- Consist of three main aspects:
  - Repertoire
  - Variants
  - Rules

What is the Goal?

- Successfully defining variant rules for an LGR is not trivial.
- Code point or code point sequences causing two (or more) labels functionally “the same” in a script.
- Use the mnemonic system to minimize user confusion.
- Conservatism requires:
  - Maximizing “blocked” variants
  - Minimizing “allocatable” variants

Examples of Variants for Latin Script as per RZ-LGR

- Visual Variant Pairs

  U+011F ğ Latin Small Letter G with Breve and
  U+01E7 ǧ Latin Small Letter G with Caron

  U+0169 ũ Latin Small Letter U with Tilde and
  U+016B ū Latin Small Letter U with Macron

- Non-Visual Variant Pairs

  U+0066 f Latin Small Letter F and
  U+0192 ƒ Latin Small Letter F with Hook

  U+0073 U+0073 ss Latin Small Letter S + Latin Small Letter S and
  U+00DF ß Latin Small Letter Sharp S

- For complete variant sets please see the Latin Script RZ-LGR Proposal.

Label Generation Rules

- Consist of three main aspects:
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What is the Goal?

- Goal is to reduce label space.

  Preventing labels that should not be possible for various reasons:

  - Not licensed by the script (but not related to spelling rules) or cause security issues.
  - Cause usability constraints.

- Reducing allocatable label by making them blocked in certain cases.

Examples

- Based on IDNA2008 (RFC5892)
  - U+00B7 · MIDDLE DOT must be between 'l' (U+006C) characters only, used to permit the Catalan character ela geminada to be expressed.

- Based on the Latin script RZ-LGR
  - U+0304 ̄ Combining Macron is not included as a stand alone code point, but always in a sequence:
    - 006E 0304 n̄ Latin Small Letter N with Combining Macron, used in Raga (Hano) and Marshallese languages

Example

- Based on the Thai language reference LGR

  The following 2 code points are different vowels:

U+0E40	เ	THAI CHARACTER SARA E
U+0E41	แ	THAI CHARACTER SARA AE

  Defining a rule to disallow 0E40 to follow itself could reduce the homoglyph confusion with 0E41

แมว (cat)

แ	ม	ว		✓
U+0E41	U+0E21	U+0E27		
เ	เ	ม	ว	✗
U+0E40	U+0E40	U+0E21	U+0E27	

Designing for Secure and Stable IDNs Under Your TLD

Reference Label Generation Rules (LGR)

- Background
  - Based on script user community input for 26 scripts garnered through the RZ-LGR project. ICANN org developed second level reference LGRs derived from RZ-LGR with some additions to remain consistent.
  - All reference LGRs include consultations with the script communities and are finalized after Public Comment proceedings.
  - TLD registry operators can use reference LGRs when they develop rules for IDN registration under their TLDs.
  - The online LGR Tool is available for reviewing the designed IDN table with a reference LGR.
  - ICANN org uses reference LGRs and the LGR Tool to review the registration rules under gTLDs.
  - This contributes to consistency and transparency of the review as requested by the Registries Stakeholder Group (RySG).

Reference Label Generation Rules (LGR)

- Additional 7 script-based LGRs and related updates will be published which will bring the number of reference LGRs to 54.

- 31 language-based LGRs

  Arabic, Belarusian, Bosnian (Cyrillic), Bosnian (Latin), Bulgarian, Chinese, Danish, English, Finnish, French, German, Hebrew, Hindi, Hungarian, Icelandic, Italian, Japanese, Korean, Latvian, Lithuanian, Macedonian, Montenegrin, Norwegian, Polish, Portuguese, Russian, Serbian, Spanish, Swedish, Thai, and Ukrainian.

- 23 script-based LGRs

  Arabic, Armenian, Bangla (Bengali), Cyrillic, Devanagari, Ethiopic, Georgian, Greek, Gujarati, Gurmukhi, Hebrew, Japanese (Hiragana, Katakana, Kanji[Han]), Kannada, Korean (Hangul, Hanja [Han]), Khmer, Lao, Latin, Malayalam, Myanmar, Oriya, Sinhala, Tamil, and Telugu.

Collaboration on Developing Reference LGRs

- If any additional reference LGR is needed for your target users, TLD registries are encouraged to cooperate and contribute toward the development of and updates to the Reference Second Level LGRs.
- Script user communities, TLD registries, and ICANN org will collaborate on developing the additional reference LGRs.
- Please contact us at IDNProgram@icann.org

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