



Increasing Internet Inclusivity and Diversity Through Universal Acceptance (UA)

Executive Summary

As the organization overseeing the expansion of the Domain Name System (DNS) – and an active supporter of Universal Acceptance (UA) – ICANN is sharing best practices and key learnings as it updates its systems to become UA-ready. Through UA, organizations provide inclusive Internet experiences and can reach new customers and users through their unique domains, including those in local languages. In an increasingly connected world, achieving UA is key to reducing technical debt, supporting the next billion Internet users, promoting competition and customer choice, as well as improving access. ICANN's efforts to support UA benefit the Internet industry, registrants and users alike.

Situation Overview

ICANN manages the top level of the DNS, called the Root Zone. The Root Zone matches each unique top-level domain name (TLD) with its unique Internet Protocol address (IP address). Without a seamless matching process there would not be a global, interoperable Internet – it could work differently depending on a user's location.

Today, the Internet has expanded to include domain names represented in different languages and scripts, such as Arabic, Chinese, Hindi, Russian, etc., as well as top-level domain names longer than the traditional two or three letters/characters to better represent users' identities, as listed in the [IANA Root Zone Database](#). UA is a best practice that ensures all applications, devices and systems accept all domain names and email addresses regardless of the chosen language or identity. Due to the rapidly changing domain name landscape, many Internet-enabled applications, devices and systems still do not recognize or appropriately process these new domain names or associated email addresses. This prevents users with valid credentials from fully experiencing the Internet. Lack of UA results in frustrating and inconsistent experiences for Internet users and limits an organization's ability to connect with users globally.

By making its systems UA-ready, ICANN is helping to increase online diversity and support an inclusive Internet experience for all. ICANN is an early adopter working diligently to set an example and provide insights to help other organizations achieve UA-readiness

Universal Acceptance Approach

ICANN's Chief Information Officer, along with its Front Office Relationship & Delivery and Software Engineering groups, oversee the organization's move to UA, which encompasses all of its global systems and services that gather and process domain names and/or email addresses. ICANN developed project initiation guidelines as well as three stages of UA-readiness that can be applied to other organizations. At any time, there may be systems at any one of these identified stages.

Universal Acceptance Case Study:

Internet Corporation for Assigned Names and Numbers (ICANN)

The mission of the Internet Corporation for Assigned Names and Numbers (ICANN) is to help ensure a stable, secure and unified global Internet. To reach another person on the Internet, you need to type an address – a name or a number – into your computer or other device. That address must be unique, so computers know where to find each other. ICANN helps coordinate and support these unique identifiers across the world. ICANN was formed in 1998 as a not-for-profit public-benefit corporation with a community of participants from all over the world.

Industry: Technology

Location: Los Angeles, CA

"Universal Acceptance (UA) is critical for creating an inclusive Internet. One where all domains and email addresses, regardless of length or language, are accepted by any application. The process for becoming UA-ready is straightforward and can be integrated into an organization's roadmap. To help organizations become UA-ready, we are sharing first-hand insights to help all app and system owners."

— Ashwin Rangan
SVP, Engineering & Chief Information Officer



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UA Project Initiation:

- *Review and map all systems and services.* For all business-directed services, identify which systems are off-the-shelf or custom, and whether UA is a consideration for those systems. In addition, determine what coding languages the custom systems are built on.
- *Choose systems and services to pilot.* Within the pool of applicable custom systems, select one system from each coding language to pilot the UA-readiness stages.
- *Review and begin third-party service assessments.* Ensure there are contractual agreements with off-the-shelf service vendors that include language indicating they must agree to support UA. Work with vendors directly to educate them on UA, where needed, and determine a roadmap and timeline for UA support.

Note: ICANN split its services into custom-developed and off-the-shelf/software as a service (SaaS) services. Because custom services are fully under ICANN's control, the decision was made to address these first.

Three Stages:

Stage 1: Establish support for new short and long ASCII¹-based TLDs

- *Update custom services to support both new short and long ASCII TLDs.* Start by handling new (three characters) and longer (more than three characters) ASCII TLD updates. This step is a day or two worth of programming per service and helps to identify which services require further updates and code to accept Unicode-based TLDs² for Stage 2 below.

Stage 2: Establish support for Internationalized Domain Name (IDN) TLDs in Unicode or Punycode

- *Update custom services to support non-ASCII IDNs in Unicode native form (U-label).* The U-label is the format that a user expects to see the IDN displayed. For each system, locate all instances in the code that process URLs. Then, update the code to accept Unicode in all levels of the domain name as an input parameter.
 - In ICANN's case, this also means being able to support both left-to-right (LTR) and right-to-left (RTL) scripts (e.g., Arabic URLs).

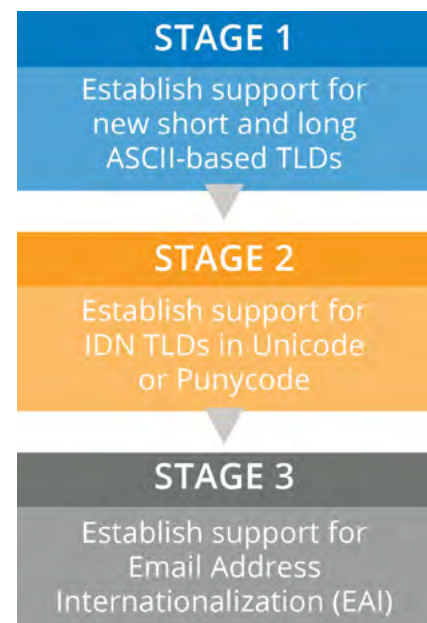
¹ American Standard Code for Information Interchange (ASCII) is a character encoding standard for electronic communication. Originally based on the English alphabet, ASCII encodes 128 specified characters into seven-bit integers. <https://www.icann.org/icann-acronyms-and-terms/en/G0335>

² Unicode is a commonly used single encoding scheme that provides a unique number for each character across a wide variety of languages and scripts. <https://www.icann.org/resources/pages/glossary-2014-02-04-en#u>

Systems that are Universal Acceptance-Ready:

ICANN is assessing its systems holistically and outlining a path forward to ensure all become fully Universal Acceptance (UA)-ready in the next couple of years. Currently, many systems created and run by ICANN are UA-ready, and those that rely on plug-ins or software operated by third parties are underway. Examples of ICANN systems that are UA-ready include:

- * At-Large system – the website dedicated to individual Internet community users who participate in the policy development work of ICANN.
- * ICANN Lookup (previously ICANN WHOIS) – a tool that provides users with the ability to look up publicly available registration data for top-level domain (TLD) names.
- * New generic TLD Application Status – the website that provides the current status and details for gTLD applications.





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- *Update custom services to support ASCII-based IDN representations in Punycode³ format (A-label).* The A-label is primarily used by the DNS and not typically displayed to the user but may be displayed alongside the U-label. For each system, locate all instances in the code that process URLs. Then, update the code to accept A-label in all levels of the domain name as an input parameter.

A suggestion of how Stage 2 compliance can be achieved is to use a phased approach to Unicode implementation, which may simplify development and allow testing and validation to be conducted incrementally. Details can be found in the [UASG Quick Guide](#) and examples include:

1. Provide the ability for a service to accept an IDN input as either a U-label or an A-label.
2. Ensure that the service can validate the accepted IDN input.
3. Establish a capability so the service can store the validated IDN input.
4. Enable the service so that it can process the stored IDN input.
5. Supply a method for the service to display the processed IDN input.

Stage 3: Establish support for Email Address Internationalization (EAI)

- *Update infrastructure and custom services to support non-ASCII email addresses (with non-ASCII codes either in their mailbox name and/or in their domain name part).* Work with third-party vendors supporting infrastructure to deliver patches and updates to support EAI, including for (but not limited to) end-user email client, email server, routers/gateway, security/spam filter and archive/backup.
 - *Note: all components must support EAI before infrastructure is deemed fully compliant. Applicable custom services must be updated to support EAI in preparation for infrastructure readiness.*

Note: Testing is a key step within each phase. Develop a testing environment for each pilot system and test each instance identified in Stages 1 - 3 (i.e., fix the code, update off-the-shelf systems). The testing environment must be able to trap all outgoing emails and DNS queries. Systems managers can determine whether the instances pass or fail the test by reviewing system logs. Continue to test and update until the pilot systems accept all email addresses and URLs.

Procurement:

When ICANN embarked on this UA-journey it also implemented a policy where UA was incorporated into every new vendor contract. While all vendors may not be able to initially meet the requirement, it serves as a trigger to educate the vendor and to get their commitment to incorporate UA into their own roadmap.

(continued from previous page):

- * TLD Watch – an internal ICANN service that facilitates the process of onboarding a newly delegated TLD.
- * Naming Services portal (NSp) – the web-based portal between registries/registrars and ICANN, used for day-to-day operations.

Benefits of Universal Acceptance Identified:

- * Provides greater access for all Internet users.
- * Promotes standards and best practices to achieve global interoperability.
- * Keeps pace with Internet changes to reduce organizations' "technical debt."
- * Improves user experience and engagement.
- * Promotes competition and user choice.

³ Punycode is the letter, digit, hyphen (LDH)-compatible encoding algorithm described in Internet standard [RFC3492], and in use today. <https://www.icann.org/resources/pages/glossary-2014-02-04-en#p>



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Results and Next Steps

In late 2018, ICANN completed Stage 1 by updating its custom services to handle new short and long ASCII-based TLDs. This stage took about a year to complete by updating each service as time allowed. Inventorying the applications took six months and was completed in 2017. Since then, many applications have been combined or retired. As of mid-2019, about 60 percent of applicable ICANN systems are “off-the-shelf” services, meaning only the third-party service providers can alter the code, and the other 40 percent of services are custom (developed in-house by ICANN). Stage 1 provided ICANN with a clear roadmap for how it intended to update its services.

ICANN initiated Stage 2 by updating custom services to support Unicode input for IDNs in local languages and scripts. This stage has a longer timeline due to the complexity of supporting local language domains. Stage 2 is in progress and is expected to be completed in 2020. Currently, 64 percent of the custom services are now compliant; 30 percent are internal systems that do not need to support local language domains; and only 6 percent of services are in review. While these services are IDN-compliant internally, they still rely on a third-party service for single-sign-on which is not yet IDN-compliant.

Stage 3 was initiated by updating ICANN's infrastructure and custom services to support non-ASCII email addresses. ICANN anticipates this stage to be the lengthiest to complete due to its reliance on third-party systems; therefore, it must work with those vendors to ensure their support of Email Address Internationalization (EAI). As defined above, there are several areas of focus that must be addressed before EAI can be fully supported. Currently, ICANN has upgraded its internal email clients to a UA-ready compliant version, and its infrastructure and email service will be compliant by mid-2020. The final component is its spam filtering service – once the vendor has updated its service, ICANN will be fully UA-ready.

Currently, ICANN has updated its internal and custom services to be as UA-ready as possible, but in some instances, it is restricted from having full UA functionality (IDNs/EAI) due to certain services being provided by a third-party product. ICANN is concentrating on working with its vendors to have them update their services, with a focus on those that directly impact the community.

Throughout its process, ICANN is participating in events and working closely with the Universal Acceptance Steering Group (UASG) to share best practices and findings with the larger technology community. As all organizations make the move to achieve UA, they will better serve audiences across the globe, as well as support a fully accessible Internet that is inclusive of all users regardless of geography or online identity.

Resources and Best Practices:

Code Libraries: ICANN found that creating code libraries greatly reduced programming efforts. For example, when looking at Python, ICANN determined it already had the ability to process Kanji (Chinese/Han) characters in its code library; therefore, there was no need to program it in as that would rework the code. Findings like this can be useful to other organizations as they embark on their projects. Additional programming languages ICANN worked with include: Drupal, Java, Pearl, PHP and Ruby on Rails.

Test Environments: ICANN developed testing environments for systems built on Java and Ruby on Rails. These test environments were critical in reducing the amount of time it took to test and fix each system or service.

UASG Resources: Throughout the process of becoming UA-ready, ICANN leveraged the following resources from the UASG that may also be helpful to other organizations.

- * The UASG compiled “[Use Cases for UA Readiness Evaluation](#),” which developers can use when assessing their systems. The document provides generic examples as well as specific names that can be used for testing.
- * The “[Blueprint for CIOs](#)” is a guideline geared toward Chief Information Officers (CIOs) to use when reviewing software systems to ensure that they accept all domain names and email addresses.



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Challenges and Key Learnings

In Stage 1, ICANN realized that by first handling new short and long ASCII-based TLDs, they were able to quickly garner results and define where remaining efforts (i.e. non-ASCII TLDs and EAI) were needed most. This enabled ICANN to understand the scope of services to be addressed. It also allowed ICANN to create a roadmap to tackle them, an essential step for any organization updating a significant number of systems.

Initially, ICANN planned to make becoming UA-ready a requirement any time a system underwent a more than minor update. However, while the act of updating systems to become UA-ready is not always a heavy technical lift, the organization found that when it was not attached to a timeline, it was not always prioritized during maintenance.

To ensure the UA effort moved forward, ICANN established individual projects for each service that needed to be updated. In addition, when talking about the UA project and the enhancements it would provide, the groups emphasized that it is a way to keep pace with Internet advancements and minimize “technical debt.”

For ICANN's off-the-shelf systems, the organization has worked extensively with its vendors to determine their awareness of UA and their roadmap commitments. For some vendors, ICANN is the first to reach out about UA, while others are working on handling all character sets on webpages but without considering implications for email. While ICANN is often the first to ask for a UA-related change, many of its vendor partners understand the benefits and have already added it to their roadmaps. Throughout its journey, ICANN is sharing best practices and resources to help other organizations and vendors prioritize these system updates.

ICANN's system updates are ongoing. By making its environment UA-ready, ICANN is well positioned to increase the accessibility and convenience of its services and help support the next billion Internet users.

UASG Resources (continued from previous page):

- * Additionally, organizations can leverage the “[Quick Guide to Tender and Contractual Documents](#)” to ensure UA is a requirement included in such documents.
- * Information about which code libraries to use for developing UA-ready applications is available at <https://uasg.tech/software/>.

All UASG guides and resources can be found here: <https://uasg.tech/information/>.

About:

Universal Acceptance Steering Group

The Universal Acceptance Steering Group is an Internet community initiative that was founded in February 2015 and tasked with undertaking activities that will effectively promote the Universal Acceptance of all valid domain names and email addresses. The group is made up of members from more than 120 companies (including Apple, GoDaddy, Google, Microsoft and Verisign), governments and community groups. The UASG receives significant financial and administrative support from ICANN. For more information, visit <https://uasg.tech/>.