

Internationalized Domain Name (IDN) Annual Report 2022

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1. Executive Summary

The world population reached 8 billion as per the [Population Prospects 2022](#) report released by the United Nations. As of July 2022, the number of Internet users was estimated at 5.03 billion according to [Statista](#). Therefore, we can assume that around 62.9% of the global population is now online.

The Internet is at the core of current digital activities. Based on the numbers above, there are almost 3 billion people who are not yet connected to the Internet. Multiple factors contribute to this. Based on the report by the International Telecommunication Union (ITU), “affordability of devices and services is a major issue, and the lack of digital skills and an appreciation of the benefits of an online connection is another bottleneck, compounded by a lack of content in local languages, as well as by interfaces that demand literacy and numeracy skills that many people do not possess.”

Currently Internationalized Domain Names (IDNs) are used in various sectors including governments and businesses around the world. For example, the official website of the Indian Government’s Ministry of Electronics and Information Technology is an IDN in the Hindi language and Devanagari script, [एमईआईटीवाई.सरकार.भारत](#). In Russia, the government’s main COVID-19 information website is a Cyrillic IDN, [стопкоронавирус.рф](#). In Thailand, local tourism is encouraged through the Thai IDN, [ทัวร์เที่ยวไทย.ไทย](#). In China, the Beijing ZHTY Technology Company uses a Chinese IDN, [中航天业.网址](#), as its official site.

ICANN organization (ICANN org) has been working with the ICANN community to make the Internet’s Domain Name System (DNS) accessible in local languages for its diverse and global users, while maintaining the stability and security of the DNS. IDNs help lower the barrier to Internet access by enabling people around the world to use domain names in local languages and scripts.

The IDN Annual Report provides an overview of the status of IDNs, both at the top level and second level of the DNS. The report contains four main parts:

- (1) Delegation and registration statistics;
- (2) IDN policy development by the ICANN community;
- (3) IDN-related projects at ICANN organization (ICANN org); and
- (4) IDN implementation and operations at ICANN org.

As of 20 December 2022, the total number of delegated top-level domains (TLDs) is 1,481¹. Table 1 shows the breakdown of American Standard Code for Information Interchange (ASCII) TLDs, IDN TLDs, country code TLDs (ccTLDs), and generic TLDs (gTLDs).

Table 1: Number of ASCII and IDN delegated TLDs as of 20 December 2022.

	ASCII TLDs	IDN TLDs	Total TLDs
ccTLD	248	61	309
gTLDs	1,081	91	1,172
Total	1,329	152	1,481

¹ <https://data.iana.org/TLD/tlds-alpha-by-domain.txt> accessed 20 December 2022.

At the second level, there were 1.52 million IDN registrations² across all gTLDs, as of December 2022. The registrations in 2022 show a 2.94% decline from the previous year while the three-year (2019-2021) average decline was 11.36%. This shows a slower decline in 2022. IDN registrations are highest in the Chinese script (50%) followed by the Latin script (26%).

The ICANN community is working on IDN-related policies by taking [relevant ICANN Board resolutions](#) and other technical information as input for their considerations. The work of both the Country Code Names Supporting Organization (ccNSO) Policy Development Process (ccPDP4) - (De-) Selection of IDN ccTLD Strings Working Group and the Generic Names Supporting Organization (GNSO) IDN Expedited Policy Development Process (IDN EPDP) are underway.

The IDN projects active within ICANN org in 2022 include: (1) Root Zone Label Generation Rules ([RZ-LGR](#)), (2) [Second-Level Reference Label Generation Rules](#), (3) [LGR Tool](#), and (4) [IDN Implementation Guidelines](#).

- The RZ-LGR project has 26 scripts integrated into the RZ-LGR, concluding the work of all active Generation Panels.
- The Reference Label Generation Rules project developed 7 more script-based reference LGRs, which was opened for Public Comment in January 2023.
- The LGR tool has been enhanced to be able to review IDN tables against user uploaded reference data.
- The [IDN Implementation Guidelines version 4.1](#) was adopted by the ICANN Board, and ICANN org is working with contracted parties to implement them.

On the operational side, ICANN org continues to implement the [Final Implementation Plan for IDN ccTLD Fast Track Process](#) for ccTLDs and conducted the IDN Table Reviews for gTLDs.

- There were no IDN ccTLD String Evaluation Requests received in 2022.
- The existing IDN tables published in the IANA Repository have been reviewed for stability and security issues. The issues found have been communicated to the relevant Registry Service Provider (RSP) and ICANN org is collaboratively working with registry operators (ROs) and RSPs to address these issues.
- ICANN org conducted 323 IDN table reviews for 281 TLDs through the IDN Service of the Registry Services Evaluation Policy ([RSEP](#)) Process and Registry System Testing ([RST](#)) in 2022.

² This data is collected by ICANN org internally using the gTLD zone files data.

2. Background of IDNs

IDNs are formed using characters from different scripts, such as Arabic, Chinese, Latin, and others.

For second-level domain name registrations, IDNs have to conform with the Internationalized Domain Name in Applications (IDNA) 2008 Standard to be secure and interoperable, with further specification from script communities and the IDN Implementation Guidelines.

The [IDNA Standard](#) was developed by the Internet Engineering Task Force (IETF) in 2003, and later updated in 2008 (IDNA2008). The technical community also issued additional guidance through IDN-related Request for Comments (RFCs) and ICANN's Security and Stability Advisory Committee (SSAC) reports. See Appendix 1 for a complete list of relevant standards and reports.

The ICANN Board [endorsed](#) guidelines for the implementation of IDNs in March 2003. Version 1 of the IDN Implementation Guidelines was published in June 2003 and ICANN org began authorizing gTLD registries with agreements to offer IDN registrations according to the provisions in the guidelines.

[IDN guidelines](#) have been developed collaboratively since 2003 by some gTLD registries and ccTLD managers to implement IDNs at the second level. The guidelines have been updated based on community input. [Version 4.1](#) was published in November 2022.

Further, for the top-level, script communities have developed the Root Zone LGR [proposals](#) which are being incrementally integrated into the Root Zone Label Generation Rules ([RZ-LGR](#)). This includes important knowledge gained from script communities on how to form a label using a particular script taking into account usability and security considerations.

IDN TLDs were first delegated through the IDN [ccTLD Fast Track Process](#) starting in 2010, and then through the [New gTLD Program](#) from 2013 onwards.

3. Status of IDNs

3.1 IDNs Delegated at the Top Level

There are 1,481 TLDs³ delegated into the root zone.

- 309 are ccTLDs, of these, 61 are IDN ccTLDs.
- 1,172 are gTLDs, of these, 91 are IDN gTLDs.

The first IDN TLDs were delegated in 2010 under the [IDN ccTLD Fast Track process](#). To date, [62 strings](#) have been successfully evaluated for 43 countries and territories (61 delegated, one pending delegation), as shown in Figure 1.

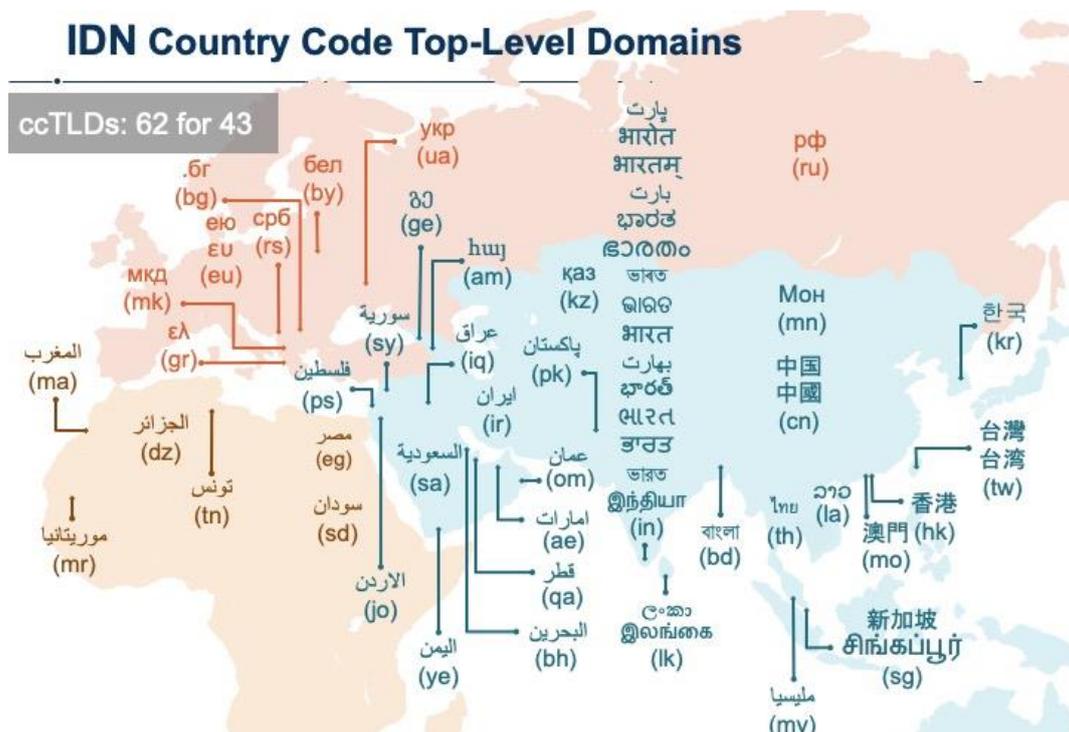


Figure 1: IDN ccTLDs Successfully Evaluated Under the IDN ccTLD Fast Track Process

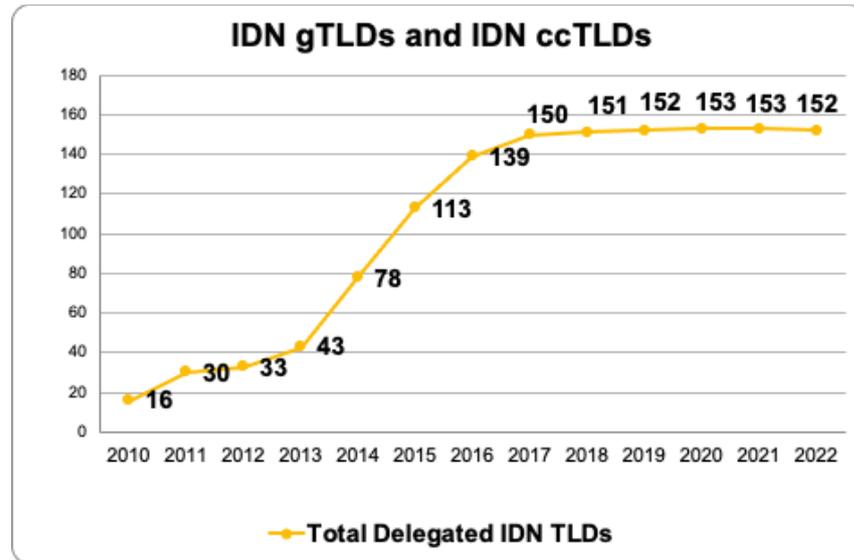
Applicants were able to apply for IDN gTLDs in the new gTLD application round in 2012. Currently, 91 IDN gTLDs are currently delegated.

The delegation history by category (ccTLD and gTLD) of the 152 IDN TLDs is given in Figure 2a.

In addition, Figure 2b shows how the cumulative number of IDN TLDs (ccTLDs and gTLDs) delegated has increased since 2010 (when the first IDN TLDs were delegated, excluding the test IDN TLD delegations by IANA). Most of the IDN ccTLDs were delegated between 2010 and 2011, and none of the IDN ccTLDs have been revoked. Most of the IDN gTLDs were delegated from 2014 to 2016, a few of which were revoked in recent years, resulting in the decline of the number of IDN TLDs (ccTLDs and gTLDs) in 2022.

³ <https://data.iana.org/TLD/tlds-alpha-by-domain.txt>, accessed on 20 December 2022

(a)



(b)

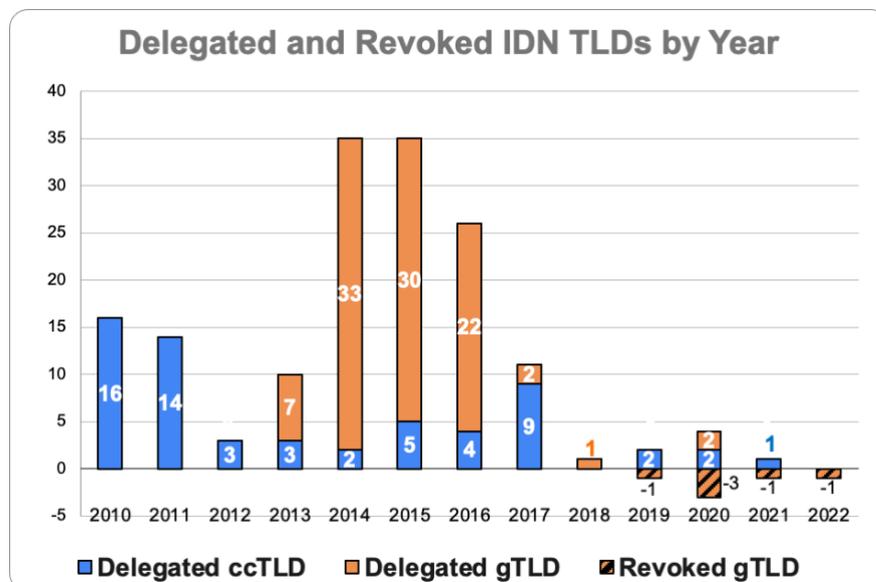


Figure 2: (a) History, and (b) Cumulative Delegations of IDN ccTLDs and IDN gTLDs

The IDN TLDs delegated to date represent 37 languages in 23 scripts.

- The languages include Arabic, Armenian, Assamese, Bangla, Belarusian, Bengali, Bulgarian, Chinese, Georgian, Greek, Gujarati, Hebrew, Hindi, Japanese, Kannada, Kashmiri, Kazakh, Korean, Lao, Macedonian, Malay, Malayalam, Mongolian, Oriya, Persian, Punjabi, Russian, Sanskrit, Santali, Serbian, Sindhi, Sinhalese, Tamil, Telugu, Thai, Ukrainian, and Urdu.
- The scripts include Arabic, Armenian, Bengali, Cyrillic, Devanagari, Georgian, Greek, Gujarati, Gurmukhi, Han, Hangul, Hebrew, Hiragana, Kannada, Katakana, Lao, Latin,

Malayalam, Oriya, Sinhala, Tamil, Telugu, and Thai. The TLDs are grouped by scripts and presented in Figure 3⁴.

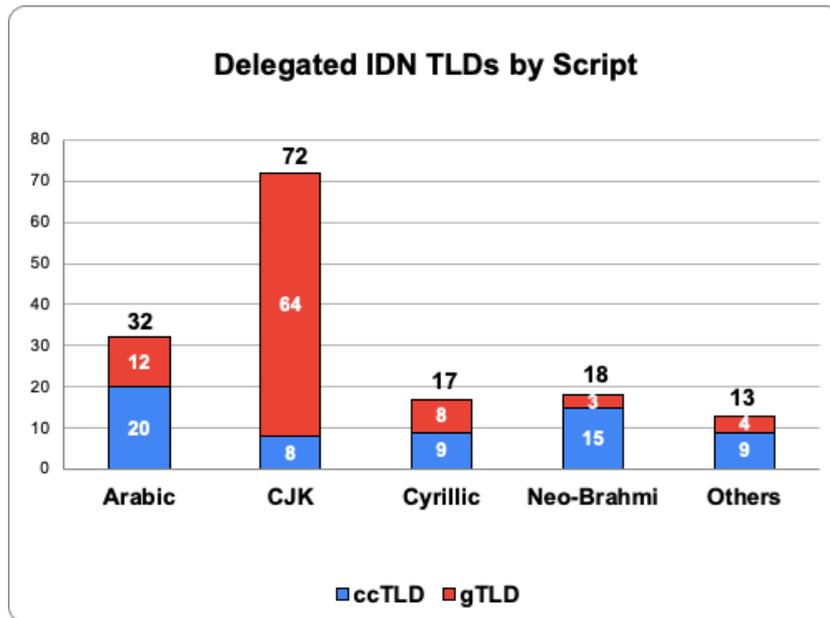


Figure 3: Delegated IDN ccTLDs and IDN gTLDs by Script

3.2 IDN Registration at the Second Level Under gTLDs

3.2.1 IDN Registrations

IDN registrations at the second level under gTLDs, grouped by script, are provided in Table 2⁵ and Figure 4. Currently, there are 1.52 million total IDN registrations under all gTLDs as of December 2022.

Table 2: Second-Level IDN Registrations Under All gTLDs (in thousands)

Script/ Language	2015	2016	2017	2018	2019	2020	2021	2022
Chinese	1,162	1,251	1,119	1,207	995	877	793	760
Latin	300	306	316	359	353	364	381	396
Korean	112	131	126	143	146	136	134	134
Japanese	347	482	435	341	222	140	97	74
Cyrillic	68	139	190	109	93	85	72	69
Thai	31	32	33	38	36	37	40	43
Arabic	26	26	26	27	24	21	27	20
Hebrew	9	7	7	12	9	7	10	12
Others	9	13	14	16	15	8	10	10

⁴ CJK represents Chinese, Japanese and Korean scripts. Neo-Brahmi includes nine scripts: Bengali, Devanagari, Gujarati, Gurmukhi, Kannada, Malayalam, Oriya, Tamil and Telugu.

⁵ This data is collected by ICANN org internally using the gTLD zone files data.

Total	2,064	2,378	2,266	2,252	1,893	1,675	1,564	1,518
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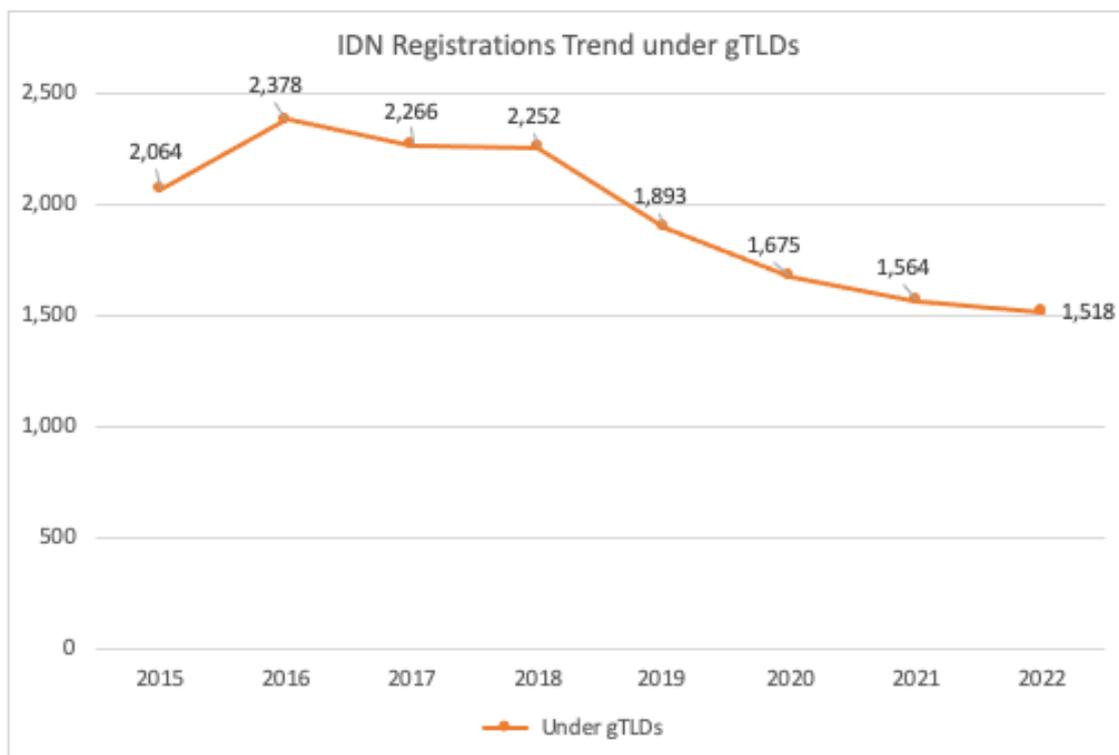


Figure 4: Trend of IDN Registrations Under gTLDs from 2015 to 2022

IDN registrations under gTLDs have been decreasing over the past few years but at a slower rate in 2022. Registrations in 2022 are 2.94% less than the previous year. The previous three-year (2019 - 2021) average declination was 11.36% per year.

Table 2a: Second-Level IDN Registrations Year Over Year Comparison

Year	2016	2017	2018	2019	2020	2021	2022
%Change from Previous Year	15.65%	-5.07%	-0.62%	-15.94%	-11.52%	-6.63%	-2.94%
Average % Change from previous three-year	N/A	N/A	3.32%	-7.21%	-9.36%	-11.36%	N/A

3.2.2 Scripts Used for IDN Registrations Under gTLDs

Based on Table 2, IDN registrations under gTLDs in different scripts are decreasing except in the Latin script, which continues to grow gradually. Please see Figure 5.

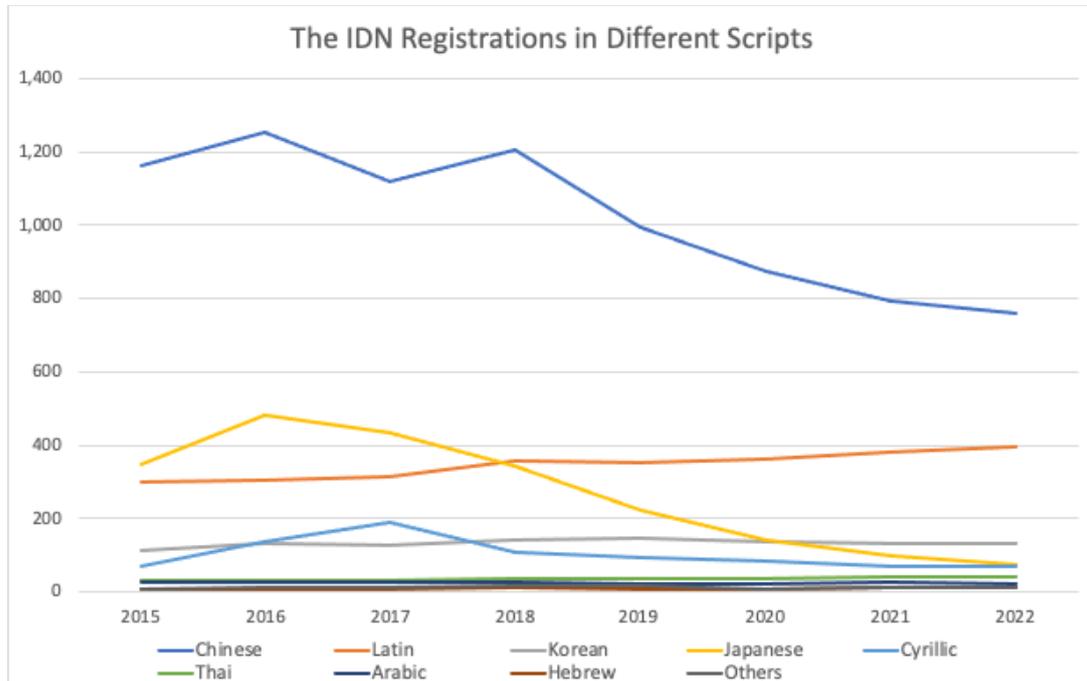


Figure 5: IDN Registrations under gTLDs by Script from 2015 to 2022

Based on the data for 2022 in Table 2, Figure 6 shows the relative number of IDN registrations for different scripts under gTLDs. Half of the IDN registrations are in the Chinese script, followed by the Latin script with approximately a quarter of the registrations.

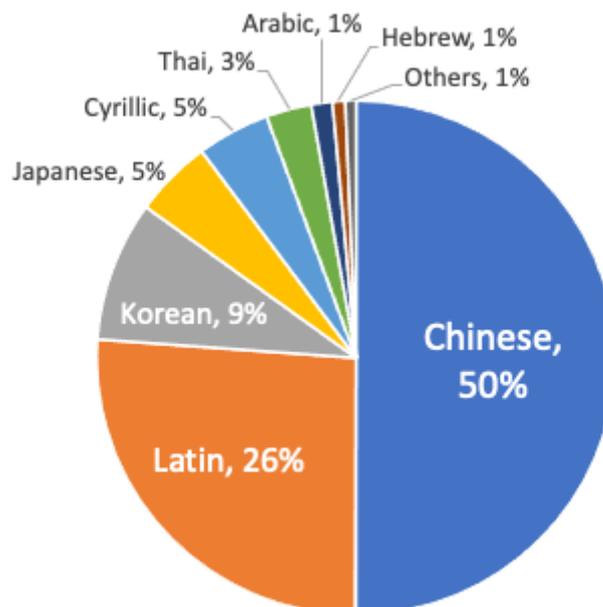


Figure 6: Percentage IDN Registrations by Script Under gTLDs in December 2022

3.3 IDN Tables Published in the IANA Repository

When a gTLD registry operator (RO) intends to offer registrations in different languages and scripts, they must define an IDN table for each language or script. The IDN table represents permitted code points (letters), variant, and contextual rules allowed for IDN registrations in a particular TLD.

The IDN table must be reviewed by ICANN for security and stability considerations. It is required by the [IDN Implementation Guidelines](#) that the reviewed and approved IDN tables be published in the [IANA Repository of IDN Practices](#) (IANA Repository). ccTLD managers are also encouraged to publish their IDN tables in the IANA Repository as per the IDN ccTLD Fast Track Process.

As of 28 November 2022, 462 TLDs list their IDN tables in the IANA Repository (see Appendix 2 for the complete list). A total of 13,980 IDN tables are published across all gTLDs and ccTLDs.

- 7,320 are script-based IDN tables
- 6,660 are language-based IDN tables

The top 10 script-based IDN tables are shown in Figure 7, while the top 10 language-based IDN tables are shown in Figure 8. The top 10 IDN tables indicate that these scripts or languages are frequently used across TLDs.

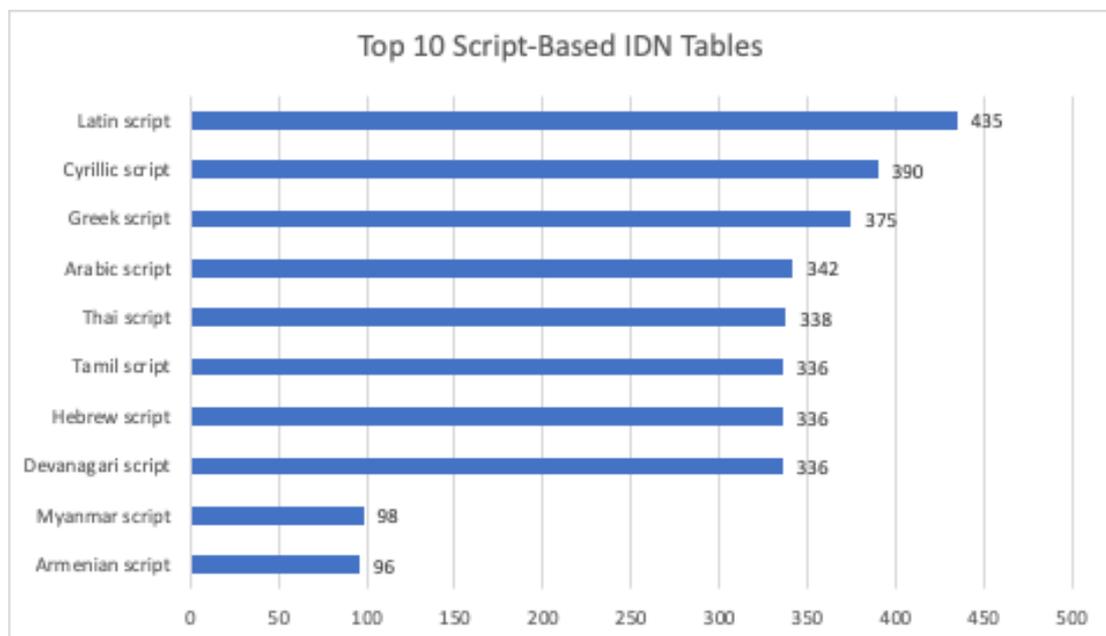


Figure 7: Top 10 Script-Based IDN Table as of 28 November 2022

Please note that the English language is not included in Figure 8 as ASCII, which covers English, is generally supported.

For other languages, .e.g., Spanish, German, French and others, ASCII may not cover all characters used in the language. For example, ñ in Spanish, ß r in German, é in French. Therefore, the IDN tables for these languages are required for IDN registrations.

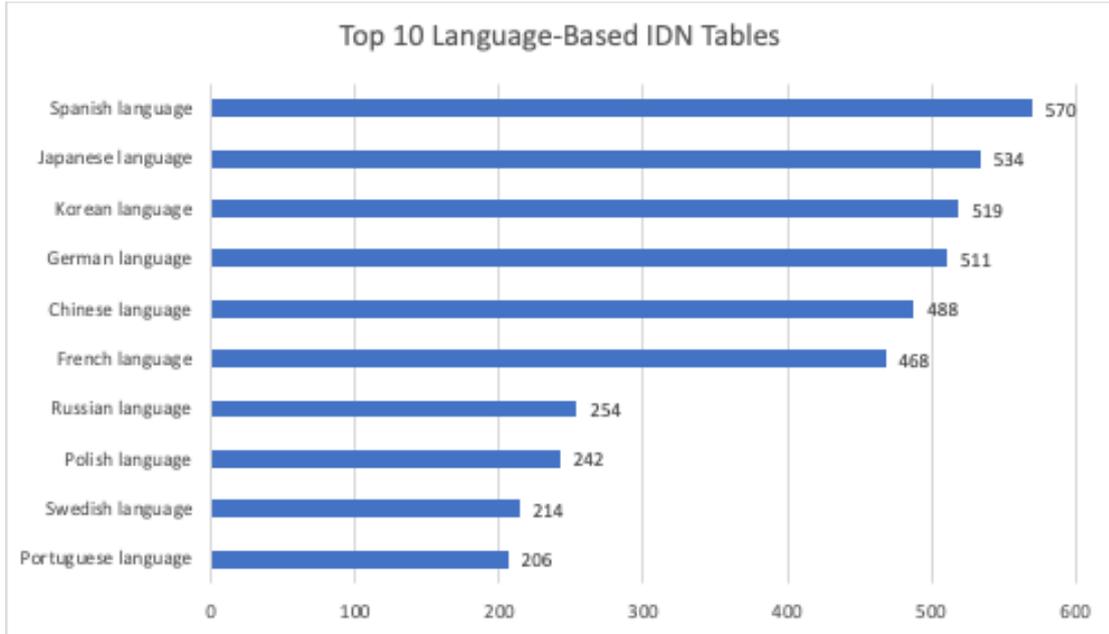


Figure 8: Top 10 Language-Based IDN Table as of 28 November 2022

The above script-based IDN tables and the above language-based IDN table combination show that there are 3,980 Latin script and Latin-based language IDN tables, while there are 841 Chinese script and language IDN tables. This data is aligned with the registration data in Figure 6.

4. Status of IDN-Related Projects at ICANN

4.1 Root Zone Label Generation Rules (RZ-LGR)

Webpage: <https://www.icann.org/resources/pages/root-zone-lgr-2015-06-21-en>

On 26 May 2022, RZ-LGR Version 5 (RZ-LGR-5) was published with seven additional scripts. RZ-LGR-5 covers the following 26 scripts: Arabic, Armenian, Bangla, Chinese (Han), Cyrillic, Devanagari, Ethiopic, Georgian, Greek, Gujarati, Gurmukhi, Hebrew, Japanese (Hiragana, Katakana, and Kanji [Han]), Kannada, Khmer, Korean (Hangul and Hanja [Han]), Lao, Latin, Malayalam, Myanmar, Oriya, Sinhala, Tamil, Telugu, and Thai.

This has concluded the work of all current script Generation Panels (GPs). The timeline of each GP is shown in Figure 9. Each GP has commenced in differing years and worked on a different timeline based on the characteristics and the coverage of the script.

Script	Start	End	Days	2014	2015	2016	2017	2018	2019	2020	2021	2022
Arabic	14-Feb-14	18-Nov-15	642									
Armenian	3-Feb-15	5-Nov-15	275									
Bangla	26-May-15	20-May-20	1821									
Chinese	24-Sep-14	26-May-20	2071									
Cyrillic	10-Dec-15	3-Apr-18	845									
Devanagari	26-May-15	22-Apr-19	1427									
Ethiopic	22-Dec-15	17-May-17	512									
Georgian	17-Jun-16	24-Nov-16	160									
Greek	31-Oct-16	15-Jul-21	1718									
Gujarati	26-May-15	6-Mar-19	1380									
Gurmukhi	26-May-15	22-Apr-19	1427									
Hebrew	15-Oct-18	24-Apr-19	191									
Japanese	17-Mar-15	30-Sep-21	2389									
Kannada	26-May-15	6-Mar-19	1380									
Khmer	17-Jun-15	15-Aug-16	425									
Korean	1-Feb-16	1-May-21	1916									
Lao	15-Sep-15	31-Jan-17	504									
Latin	15-May-17	23-Sep-21	1592									
Malayalam	26-May-15	26-Jun-20	1858									
Myanmar	28-Jun-18	ongoing	-									
Oriya	26-May-15	6-Mar-19	1380									
Sinhala	3-Jan-18	22-Apr-19	474									
Tamil	26-May-15	6-Mar-19	1380									
Telugu	26-May-15	7-Jun-19	1473									
Thai	6-Oct-15	25-May-17	597									

Figure 9: Timeline of work by script Generation Panels

ICANN org will continue to support other scripts as Generation Panels are formed based on the [LGR Procedure](#).

With the publication of the RZ-LGR-5, a celebration session was organized at the ICANN75 Public Meeting with participants from all GPs both on-site and remotely. Figure 10 shows key RZ-LGR stats and Figure 11 shows the collection of some of the 270-plus members across GPs who contributed to the RZ-LGR project.

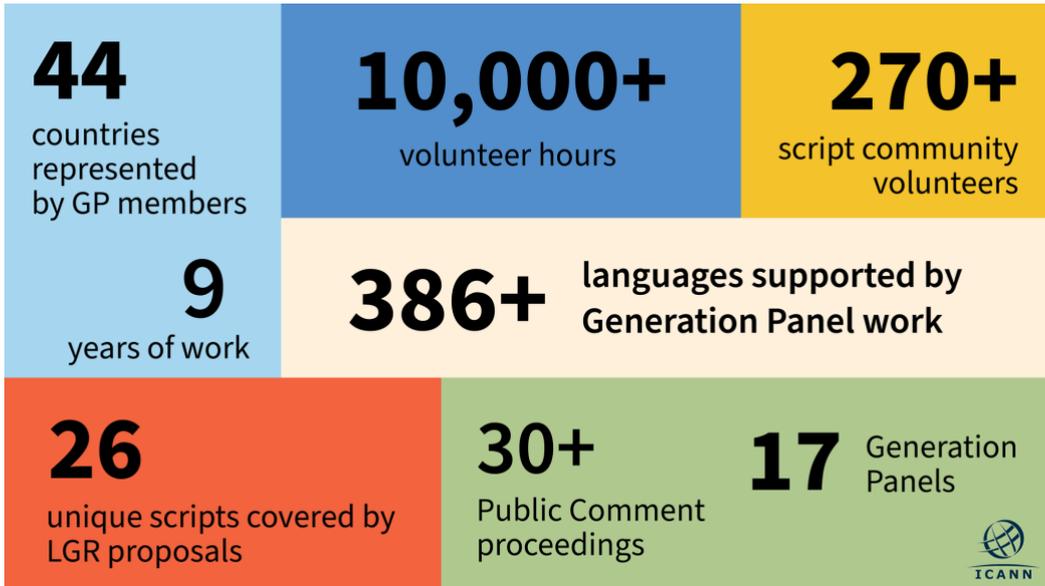


Figure 10: RZ-LGR in Numbers



Figure 11: Collection Generation Panel Members Who Volunteered for the RZ-LGR Project

RZ-LGR has been adopted for validating gTLDs and their variant labels through the recommendations provided in the [Final Report on the new gTLD Subsequent Procedures Policy Development Process](#) by the GNSO. This means that when future gTLDs are applied for, ICANN org will validate applied-for labels in using RZ-LGR-5.

- The RZ-LGR relevant recommendation is Recommendation 25.2: “Compliance with Root Zone Label Generation Rules (RZ-LGR), RZ-LGR-2, and any future RZ-LGR rules sets) must be required for the generation of TLDs and variants labels, including

the determination of whether the label is blocked or allocatable. IDN TLDs must comply with IDNA2008 (RFCs 5890 - 5895) or its successor(s). To the extent possible, and consistent with Implementation Guidance 26.10, algorithmic checking of TLDs should be utilized.”

RZ-LGR is also being considered as an input to two other current policy working groups: the ccNSO Policy Development Process for (de-)selection of IDN ccTLD Strings (ccPDP4) Working Group and the GNSO IDN EPDP Working Group.

4.2 Second-Level Reference Label Generation Rules

Webpage: <https://www.icann.org/resources/pages/second-level-lgr-2015-06-21-en>

Based on input from script communities through the RZ-LGR project, ICANN org developed reference LGRs for the second level using [guidelines](#). Consultation with the script communities followed and then the guidelines were finalized after a Public Comment proceeding.

Reference LGRs are vetted for security and stability through community input. TLD registry operators can use reference LGRs when they develop the rules for IDN registration under their TLDs.

ICANN org has published 46 reference LGRs to-date:

- **30 language-based LGRs:** Arabic, Belarusian, Bosnian (Cyrillic), Bosnian (Latin), Bulgarian, Chinese, Danish, English, Finnish, French, German, Hebrew, Hindi, Hungarian, Icelandic, Italian, Korean, Latvian, Lithuanian, Macedonian, Montenegrin, Norwegian, Polish, Portuguese, Russian, Serbian, Spanish, Swedish, Thai, and Ukrainian.
- **16 script-based LGRs:** Arabic, Bangla (Bengali), Devanagari, Ethiopic, Georgian, Gujarati, Gurmukhi, Hebrew, Kannada, Khmer, Lao, Malayalam, Oriya, Sinhala, Tamil, and Telugu.

As the knowledge from the community on an additional seven scripts (Armenian, Cyrillic, Greek, Japanese, Korean, Latin, and Myanmar) has become available through the RZ-LGR project, a Public Comment proceeding for these reference LGRs was opened in January 2023.

4.3 Label Generation Rules (LGR) Tool

Webpage: <https://www.icann.org/resources/pages/lgr-toolset-2015-06-21-en>

The LGR Tool has been developed and maintained by ICANN org to provide three main functions.

1. **Basic mode:** Users can easily validate a label or list of labels, and generate their variant labels by selecting the applicable LGR.
2. **Advance mode:** Users can use the mode to create an LGR, modify, merge, compare, and manage multiple LGRs.
3. **IDN Table Review mode:** Users can upload IDN tables and compare them with the reference data. The reference data can be the pre-loaded RZ-LGRs or reference LGRs. Users can also compare the IDN table with the uploaded reference data which is a new feature in 2022.

The LGR Tool is updated over time based on user feedback. In 2022, the tool was updated to be integrated with an ICANN account. Any user who has an ICANN account can automatically use the tool and have full control of the tasks and reports generated. The reports will not be periodically deleted by the system as it did for the earlier versions.

The tool is an open source software. The parties interested in integrating this functionality into their own systems can find the source code on GitHub: [lgr-core](#), [lgr-django](#), [munidata](#), and [picu](#).

4.4 IDN Implementation Guidelines

Webpage: <https://www.icann.org/resources/pages/implementation-guidelines-2012-02-25-en>

IDN Implementation Guidelines apply to second-level IDN registration policies and practices under TLDs. They are contractually binding through most gTLD Registry Agreements (RAs) and the 2013 Registrar Accreditation Agreement (RAA). They are also recommended through the IDN ccTLD Fast Track Process.

[Version 4](#) of the IDN Implementation Guidelines was finalized by a community-based [IDN Implementation Working Group](#). These guidelines were presented to the ICANN Board for consideration in 2019, but deferred based on the [request](#) of the GNSO. On 18 August 2021, the GNSO [requested](#) that the adoption of the IDN Implementation Guidelines be delayed until the IDN Expedited Policy Development Process (IDN EPDP) is concluded due to some overlap. The ICANN Board [responded](#) on 20 October 2021 requesting the GNSO to analyze and identify the guidelines which overlap with the topics included in the IDN EPDP and share the details for further consideration by the Board.

On 22 September 2022, the ICANN Board [approved](#) IDN Guidelines version 4.0, except for the deferred guidelines 6a, 11, 12, 13, 18 and associated additional notes, and directed that these be published as IDN Guidelines version 4.1 and implemented.

Following the ICANN Board resolution, [Guidelines version 4.1](#) was published on 11 November 2022. ICANN org is working on implementing them and will communicate the effective date to relevant parties when available.

5. IDN Policy Development by the ICANN Community

The ccNSO and the GNSO are developing IDN-related policies, taking the [Variant TLD Recommendations](#) and [Recommendations for the Technical Utilization of the RZ-LGR](#) into account as per the ICANN Board's request and collaborating with each other for consistent solutions.

5.1 ccNSO ccPDP4

Webpage: <https://ccnso.icann.org/en/workinggroups/idn-cctld-strings.htm>

In August 2020, the ccNSO formed the [Policy Development Process \(ccPDP4\) - \(De-\) Selection of IDN ccTLD Strings](#) Working Group to recommend new policy based on the experience from the [IDN ccTLD Fast Track Process](#).

The IDN ccPDP4 Working Group has organized three sub-working groups to look into specific topics, including Variant Management, De-selection of IDN ccTLD String, and Confusing Similarity. These sub-groups are approaching the conclusion of their work. The full working group is integrating their input into the main document as well as planning stress testing of the recommendations in the policy. The initial report is planned to be published in early 2023 for Public Comment.

5.2 GNSO EPDP on IDNs

Webpage: <https://gnsso.icann.org/en/group-activities/active/idn-epdp>

On 20 May 2021, the GNSO Council initiated an [Expedited Policy Development Process \(EPDP\) on IDNs](#) to address additional issues related to IDNs not discussed in the [SubPro report](#), including how to securely and stably define and manage variant gTLDs and how to update IDN guidelines in the future. The scope of this work is defined in the [EPDP charter](#). The working group was officially formed and started meeting in August 2021.

The EPDP Working Group plans to publish two final reports. The first report will include top-level domain recommendations and the second report will include the second-level domain recommendations. The two-phase approach will allow the EPDP Working Group to deliver the first set of recommendations to the GNSO Council and then the ICANN Board while the work on recommendations for the second-level domains continues. The EPDP Working Group is currently planning the following timeline:

- Phase 1 Initial Report Public Comment: 21 April 2023
- Phase 1 Final Report submission to Council: 3 November 2023
- Phase 2 Initial Report Public Comment: 25 April 2025
- Phase 2 Final Report submission to Council: 7 November 2025

The EPDP Working Group also shared the initial report with ICANN org requesting initial input, which was received in November 2022.

5.3 New gTLD Subsequent Procedures

Webpage: <https://gnso.icann.org/en/group-activities/active/new-gtld-subsequent-procedures>

The GNSO Council voted to approve the [New Generic Top Level Domain \(gTLD\) Subsequent Procedures Policy Development Process Final Report](#) on 18 February 2021.

The policy recommendation relevant to IDNs are the following:

- RZ-LGR is used to validate a gTLD string and to determine its variant labels (Recommendation 25.2).
- Single character gTLDs are allowed, pending input from Chinese, Japanese, and Korean script communities (Recommendation 25.4).
- Variant gTLDs are allowed with the following conditions:
 - Variant gTLDs are managed by the same RO and backend provider (Recommendation 25.5).
 - Variant labels at the second level are registered to the same registrant (Recommendation 25.6 – 25.8).

The Operational Design Phase (ODP) was conducted in 2022 to facilitate the Board's determination whether the outputs contained in the Final Report are in the best interest of the ICANN community or ICANN, in accordance with the ICANN Bylaws.

On 12 December 2022, ICANN org delivered the Operational Design Assessment ([ODA](#)) of New Generic Top-Level Domain Subsequent Procedures to the ICANN Board of Directors. The ODA is intended to guide the ICANN Board in its consideration of policy recommendations for potential future rounds of new gTLD applications.

6. IDN Implementation and Operations at ICANN Org

6.1 IDN ccTLD String Evaluation

Project webpage: <https://www.icann.org/resources/pages/fast-track-2012-02-25-en>

Based on the IDN ccTLD Fast Track Process, there are 62 IDN ccTLD strings successfully evaluated from 43 countries and territories, as shown in Figure 1. Of these, 61 applications from 42 countries and territories have been delegated covering 35 languages in 20 different scripts. The latest string was published in 2020. There are no pending IDN ccTLD requests.

ICANN org continues to provide information about the process for additional IDN ccTLD requesters and continues to process requests for IDN ccTLDs received through the Fast Track Process.

6.2 IDN Table Update Project and IDN Table Reviews

The IDN Table Update project was initiated by ICANN org to address concerns raised by the Registries Stakeholder Group (RySG) on the IDN table review process and to incorporate additional security, stability, and linguistic considerations for IDN implementation identified by the technical and script communities. ICANN org reviews IDN tables submitted through the Registry Services Evaluation Policy ([RSEP](#)) Process and Registry System Testing ([RST](#)).

The first phase, completed in June 2021, ensured that all the contractually approved IDN tables are made available in the IANA [Repository](#) as required in Specification 6, Section 1.4 of the [Base gTLD Registry Agreement](#). In addition, an [IDN Table Review Tool](#) and additional [Reference LGRs](#) have been developed and made publicly available for ROs and RSPs to be able to check their IDN tables before submitting to ICANN org. A dedicated [IDN Service: Add, Modify, or Remove](#) service request was also made available in the Naming Services portal (NSp) to create a more efficient process for ROs.

In Phase 2 of the project, which concluded in December 2021, ICANN org reviewed and analyzed all 14,139 IDN tables published in the IANA Repository and identified the IDN tables that contain a potential security or stability issue, based on the IDN Table Review Tool calculation using the reference LGRs and information provided by the relevant script community.

For Phase 3 of the project, in 2022, ICANN org communicated the issues found in Phase 2 to the relevant RSPs and collaboratively worked with ROs and RSPs to address these issues. The new [IDN Service: Update and Publish](#) was made available in the NSp for the ROs who request to update previously approved IDN tables within the IANA Repository.

In addition to the IDN Table Update project, ICANN org continued to review IDN tables submitted by ROs and RSPs. In 2022, ICANN org reviewed a total of 323 IDN tables for 281 TLDs. The details by type of service request is shown in Table 3.

Within these 323 IDN tables, the majority of submitted IDN tables were for the Japanese language. The top 10 language or script IDN table reviews are shown in Table 4 and the complete list can be found in Appendix 5.

Table 3: Number of IDN Table Reviews in 2022

Type of Request	Number of TLDs	Number of IDN Table Reviews
IDN Service: Add, Modify, or Remove	257	93
IDN Service: Update and Publish	4	11
Registry System Testing	20	219
Total	281	323

Table 4: Top 10 Language or Script IDN Tables Reviewed in 2022

Language or Script	Number of IDN Tables Reviewed
Japanese (Kanji + Hiragana + Katakana) language	32
Spanish language	20
Cyrillic script	19
German language	19
Portuguese language	18
French language	17
Italian language	17
Chinese (Simplified + Traditional) language	16
Chinese (Simplified) language	13
Chinese (Traditional) language	13

7. Conclusion

In 2022, a major milestone was the completion of [RZ-LGR version 5](#) by script communities. The knowledge gained from the RZ-LGR project paves the way for policy development on IDNs and improves the security and stability of IDN implementation.

The ccNSO and GNSO continue their work on developing IDN-related policies and are considering the request by the ICANN Board to take relevant recommendations and reports into account in their policy development work.

The IDN Implementation Guidelines version 4.1 was adopted by the ICANN Board and ICANN org will move forward with implementation. In addition, IDN table review processes have been updated to enhance transparency and consistency and have been in full operation as of 2022.

ICANN org will continue to support the work being done by the community to advance IDN technical knowledge, support the ccNSO and GNSO in their policy development, and ultimately implement these policies.

Appendix 1 Relevant Standards and Reports

IDNA2008

Standards Track

- [RFC 5890](#) Internationalized Domain Names for Applications (IDNA): Definitions and Document Framework
- [RFC 5891](#) Internationalized Domain Names in Applications (IDNA): Protocol
- [RFC 5892](#) The Unicode Code Points and Internationalized Domain Names for Applications (IDNA)
- [RFC 5893](#) Right-to-Left Scripts for Internationalized Domain Names for Applications (IDNA)

Informational

- [RFC 5894](#) Internationalized Domain Names for Applications (IDNA): Background, Explanation, and Rationale
- [RFC 5895](#) Mapping Characters for Internationalized Domain Names in Applications (IDNA) 2008

IAB statements

- [IAB Statement on Identifiers and Unicode \(2018-03-15\)](#)
- [IAB Statement on Identifiers and Unicode 7.0.0 \(2015-02-11\)](#)

Additional Relevant RFCs:

- [RFC 9233](#) Internationalized Domain Names for Applications 2008 (IDNA2008) and Unicode 12.0.0
- [RFC 8753](#) Internationalized Domain Names for Applications (IDNA) Review for New Unicode Versions
- [RFC 8228](#) Guidance on Designing Label Generation Rulesets (LGRs) Supporting Variant Labels
- [RFC 7940](#) Representing Label Generation Rulesets Using XML
- [RFC 6927](#) Variants in Second-Level Names Registered in Top-Level Domains
- [RFC 6912](#) Principles for Unicode Code Point Inclusion in Labels in the DNS
- [RFC 5992](#) Internationalized Domain Names Registration and Administration Guidelines for European Languages Using Cyrillic
- [RFC 5646](#) Tags for Identifying Languages
- [RFC 5564](#) Linguistic Guidelines for the Use of the Arabic Language in Internet Domains
- [RFC 4690](#) Review and Recommendations for Internationalized Domain Names (IDNs)
- [RFC 4290](#) Suggested Practices for Registration of Internationalized Domain Names (IDN)
- [RFC 4185](#) National and Local Characters for DNS Top Level Domain (TLD) Names
- [RFC 3743](#) Joint Engineering Team (JET) Guidelines for IDN Registration and Administration for Chinese, Japanese, and Korean
- [RFC3696](#) Application Techniques for Checking and Transformation of Names
- [RFC 1123](#) Requirements for Internet Hosts -- Application and Support

IDNA2003

[RFC 3454](#) Preparation of Internationalized Strings ("stringprep")

[RFC 3490](#) Internationalizing Domain Names in Applications

[RFC 3491](#) Nameprep: A Stringprep Profile for Internationalized Domain Names

[RFC 3492](#) Punycode: A Bootstring encoding of Unicode for Internationalized Domain Names in Applications

Unicode Consortium

[Unicode Character Code Charts](#)

Unicode Standard Annex #15 ([UAX#15](#)): Unicode Normalization Forms

Unicode Standard Annex #31 ([UAX#31](#)): Unicode Identifier and Pattern Syntax

Unicode Technical Report #36 ([UTR#36](#)): Unicode Security Considerations

Unicode Technical Report #39 ([UTR#39](#)): Unicode Security Mechanisms

ccNSO/GNSO Joint IDN Working Group (JIG):

[JIG Final Report on Universal Acceptance of IDN TLDs \(2013-11-15\)](#)

[JIG Final Report on Single Character IDN TLDs \(2011-03-30\)](#)

SSAC Documents

SAC052: [SSAC Advisory on Single-Character Internationalized Domain Name Top-Level Domains](#)

SAC060: [SSAC Comment on Examining the User Experience Implications of Active Variant TLDs Report](#)

SAC084: [SSAC Comments on Guidelines for the Extended Process Similarity Review Panel for the IDN ccTLD Fast Track Process](#)

SAC088: [SSAC Response to the ccNSO evaluation of SAC084](#)

SAC089: [SSAC Response to ccNSO Comments on SAC084](#)

SAC095: [SSAC Advisory on the Use of Emoji in Domain Names](#)

SAC099: [SSAC Response to the ICANN Internationalized Domain Name Guidelines Working Group](#)

SAC120: [SSAC Input to GNSO IDN EPDP on Internationalized Domain Name Variants](#)

Appendix 2 TLDs that List IDN Tables in the IANA Repository

(As of 28 November 2022)

A

1	.aarp	8	.aeg	15	.amfam	22	.arte
2	.academy	9	.agency	16	.android	23	.associates
3	.accenture	10	.airbus	17	.apartments	24	.at
4	.accountants	11	.airforce	18	.app	25	.attorney
5	.actor	12	.alsace	19	.aquarelle	26	.auction
6	.adac	13	.alstom	20	.army	27	.auto
7	.ads	14	.americanfamily	21	.art	28	.azure

B

29	.baby	35	.bcn	41	.bing	47	.boutique
30	.band	36	.be	42	.bingo	48	.brussels
31	.bar	37	.beauty	43	.blackfriday	49	.builders
32	.barcelona	38	.bentley	44	.bond	50	.business
33	.bargains	39	.berlin	45	.boo		
34	.bbva	40	.bike	46	.bostik		

C

51	.cab	65	.casino	79	.click	93	.comsec
52	.cafe	66	.catering	80	.clinic	94	.condos
53	.cal	67	.center	81	.clothing	95	.construction
54	.cam	68	.ceo	82	.clubmed	96	.consulting
55	.camera	69	.channel	83	.co	97	.contact
56	.camp	70	.charity	84	.coach	98	.contractors
57	.capital	71	.chat	85	.codes	99	.cool
58	.car	72	.cheap	86	.coffee	100	.corsica
59	.cards	73	.chrome	87	.college	101	.country
60	.care	74	.church	88	.cologne	102	.coupons
61	.career	75	.city	89	.com	103	.credit
62	.careers	76	.cl	90	.community	104	.creditcard
63	.cars	77	.claims	91	.company	105	.cruises
64	.cash	78	.cleaning	92	.computer		

D

106 .dad	113 .degree	120 .dhl	127 .doctor
107 .dance	114 .delivery	121 .diamonds	128 .dog
108 .dating	115 .democrat	122 .digital	129 .domains
109 .day	116 .dental	123 .direct	130 .drive
110 .dclk	117 .dentist	124 .directory	
111 .dealer	118 .design	125 .discount	
112 .deals	119 .dev	126 .docs	

E

131 .eat	136 .engineering	141 .estate	146 .exchange
132 .education	137 .enterprises	142 .eu	147 .expert
133 .email	138 .equipment	143 .eurovision	148 .exposed
134 .energy	139 .erni	144 .eus	149 .express
135 .engineer	140 .esq	145 .events	

F

150 .fail	157 .finance	164 .foo	171 .fund
151 .fairwinds	158 .financial	165 .football	172 .furniture
152 .family	159 .fish	166 .forsale	173 .futbol
153 .fan	160 .fitness	167 .foundation	174 .fyi
154 .fans	161 .flights	168 .frl	
155 .farm	162 .florist	169 .frogans	
156 .feedback	163 .fly	170 .fun	

G

175 .gal	181 .gift	187 .gmbh	193 .gratis
176 .gallery	182 .gifts	188 .gold	194 .gripe
177 .games	183 .gives	189 .golf	195 .group
178 .gay	184 .glass	190 .goog	196 .guge
179 .gbiz	185 .gle	191 .google	197 .guide
180 .genting	186 .gmail	192 .graphics	198 .guru

H

199 .hair	203 .healthcare	207 .hockey	211 .host
200 .hamburg	204 .here	208 .holdings	212 .hotmail
201 .hangout	205 .hiphop	209 .holiday	213 .house
202 .haus	206 .hiv	210 .hospital	214 .how

I

215 .icu	219 .inc	223 .institute	227 .irish
216 .ikano	220 .industries	224 .insure	
217 .immo	221 .ing	225 .international	
218 .immobilien	222 .ink	226 .investments	

J

228 .jetzt	229 .jewelry	230 .juegos	
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K

231 .kaufen	232 .kitchen	233 .kiwi	234 .koeln
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L

235 .la	240 .lease	245 .life	250 .link
236 .lacaixa	241 .leclerc	246 .lighting	251 .live
237 .lancaster	242 .legal	247 .limited	252 .loans
238 .land	243 .lego	248 .limo	253 .love
239 .lawyer	244 .lidl	249 .linde	254 .ltd

M

255 .madrid	261 .map	267 .meme	273 .monster
256 .maif	262 .market	268 .memorial	274 .mortgage
257 .maison	263 .marketing	269 .microsoft	275 .mov
258 .makeup	264 .mba	270 .mma	276 .movie
259 .management	265 .media	271 .moda	277 .museum
260 .mango	266 .meet	272 .money	

N

278 .name	281 .network	284 .nexus	287 .norton
279 .navy	282 .new	285 .ninja	288 .nz
280 .net	283 .news	286 .nissay	

O

289 .omega	290 .online	291 .ooo	292 .orange
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P

293 .page	299 .photos	305 .plus	311 .property
294 .partners	300 .pictures	306 .press	312 .protection
295 .parts	301 .pizza	307 .prod	313 .pub
296 .phd	302 .place	308 .productions	314 .pw
297 .photo	303 .play	309 .prof	
298 .photography	304 .plumbing	310 .properties	

Q

315 .quest

R

316 .radio	321 .reisen	326 .republican	331 .rocks
317 .realestate	322 .rent	327 .rest	332 .rsvp
318 .recipes	323 .rentals	328 .restaurant	333 .run
319 .rehab	324 .repair	329 .reviews	334 .rwe
320 .reise	325 .report	330 .rip	

S

335 .sale	347 .sener	359 .sky	371 .studio
336 .salon	348 .services	360 .snCF	372 .style
337 .sarL	349 .sexy	361 .soccer	373 .supplies
338 .sbs	350 .sfr	362 .social	374 .supply
339 .school	351 .shell	363 .software	375 .support
340 .schule	352 .shoes	364 .solar	376 .surgery
341 .schwarz	353 .shopping	365 .solutions	377 .swatch
342 .scot	354 .show	366 .soy	378 .swiss
343 .se	355 .si	367 .space	379 .systems
344 .search	356 .singles	368 .sport	
345 .seat	357 .site	369 .storage	
346 .security	358 .skin	370 .store	

T

380 .tattoo	386 .tennis	392 .tips	398 .tours
381 .tax	387 .theater	393 .tires	399 .town
382 .taxi	388 .theatre	394 .tirol	400 .toys
383 .team	389 .tickets	395 .today	401 .training
384 .tech	390 .tienda	396 .tools	
385 .technology	391 .tiffany	397 .total	

U

402 .ua	403 .university	404 .uno
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V

405 .vacations	409 .vet	413 .vin	417 .voting
406 .ventures	410 .viajes	414 .visa	418 .voyage
407 .verisign	411 .video	415 .vision	
408 .versicherung	412 .villas	416 .vlaanderen	

W

419 .watch	422 .wien	425 .wine	428 .wtf
420 .weber	423 .wiki	426 .works	
421 .website	424 .windows	427 .world	

X

429 .xbox	430 .xyz	425 .wine	
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Y

431 .yahoo	432 .youtube		
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Z

433 .zip	434 .zone		
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IDNs

435 .ею	442 .ڍڍڍ	449 .グーグル	456 .娱乐
436 .католик	443 .بازار	450 .コム	457 .游戏
437 .ком	444 .كوم	451 .企业	458 .点看
438 .онлайн	445 .कॉम	452 .商店	459 .谷歌
439 .рус	446 .नेट	453 .嘉里	460 .香格里拉
440 .рф	447 .फ़ॉम	454 .嘉里大酒店	461 .닷컴
441 .сайт	448 .みんな	455 .大拿	462 .닷컴