Universal Acceptance of Domain Names and Email Addresses (UA)

A Technical Overview

Sarmad Hussain
Sr. Director IDN and UA Programs

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ASCII Domain Name Label

www.cafe-123.com

Third Level Domain | Second Level Domain | Top Level Domain (TLD)

② **Forming ASCII Labels**

Use LDH: **L**etters [A..Z a..z], **D**igits [0..9], **H**yphen [-]
Label length = 63
Other constraints (e.g., on hyphen)

① **Forming ASCII Labels**

Use only Letters [A..Z a..z]
Label length = 63

Internationalized Domain Names

② **Syntax of IDN Labels**
Valid U-Label: Unicode code points as constrained by IDNA 2008 like the “letter-digit-hyphen” scheme – sets to letters, marks and numbers

① **Syntax of IDN Labels**
U-Label, further constrained by the “letter” principle for TLDs, in RFC 1123

IDN Mnemonics for All Actively Used Scripts

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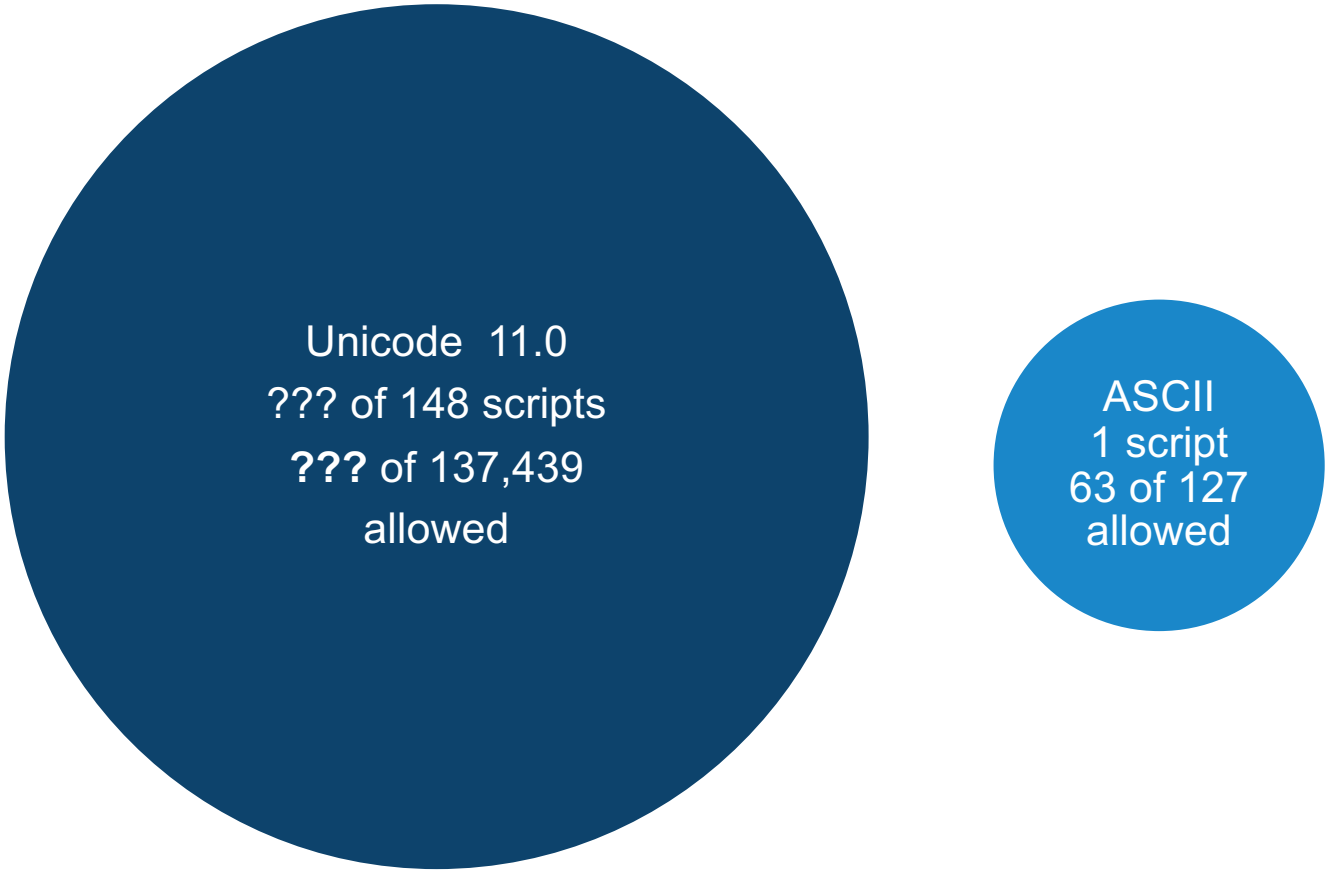
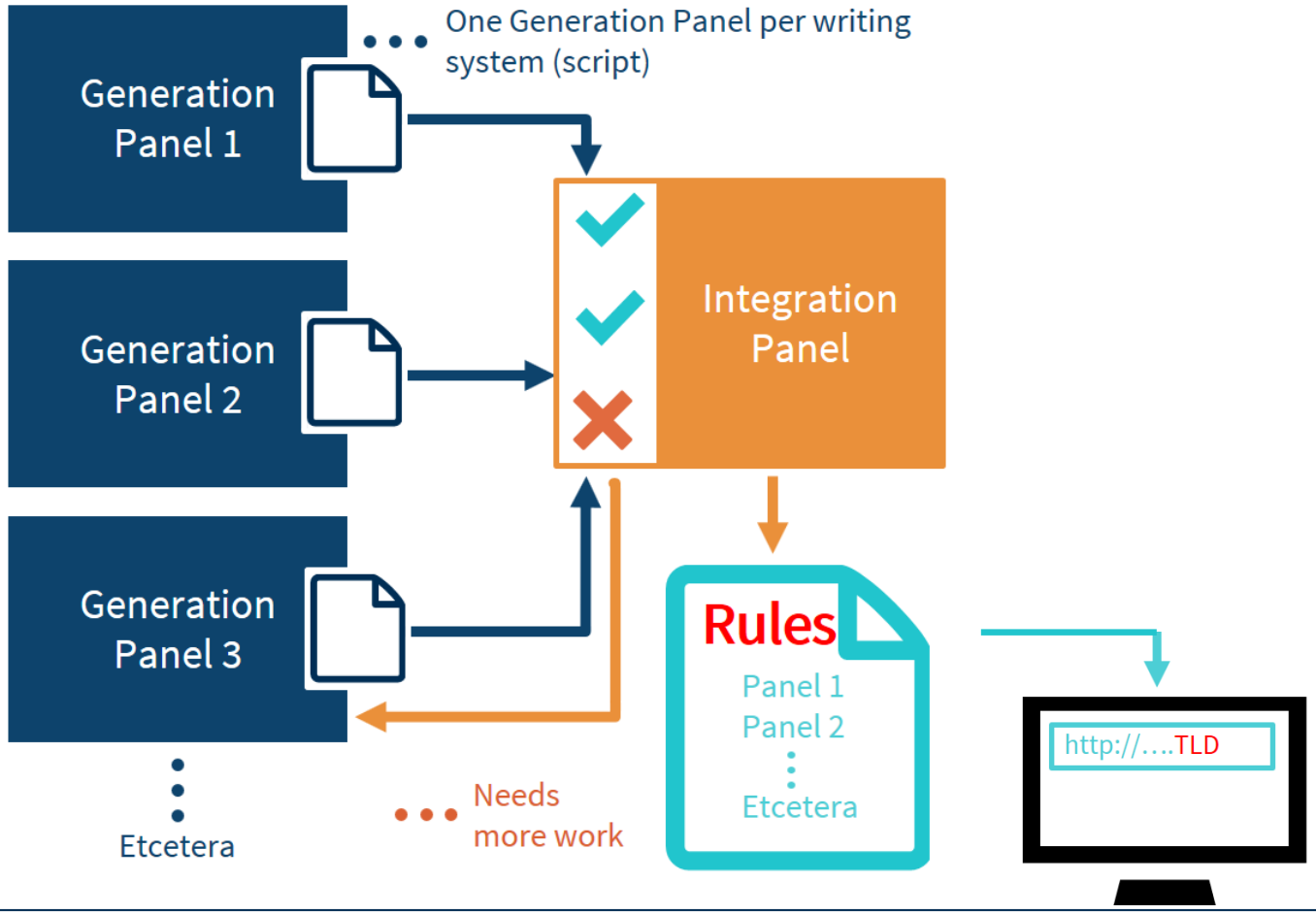


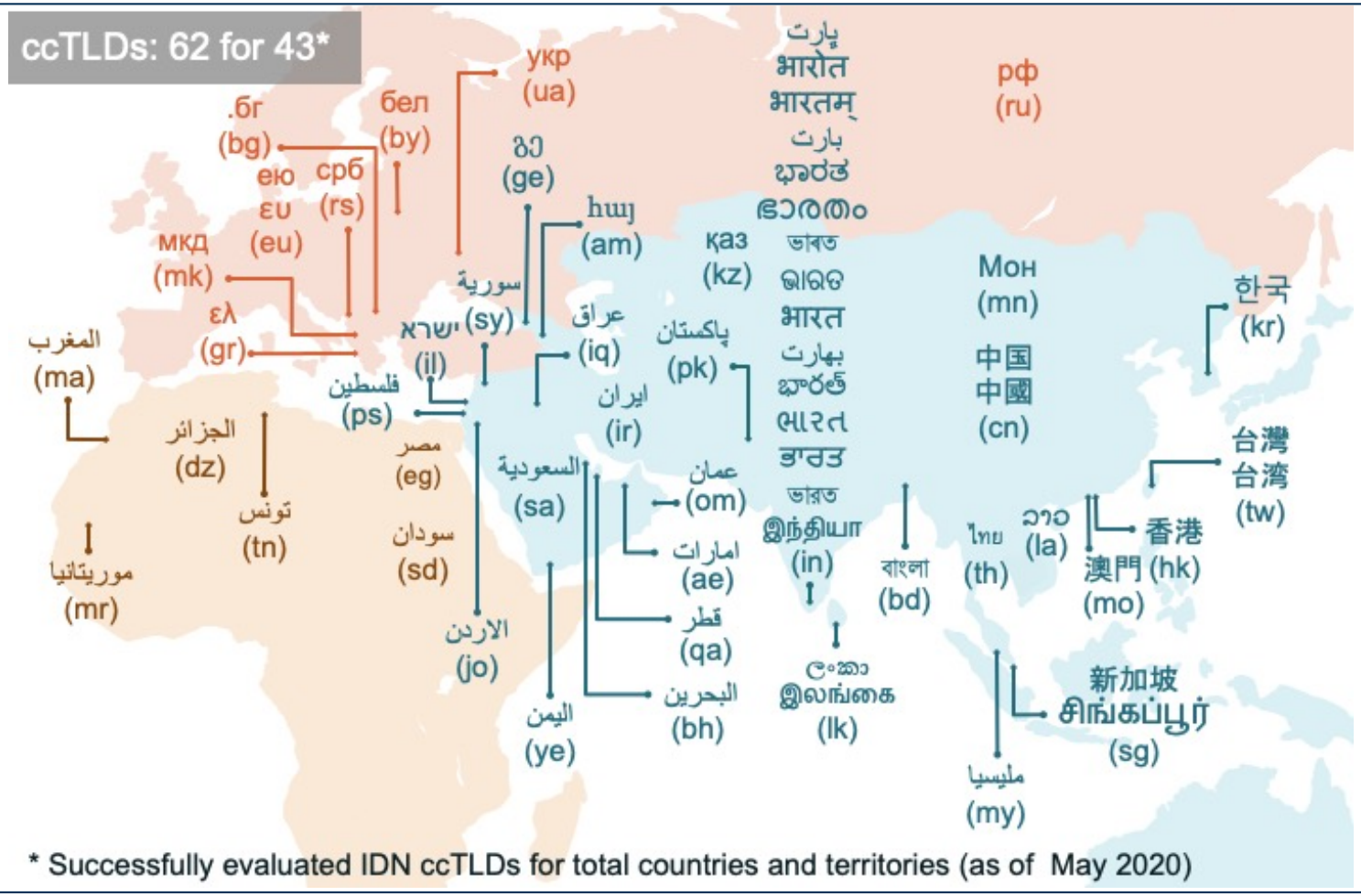
“Same” or Different Domain Labels?

- Example of within-script variant labels (Arabic script):
  - شبكتة (06C3 06A9 0628 0634)
  - شبكة (0629 06A9 0628 0634)
  - شبكة (0629 0643 0628 0634)
- Example of within-script variant labels (Simplified Chinese and Traditional Chinese):
  - 名称 (540D 79F0)
  - 名稱 (540D 7A31)
- Example of cross-script variant label (Latin script and Cyrillic script):
  - **epic (0065 0070 0069 0063)**
  - **epic (0435 0440 0456 0441)**

Root Zone Label Generation Rules (RZ-LGR)



IDN Country Code Top-Level Domains (ccTLDs)



* Successfully evaluated IDN ccTLDs for total countries and territories (as of May 2020)

IDN Generic TLDs (gTLDs)

92 IDN gTLDs are delegated (see latest at IANA DB)

Universal Acceptance of Domain Names and Email Addresses (UA)

Universal Acceptance of Domain Names and Email

Goal

All domain names and email addresses work in all software applications.

Impact

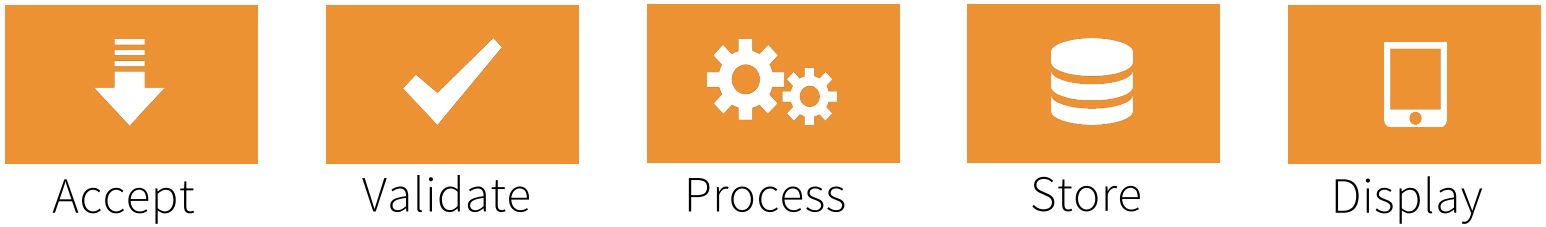
Promote consumer choice, improve competition, and provide broader access to end users.

Categories Affected and UA Readiness

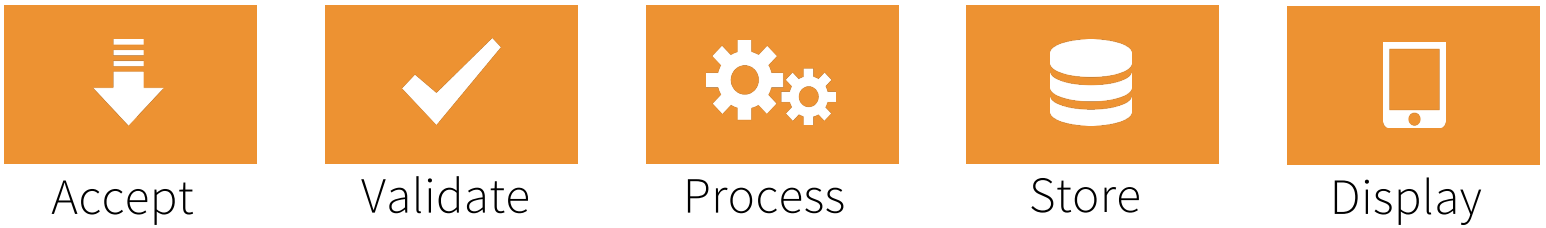
- **Domain Names:**
  - **Newer** top-level domain names: example.sky
  - **Longer** top-level domain names: example.international
  - **Internationalized** domain names คน.ไทย
- **Internationalized email addresses (EAI):**
  - ASCII@ASCII (new and long TLD) ekrem@misal.berlin
  - ASCII@**IDN** marc@société.org
  - **Unicode**@ASCII 测试@example.com
  - **Unicode@IDN** пример@тестовая.рф
  - **Unicode@IDN**; right to left scripts موقع.مثال@ای-میل

Scope of UA Readiness

1. Support All Domain Names

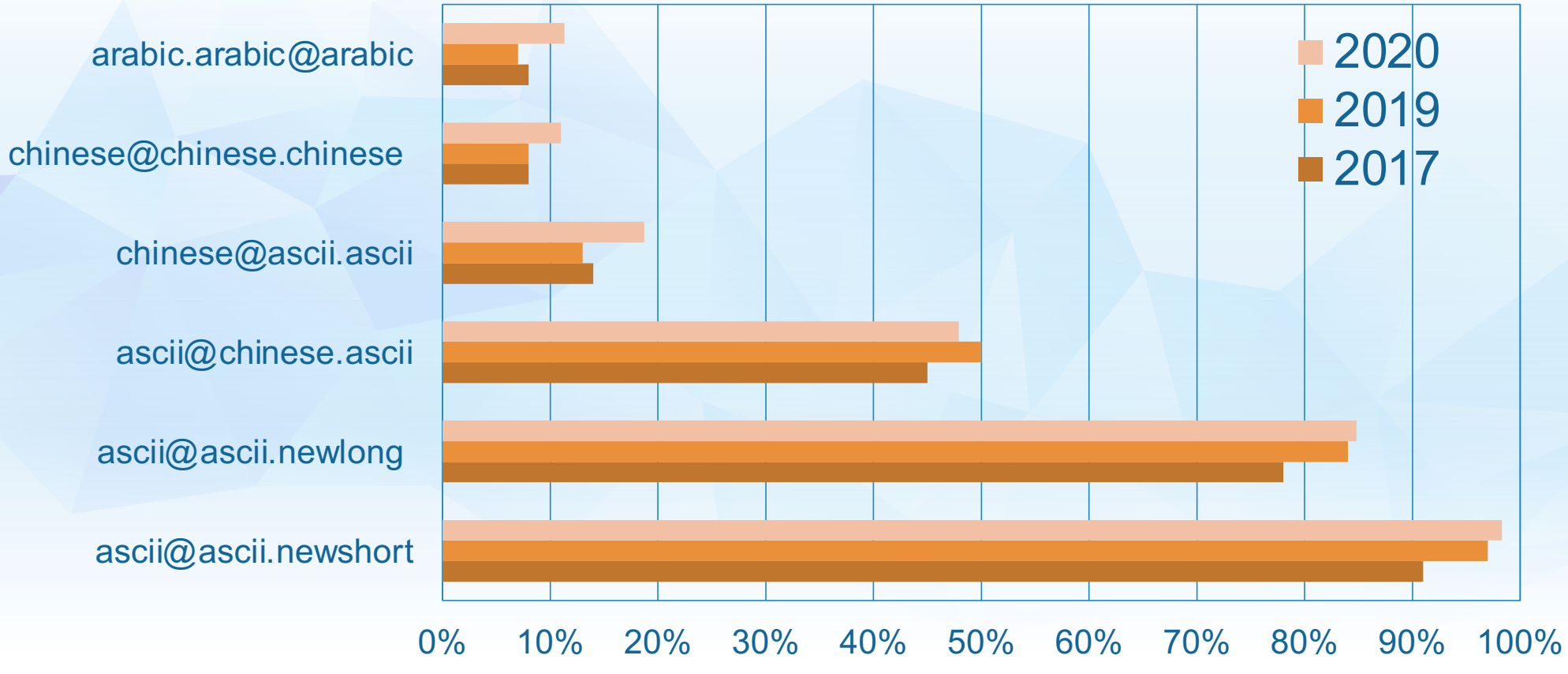


2. Support All Email Addresses



Acceptance of Email Addresses by Websites Globally

For details, see UASG027



Support of EAI in Email Systems Under All TLDs

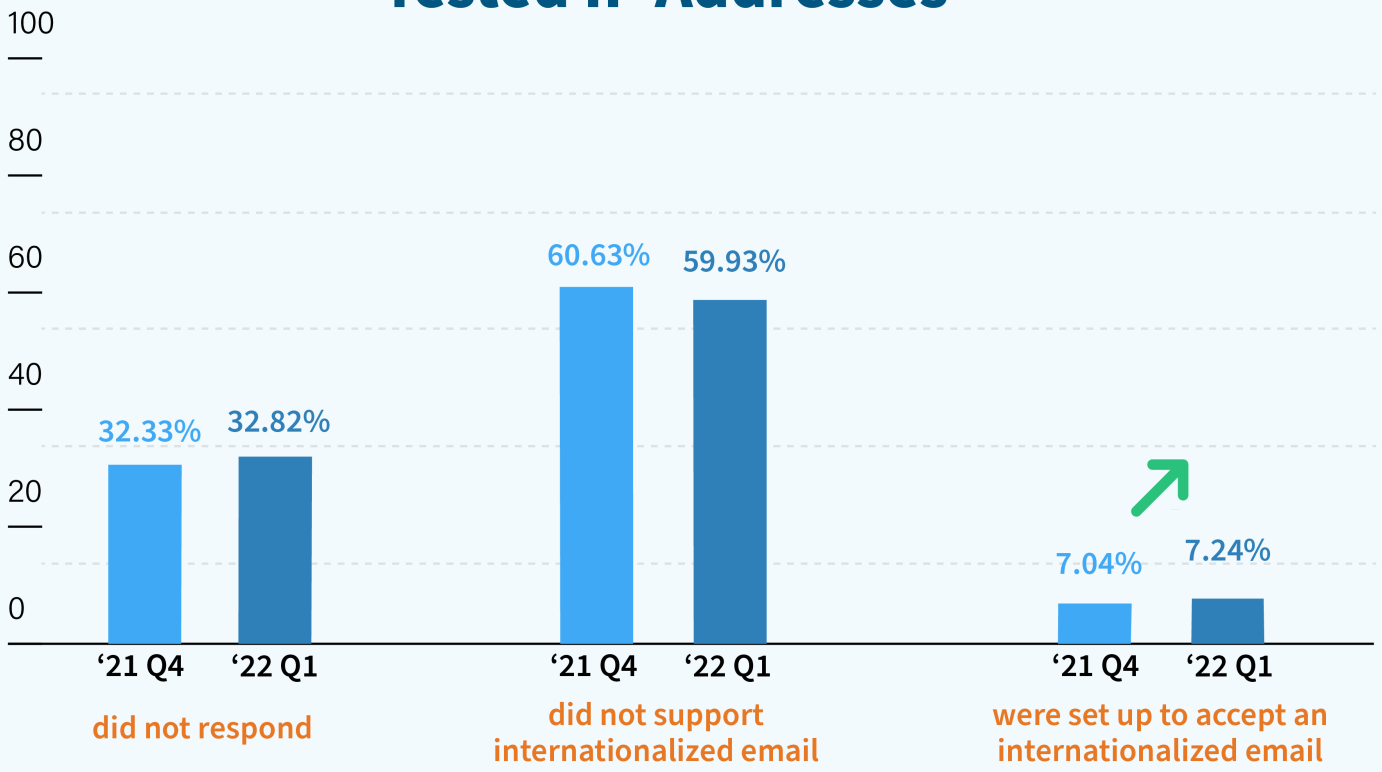
1,180
TLD zones

210,811,274
second level domains

34,996,159
unique mail servers

2,537,159
unique IP addresses

Tested IP Addresses



Technology Stack for UA Consideration

Applications and Websites

- Wikipedia.org, ICANN.org, Amazon.com, custom websites globally
- PowerPoint, Google-Docs, Safari, Acrobat, custom apps

Social Media and Search Engines

- Chrome, Bing, Safari, Firefox, local (e.g., Chinese) browsers
- Facebook, Instagram, Twitter, Skype, WeChat, WhatsApp, Viber

Programming Languages and Frameworks

- JavaScript, Java, Swift, C#, PHP, Python
- Angular, Spring, .NET core, J2EE, WordPress, SAP, Oracle

Platforms, Operating Systems and Sytem Tools

- iOS, Windows, Linux, Android, App Stores
- Active Directory, OpenLDAP, OpenSSL, Ping, Telnet

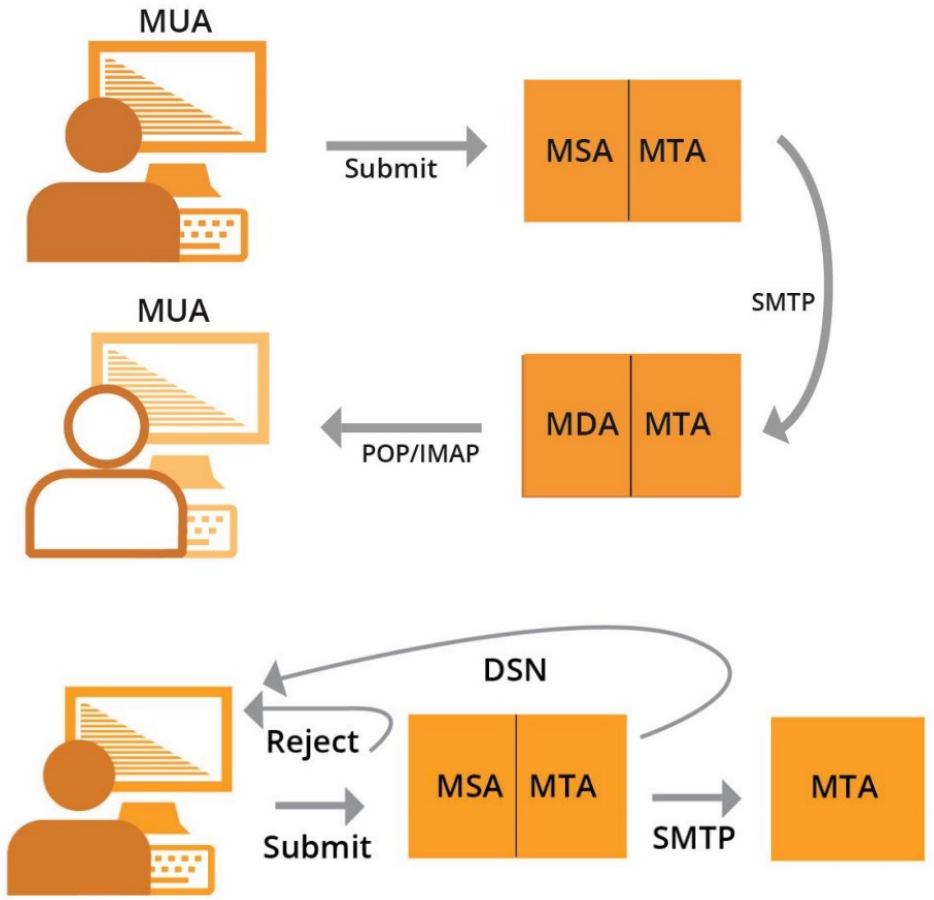
Standards and Best Practices

- IETF RFCs, W3C HTML, Unicode CLDR, WHATWG
- Industry-based standards (health, aviation, ...)

UA Readiness needs to be checked and fixed (as needed) for multiple frameworks, utilities, tools, and applications at multiple layers of technology.

Email Systems and EAI Support

- All email agents must be configured to send and receive internationalized email addresses.
  - MUA – Mail User Agent
  - MSA – Mail Submission Agent
  - MTA – Mail Transfer Agent
  - MDA – Mail Delivery Agent
- See EAI: A Technical Overview for details.



Fundamentals for Internationalized Domain Names and Email Addresses

Unicode Encoding

- Unicode encodes glyphs for different scripts of the world.
  - Codepoints shown in hex using the U+XXXX notation.
  - Files typically in UTF8, with variable bytes for a codepoint.
  - ASCII is used as is in Unicode: e = ASCII 65 = U+0065.
- There are multiple ways to encode certain glyphs in Unicode:
  - è = U+00E8 or e + ` = è = U+0065 + U+0300
- Normalization ensures same representation, even if users type differently; IDNA 2008 uses Normalization Form C (NFC).

Internationalized Domain Names (IDNs)

- A domain name is an ordered set of labels or strings: www.example.co.uk.
  - The top-level domain (TLD) is the rightmost label: ”uk”
  - Initially, TLDs only two or three characters (e.g., .ca, .com).
  - Now TLDs can be longer (e.g., .info, .google, .engineering).
  - TLDs delegated in the root zone change, so not a fixed list.
- Domain names are internationalized when one of the labels contains at least one non-ASCII character.
  - For example: www.exâmple.ca or 普遍接受-测试.世界.
  - Use the IDNA2008 standard (not outdated IDNA2003 version).

IDNs

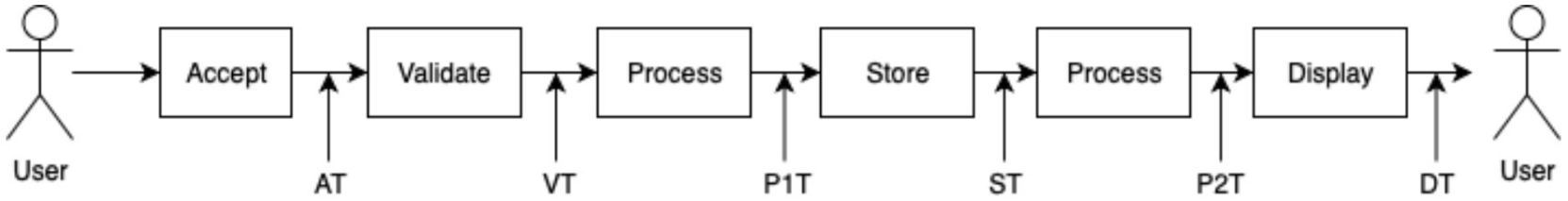
- IDNs have two equivalent forms : U-label and A-label.
  - For human users U-label (using UTF-8 format): example.
  - For applications internally A-label (ASCII equivalent):
    1. Take user input, normalize and check against IDNA2008 to form U-label.
    2. Convert U-label to punycode and then prefix by “xn--" for distinction from ASCII label.
       - exâmple => exmple-xta => xn--exmple-xta.
       - 普遍接受-测试 => --f38am99bqvcd5liy1cxsg => xn----f38am99bqvcd5liy1cxsg.

Email Address Internationalization (EAI)

- Email address syntax: mailboxName@domainName.
  - EAI has the mailboxName in Unicode (in UTF8 format).
  - The domainName can be ASCII or IDN.
    - For example: kévin@example.org or すし@快手.游戏.

UA Readiness Testing Framework

- UASG026, provides a framework to test for UA readiness of applications, identifying various test cases.
- Each gate has its own set of requirements and processing.



- AT: Accept test
- VT: Validate test
- P1T: Process test on the input
- ST: Store test
- P2T: Process test on the output
- DT: Display test

UA Test Cases

- A comprehensive list of UA test cases is documented in UASG004. Includes:
  - Coverage of multiple scripts used around the world.
  - Functional domain names, which resolve to a UA page.
  - Functional email addresses which send an auto-response to the sender to confirm email receipt.
- Developers are strongly encouraged to use these test cases in its unit and system testing.

Prog. Languages' UA Support

UASG018A

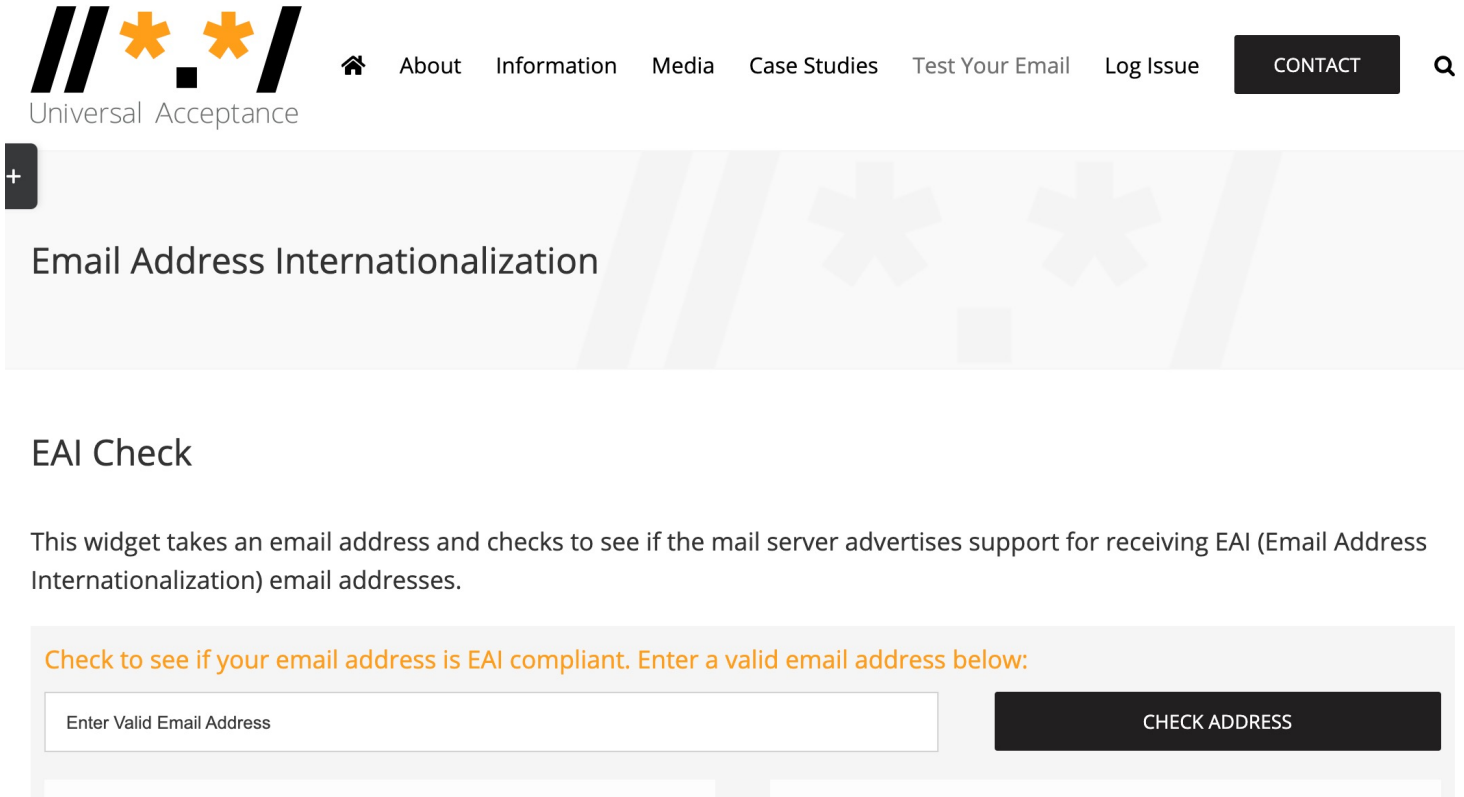
LANGUAGE	LIB NAME	COMPLIANCE (%)	Type
Javascript	Idna-Uts46	85.5	IDN
Javascript	Nodemailer	84.3	Mail
Javascript	Validator	94.2	Mail
Python3	Django_Auth	48.1	Mail
Python3	Email_Validator	86.3	Mail
Python3	Encodings_Idna	67.7	IDN
Python3	Idna	100	IDN
Python3	Smtplib	84.3	Mail
Rust	Idna	87.1	IDN
Rust	Lettre	7.8	Mail

LANGUAGE	LIB NAME	COMPLIANCE (%)	Type
C	Libcurl	84.3	Mail
C	Libidn2	95.2	IDN
C#	Mailkit	84.3	Mail
C#	Microsoft	83.9	IDN
Go	Mail	100	Mail
Go	Idna	79	IDN
Go	Smtp	19.6	Mail
Java	Commons-Validator	85.5	Mail, IDN
Java	Guava	77.8	IDN
Java	ICU	93.5	IDN
Java	Jakartamail	82.4	Mail
Java	JRE	71	IDN

Email Address Internationalization (EAI)

EAI Exercise

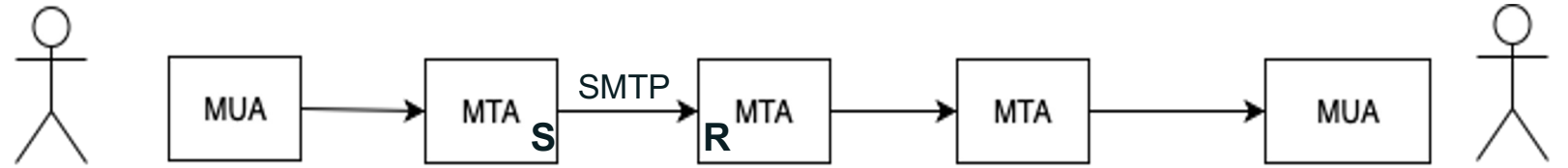
- Check if your email server supports EAI: https://uasg.tech/eai-check/.



EAI Protocol Changes

- SMTP:
  - Is augmented to support EAI.
  - Has a signaling flag (SMTPUTF8) to specify support of EAI.
  - All SMTP servers in the path must support EAI to successfully deliver the email.
- POP/IMAP:
  - Are augmented to properly support EAI.
  - Have a signaling flag to specify support of EAI.

SMTPUTF8 Signaling EAI Support

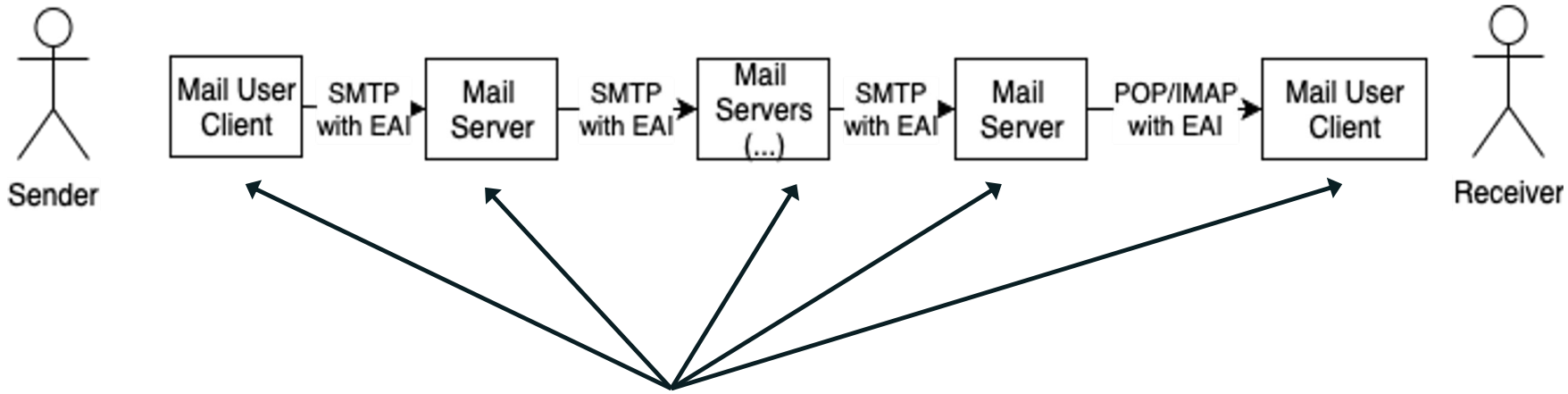


Server S forwarding an email to server R

S: <connect>
R: 220 receive.net ESMTP
S: EHLO sender.org
R: 250-8BITMIME
R: 250-**SMTPUTF8**
R: 250 PIPELINING
S: MAIL FROM:<猫王@普遍接受-测试.世界> **SMTPUTF8**
R: 250 Sender accepted
S:RCPT TO:<ray@receive.net>
R:250 Recipient accepted

SMTPUTF8 Signaling
(for EAI support)

Protocol Changes, Delivery Path Considerations



To send and receive an email with EAI:

- All email parties involved in the delivery path have to be updated for EAI support.
- If a single SMTP server in the path does not support EAI, then the email is not delivered.

EAI Support

L1 - EAI level 1 - sends to and receives from EAI addresses.

L2 - EAI level 2 - L1 plus provides local EAI addresses.

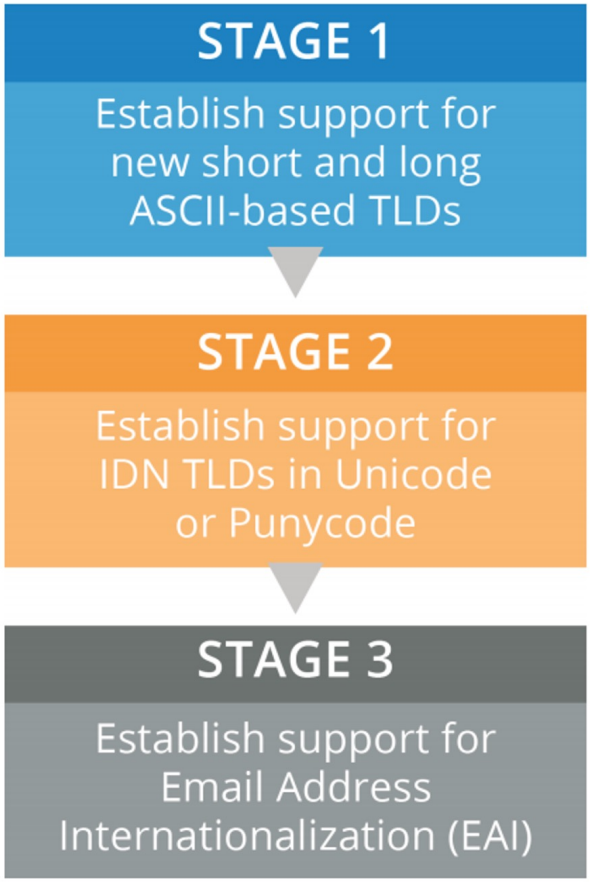
See UASG030A for details.

Name	MUA	MSA	MTA	MDA	MSP	Webmail
Coremail	Few	All L2	Most L2	Few	All L2	Most L2
MS Outlook.com	Most L1	Most L1	Most L1	None	None	Most L1
Yandex Mail	Few	None	None	Few	Part	Few
Roundcube	Most L2					
Apple Mail	Few					
Apple iOS Mail 14.x	Most L2					
Mozilla Thunderbird	Few					
MS Outlook	Most L1					
MS Exchange Server (hosted)		All L1	All L1	Few		
Exim		Most L2	All L2			
Postfix		All L2	All L2			
Courier		All L2	All L2	All L2		
Gmail	All L1	All L1	All L1	Few		
XgenPlus		Most L2	Most L2	Most	All L2	Most L2
Sendmail 8.17 Alpha		Most L2	Most L2			
Halon		Most L2	Most L2			
Thunderbird 89 beta	Most L1					
Dovecot				None		

Are Your Software Applications UA Ready?

ICANN's Journey to UA Readiness - Model

- Stage 1: Update to support new short and long ASCII top-level domains.
- Stage 2: Update to support IDNs in U-label and A-label formats.
- Stage 3: Update to support Email Address Internationalization (EAI).
  - All components must support EAI before infrastructure is compliant.
- See details in ICANN's Case Study.



Some Relevant Materials

- See https://uasg.tech for a complete list of reports.
  - Universal Acceptance Quick Guide: UASG005.
  - Introduction to Universal Acceptance: UASG007.
  - Quick Guide to EAI: UASG014.
  - EAI – A Technical Overview: UASG012.
  - EAI – Evaluation of Email Software and Services: UASG021B.
  - Universal Acceptance Readiness Framework: UASG026.
  - Considerations for Internationalized Email Mailboxes: UASG028.
  - UA Readiness Report 2020: UASG029.
  - EAI Support in Email Software and Services Report: UASG030A.

Get Involved!

- For more information on UA, email info@uasg.tech or UAProgram@icann.org.
- Access all UASG documents and presentations at: https://uasg.tech or https://icann.org/ua.
- Register to participate or listen in the UA discussion list at: https://uasg.tech/subscribe.
- Register to participate in UA working groups here.

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