Supporting Internationalized Email Addresses (EAI) in Email Servers

UA Day Program

Name
Event

Date

ICANN

Introduction to Email Address Internationalization

Universal Acceptance of Domain Names and Emails

Goal

All domain names and email addresses work in all software applications

| Accept	Validate	Process	Store	Display
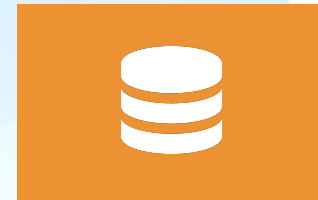
Impact

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

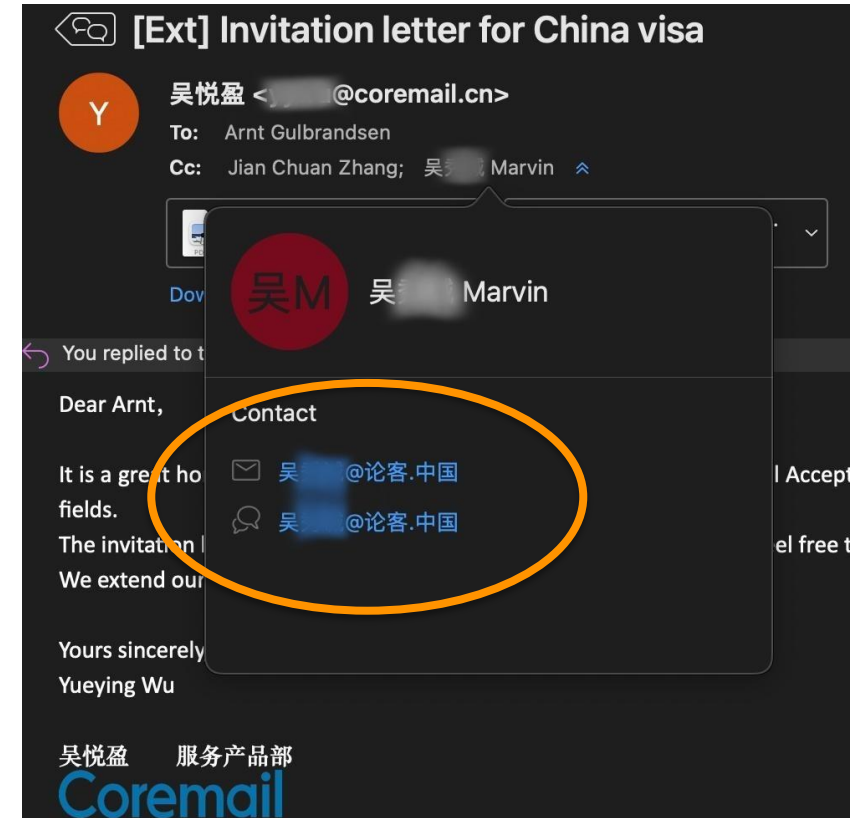# Categories of Domain Names and Email Addresses

- Now possible to have domain names and email addresses in local languages:
  - Internationalized domain names (IDNs)
  - Email Address Internationalization (EAI)
  - UTF8 format by Unicode used for IDNs and EAI

- Domain Names
  - **Newer** top-level domain names: example.sky
  - **Longer** top-level domain names: example.abudhabi
  - **Internationalized** domain names   普遍接受-测试.世界

- Internationalized email addresses (EAI)
  - ASCII@IDN   marc@société.org
  - UTF8@ASCII   ईमेल@example.com
  - UTF8@IDN   测试@普遍接受-测试.世界
  - UTF@IDN; right to left scripts   موقع.مثال@میل-ای

Support of EAI in Email Under gTLDs

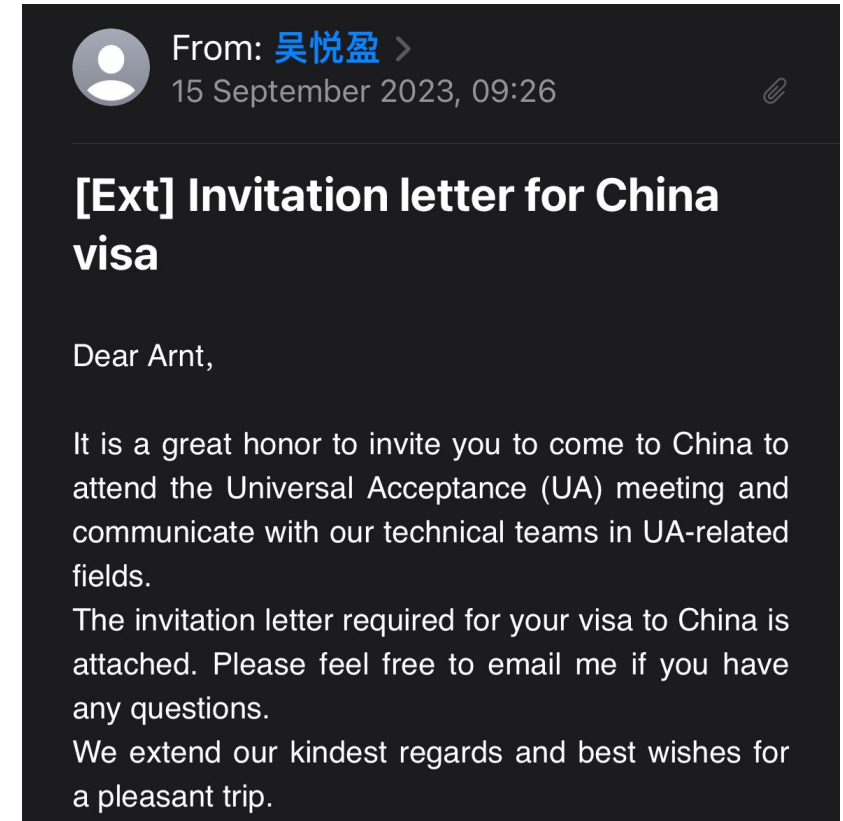EAI Support Percentage vs Total Unique MX Servers Tested
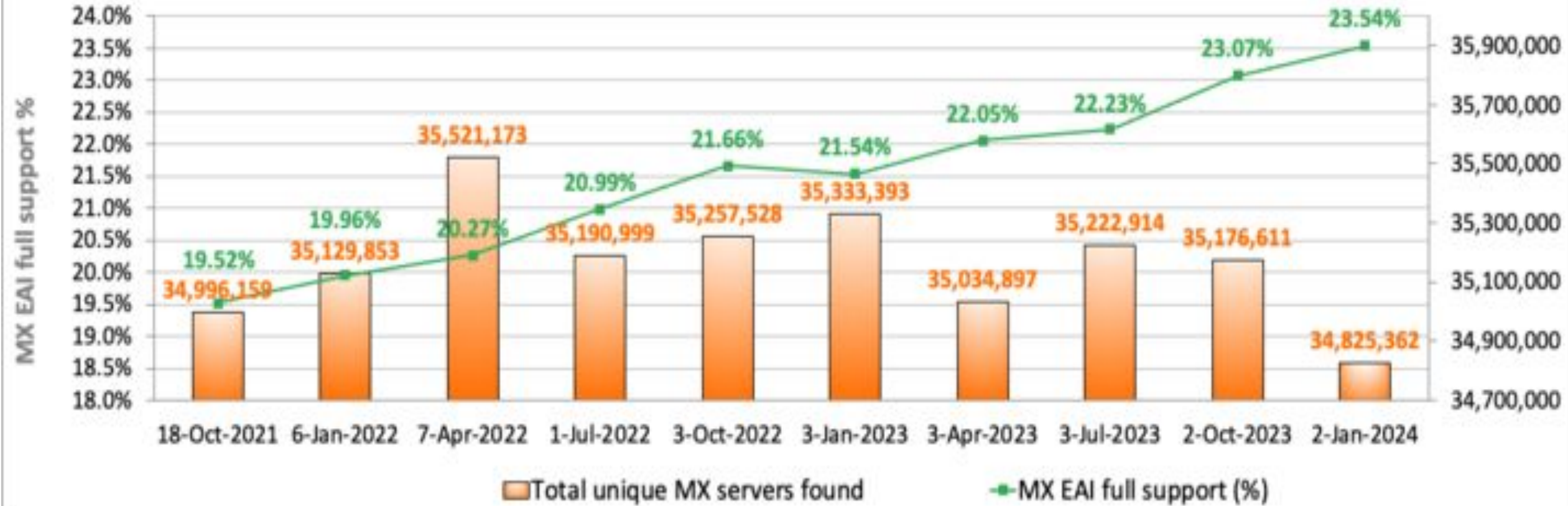
Support of EAI in Major Software and Services

- Free Email Services – EAI is supported by Gmail, Office365 and various smaller services

- Email Products – EAI is supported by Microsoft Exchange starting in version 2019, Outlook, conditionally by iPhone Mail, etc.

- Open Source Software – EAI is supported by the MTAs Postfix and Exim, the client program Thunderbird, the mail support in Java, Ruby and Python, and so on

- Email Service Providers – Companies such as Elastic Email, Mailgun, Return Path, etc. can send mail ("your order has shipped") to EAI addresses; many more have partial support

- Other Email Software – EAI-capable libraries have hundreds of thousands or millions of downloads

Outlook showing EAI

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From: 吴悦盈
15 September 2023, 09:26

[Ext] Invitation letter for China visa

Dear Arnt,

It is a great honor to invite you to come to China to attend the Universal Acceptance (UA) meeting and communicate with our technical teams in UA-related fields.
The invitation letter required for your visa to China is attached. Please feel free to email me if you have any questions.
We extend our kindest regards and best wishes for a pleasant trip.

iPhone Mail

Structure of Email Messages

- **Envelope** – Information that accompanies a message in transit, including the address(es) it is being sent to, and the return address to which error or failure reports can be sent

- **Message Header** – A series of structured fields with a header name such as From: To: or Subject: followed by the contents of the header
  - Free-format, such as the Subject:
  - Fixed-format, such as the Date: and Message-ID:
  - A combination of fixed- and free-format, such as the To:, From: and Cc: with fixed-format addresses with free-format comment text

- **Message Body** – The contents of a message, which may be unformatted text, or it may be one or more formatted or encoded MIME parts

```
EHLO mailserver.fromorg.example
MAIL FROM:<sender@fromorg.example>
RCPT TO:<recipient@rcptco.example>
```

```
From: sender@fromorg.example
To: recipient@rcptco.example
Subject: ...
Date: ...
   ... other headers ...

Content-Type: text/html; ...
   ... text MIME part ...

Content-Type: application/pdf; ...
   ... attachement MIME part ...
```
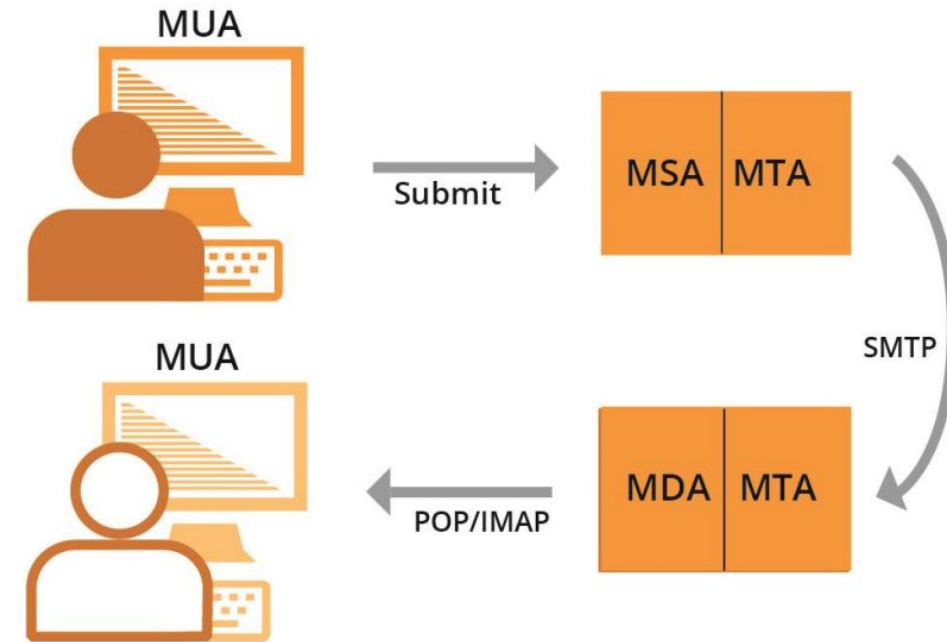
See <u>EAI: A Technical Overview</u> for details

Email Systems

- **MUA** – Mail User Agent - A client program that a person uses to send, receive, and manage mail

- **MSA** – Mail Submission Agent - A server program that receives mail from a MUA and prepares it for transmission and delivery

- **MTA** – Mail Transfer Agent - A server program that sends and receives mail to and from other Internet hosts. An MTA may receive mail from an MSA and/or deliver mail to an MDA.

- **MDA** – Mail Delivery Agent - A server program that handles incoming mail and typically stores it in a mailbox or folder
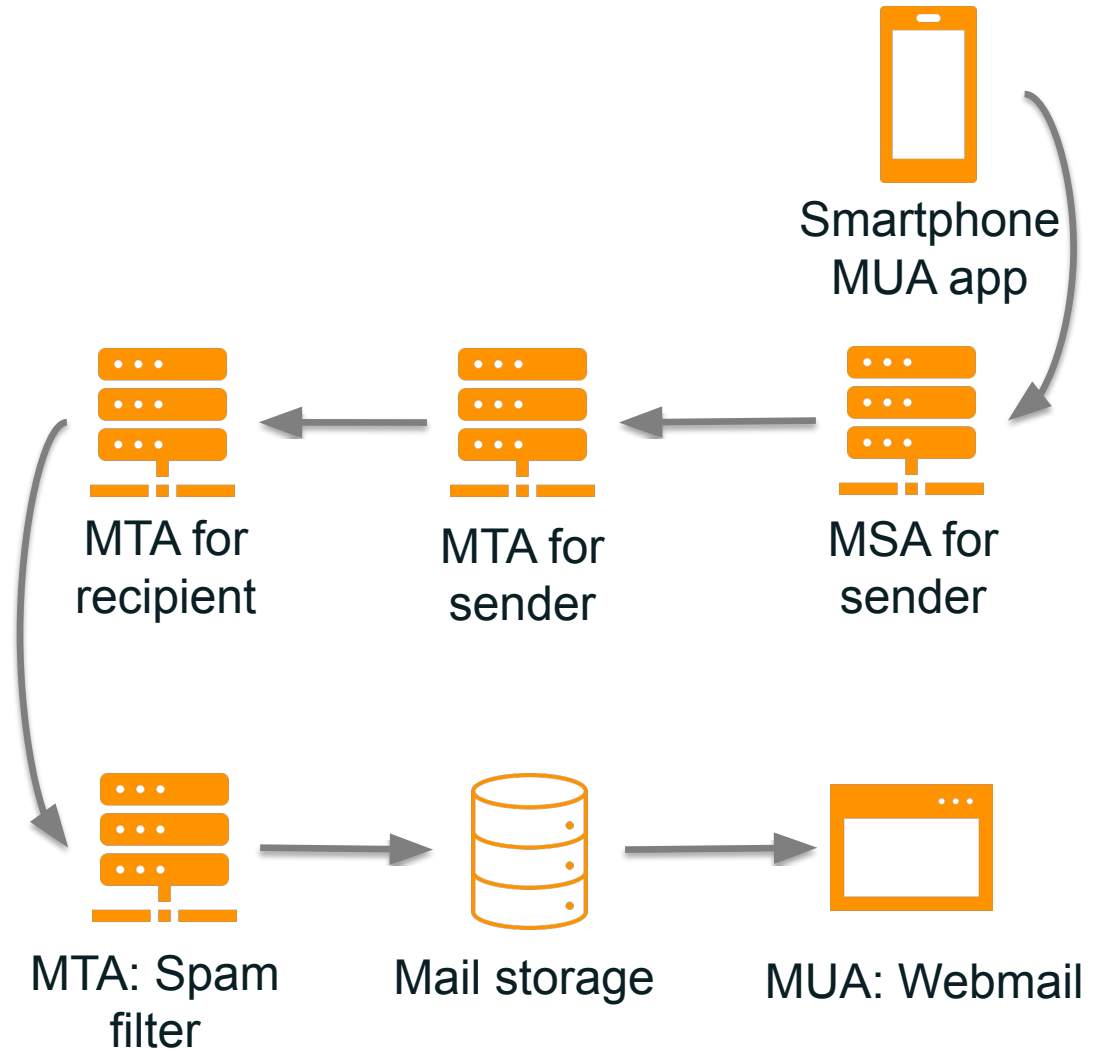
These agents create and process the email envelope, message header and message body and need to be enhanced to handle Unicode text in UTF8 format to support EAI.
See EAI: A Technical Overview for details.

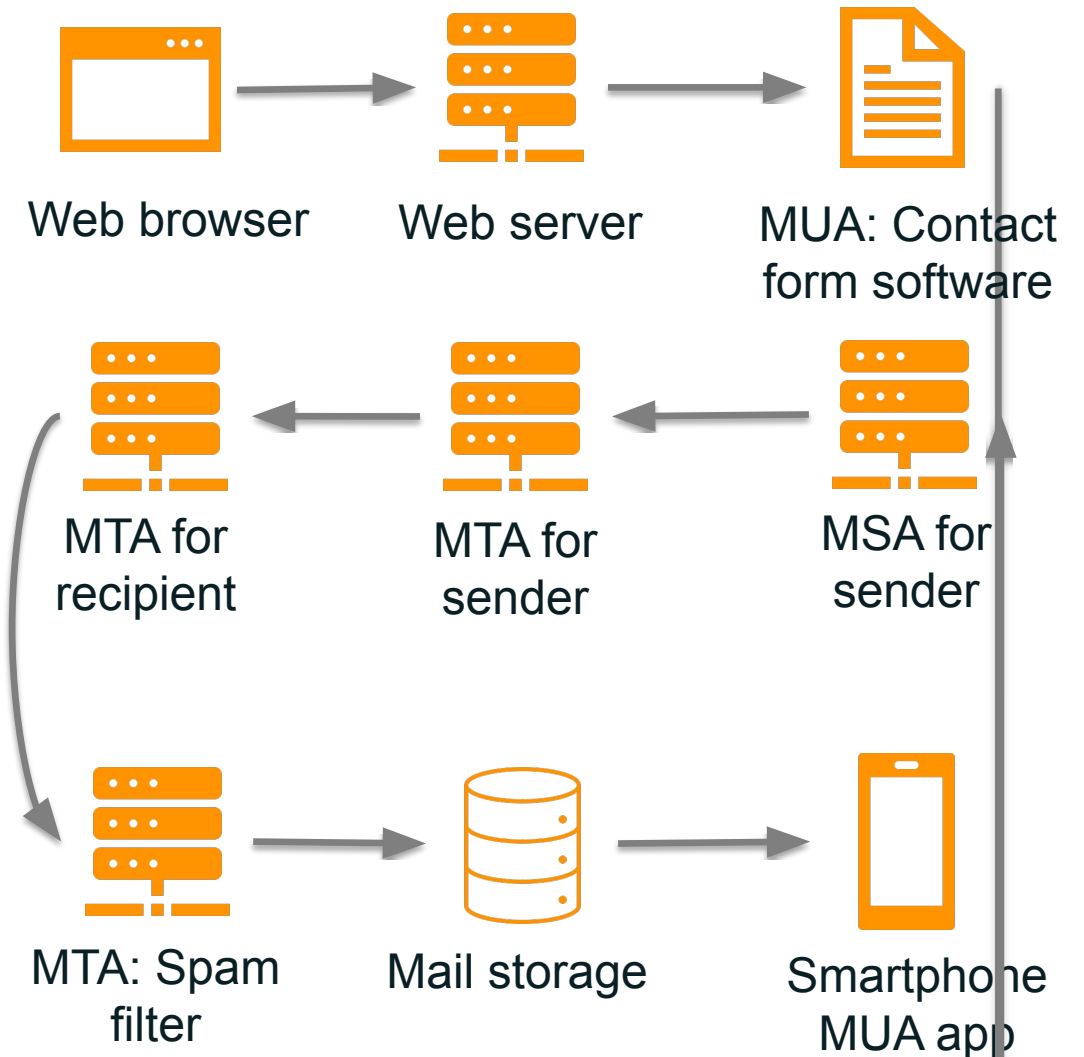# Examples of Email Components

- **MUA** – Mail User Agent – Outlook, Thunderbird, Amazon's shipping backend, Gmail's webmail subsystem, a web server's contact form

- **MSA** – Mail Submission Agent – Exchange, Postfix, Sendgrid, AWS Workmail

- **MTA** – Mail Transfer Agent – Postfix, Exim, Halon, Sendgrid, AWS Workmail

- **MDA** – Mail Delivery Agent – part of Gmail and Exchange, parts of Zendesk

Smartphone MUA app

MTA for recipient

MTA for sender

MSA for sender

MTA: Spam filter

Mail storage

MUA: Webmail

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Web browser → Web server → MUA: Contact form software

MTA for recipient ← MTA for sender ← MSA for sender

MTA: Spam filter → Mail storage → Smartphone MUA app

Email Address Internationalization

- What is EAI?
  - Having UTF8 support for:
    - Mailbox name (before the @ sign)
    - Domain name (after the @ sign)

- What is not EAI?
  - Having UTF8 support in:
    - Subject line
    - Address comments
    - Message body
  - MIME provides all these in conventional mail
  - Use of any character set other than UTF-8

Levels of EAI Implementation

- ◉ **No EAI support** - Only ASCII email addresses supported by the tools and services

- ◉ **Level 1** - Can exchange email with EAI addresses
  - ○ Receive email from an EAI address
  - ○ Send email to an EAI address
  - ○ Cannot create mailbox and domain name in UTF8

- ◉ **Level 2** - Level 1 + can create EAI addresses
  - ○ Receive email from an EAI address
  - ○ Send email to an EAI address
  - ○ Create mailbox and domain name in UTF8
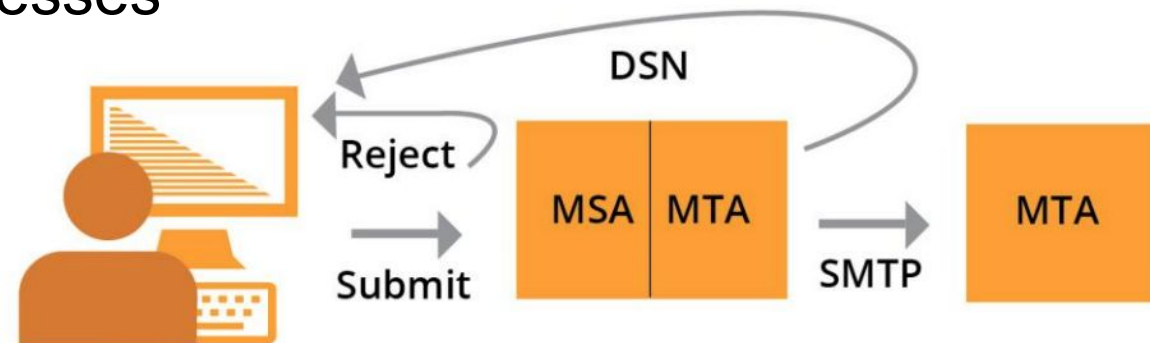
Quiz

Applications present Internationalized Domain Names (IDNs) and Email Address Internationalization (EAI) to users in the following encoding format(s):

a. ASCII

b. UTF-8

c. UTF-16

d. UTF-32

e. Some of the above

Quiz 2

Is .ieee a valid Top Level Domain?

Configuring for EAI

Prerequisites for Setting up EAI

◉ Normalize Unicode (UTF-8) string before processing, storing, etc. For IDNs use [NFC form](): e + ` (è: U+0065 U+0300) ☐ è (U+00E8).

◉ Support both [representations of IDN labels](): U-label and A-label. U-Label is used for displaying and comparing; A-label for processing:
  ○ exâmple => exmple-xta => xn--exmple-xta

◉ Always use IDNA2008, not the older IDNA2003 version

◉ Do not use code/libraries that have a static list of top-level domains (TLDs) as these change often. See [IANA list for TLDs](), with regular updates.

◉ Do not use regex for user input validation of internationalized identifiers. Use IDNA2008 libraries for IDN; EAI local part may be difficult to validate.

Email: How To Find the Destination Server

◉ When sending email to user@example.com, the method to find the destination email server is by querying the DNS for the MX records of the domain

◉ For example, the MX records for example.com could be:
   ○ MX 10 server1.example.com
   ○ MX 10 server2.example.com
   ○ MX 20 server3.example.com

◉ The sender email server would then try connecting to either server1 or server2 since they have same priority (10). If none respond, it would then try server3 since it has a lower priority (20).
   ○ The higher number means lower priority

Email Protocol Changes for EAI

- 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 Example

```
MUA → MTA → MTA → MTA → MUA
Sender      S    R              Receiver
              SMTP
```
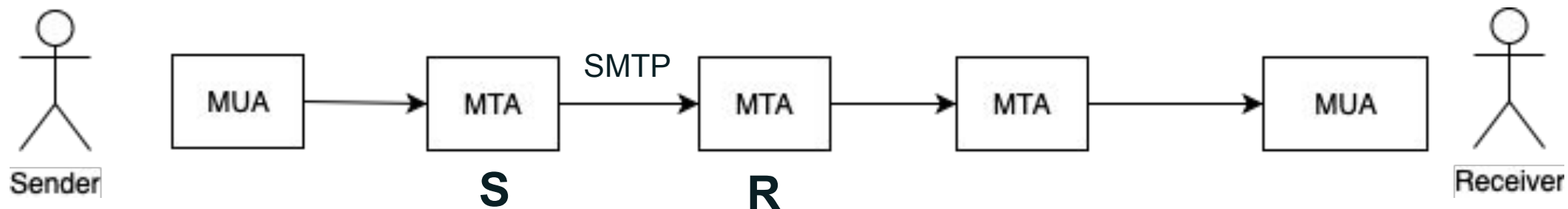
Server S forwarding an email to server R

S: \<connect\>

R: 220 receive.net ESMTP

Specific SMTPUTF8 Signaling (EAI support)

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 Example

S:DATA
R:354 Send your message
S:From: 猫王 <猫王@普遍接受-测试.世界>
S:To: ray@receive.net
S:Subject: 我们要吃午饭吗?
S:
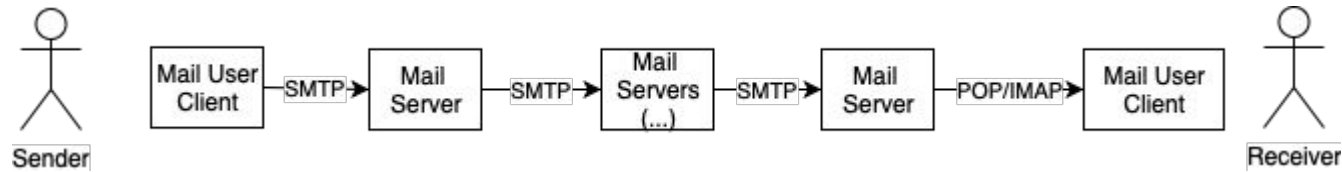S:How about lunch at 12:30?
S:.
R:250 Message accepted 389dck343fg34
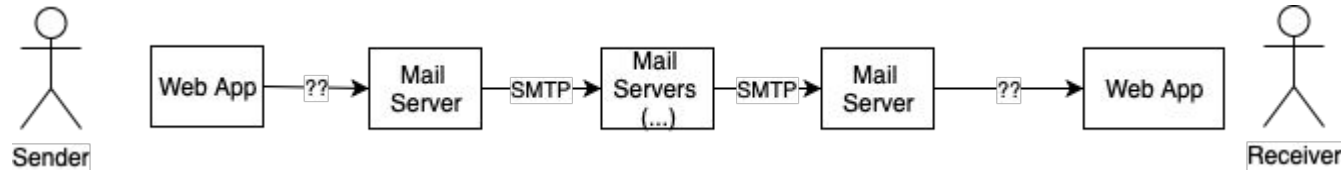S:QUIT
R:221 Sayonara

Email itself

Email Delivery Path


Using email software for both users.

Using web email for both users.

- ◉ Mix is also very common: email software for one user, web email for other user

- ◉ Mail server is the MTA; the source and destination servers are MSA and MDA, respectively

- ◉ Mail User Client can be on desktop, laptop, or mobile

Email Delivery Path Considerations

- Each user of an email communication chooses his own email environment/software/setup independently

- The sender does not know the receiver email environment, meaning:
  - The sender does not know which protocols are used to deliver email
  - The sender does not know if the receiver email supports some features

- The delivery goes through a chain of email servers
  - The number of email servers is unknown
  - The actual chain of servers:
    - Is unknown at the beginning
    - May change for any subsequent email sent
  - The features supported by each email server is unknown to the path or from the sender
  - Features are only discovered one hop at a time (i.e. the next hop)

Protocol Changes, Delivery Path Considerations
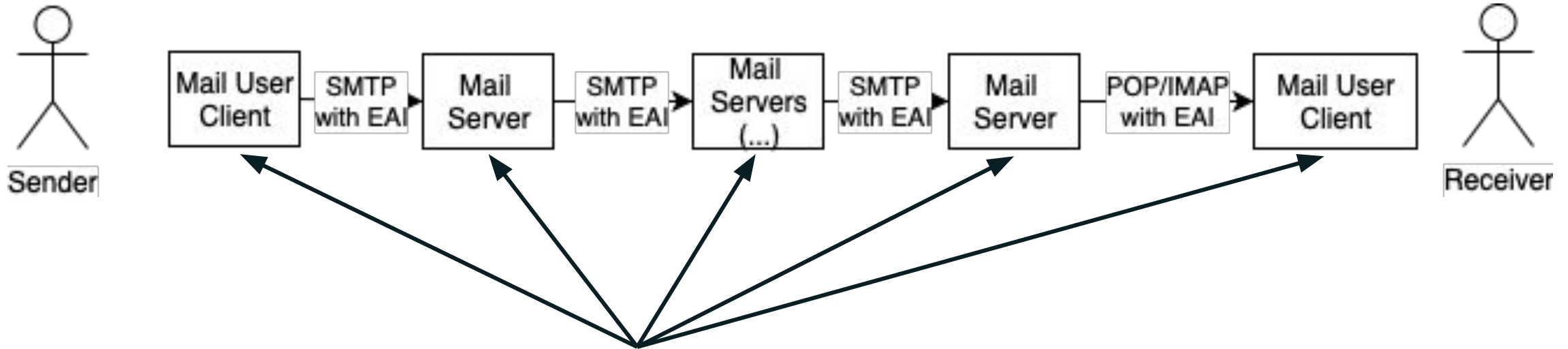
To send and receive an email with EAI:
- All email parties involved in the delivery path have to be updated for EAI support
- If a single SMTP server in the path does not support EAI, then the email is not delivered

Protocol Changes, Delivery Path Considerations

- What happens when one email (SMTP) server in the path does not support EAI?
  - The last server trying to send to the next hop:
    - Sends back to the sender user a report of unable to deliver
    - Drops the email
  - Similar to reports that a sender receives when an email address does not exist

Additional Considerations

- Case folding:
  - In ASCII, email users expect the equivalence of lowercase and uppercase. For example, PETER@example.com and peter@example.com will be delivered to the same mailbox
  - Typically for EAI, such case folding functionality is not automatically implemented in most EAI-ready software
- SPAM:
  - EAI emails may be considered as spam by spam filtering software even when proper SPF/DKIM records are enabled
- Software/Services:
  - Not every server/client software and services support EAI

EAI Support by Email Tools and Services

EAI Support by Email Tools and Services

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		

See detailed testing results in UASG030A: EAI Software Test Results

Quiz

For Email Address Internationalization (EAI) to work, MTAs should support SMTPUTF8 signaling flag.

- True or False?

Which of the following statement(s) are *True* when sending and receiving an email with EAI:

a)   All email parties/nodes involved in the delivery path have to be updated for EAI support

b)   If a single SMTP server in the path does not support EAI, then the email will not be delivered

c)   POP/IMAP servers could provide downgraded emails to non-EAI conforming email clients but this is not recommended

d)   None of the above

Considerations for Mailbox Names Using EAI

Considerations for Mailbox Names Using EAI

- UASG028 - Considerations for Naming Internationalized Email Mailboxes

- Supported Scripts:
  - Know user expectations for writing systems for mailbox name and domain name portion
  - Understand complexities involved for additional scripts (e.g. security, confusion, etc.)

- Length of a Mailbox Name String:
  - Know constraints of your system and user expectations
  - Consider same or a similar policy as for ASCII mailbox names

- Script Mixing:
  - Allow limited script mixing only when clear user need based on local practice
  - Consider security and confusion due to script mixing for mailbox and domain name

Considerations for Mailbox Names Using EAI

◉ Preventing Invalid and Unstably-Rendered Strings:
  ○ Check if Reference IDN tables meet desired mailbox string and update as needed
  ○ Use a string validation tool (e.g. LGR Tool) to validate the mailbox strings

◉ Right-to-Left (RTL) Script Consideration:
  ○ Avoid script mixing with right-to-left scripts to avoid confusability and security issues

◉ Aliases and Display Names Consideration:
  ○ Consider alias-creation option for the user interface during the mailbox name selection process. ASCII alias can be allowed with an EAI mailbox name.
  ○ Optionally allow the user to add additional aliases at a later time

Considerations for Mailbox Names Using EAI

- Signs and Symbols:
  - Avoid using signs and symbols, especially that do not exist on keyboard/input devices
  - If required for your market, the dot (.), underscore (_), hyphen (-) and plus sign (+) are commonly used
  - Review any additional signs (if needed) and ensure it does not cause a security issue

- Unicode Character Normalization:
  - Understand the normalization type of your email system
  - Ensure that your email program does normalized-form-independent name comparisons
  - If it's possible to select normalization, prefer to use NFC form

Considerations for Mailbox Names Using EAI

- Equivalence Considerations:
  - Define a policy for determining the "same" or equivalent mailbox names based on the writing system, user expectations, and technical capabilities of your implementation
  - Examine the IDN tables, case-folding, separators, numerals, and symbols for policy
  - Avoid creating different mailboxes using names which are equivalent to each other
  - Share your policy to let end users understand which characters and combinations will be considered valid and which ones might have equivalence

- Other considerations:
  - Spell domain names with their internationalized non-ASCII names. Avoid displaying the "xn--" alternative name.
  - Some email clients might not automatically link the U-label and A-label forms of email address mailbox names, so ensure that both labels are mapped to each other
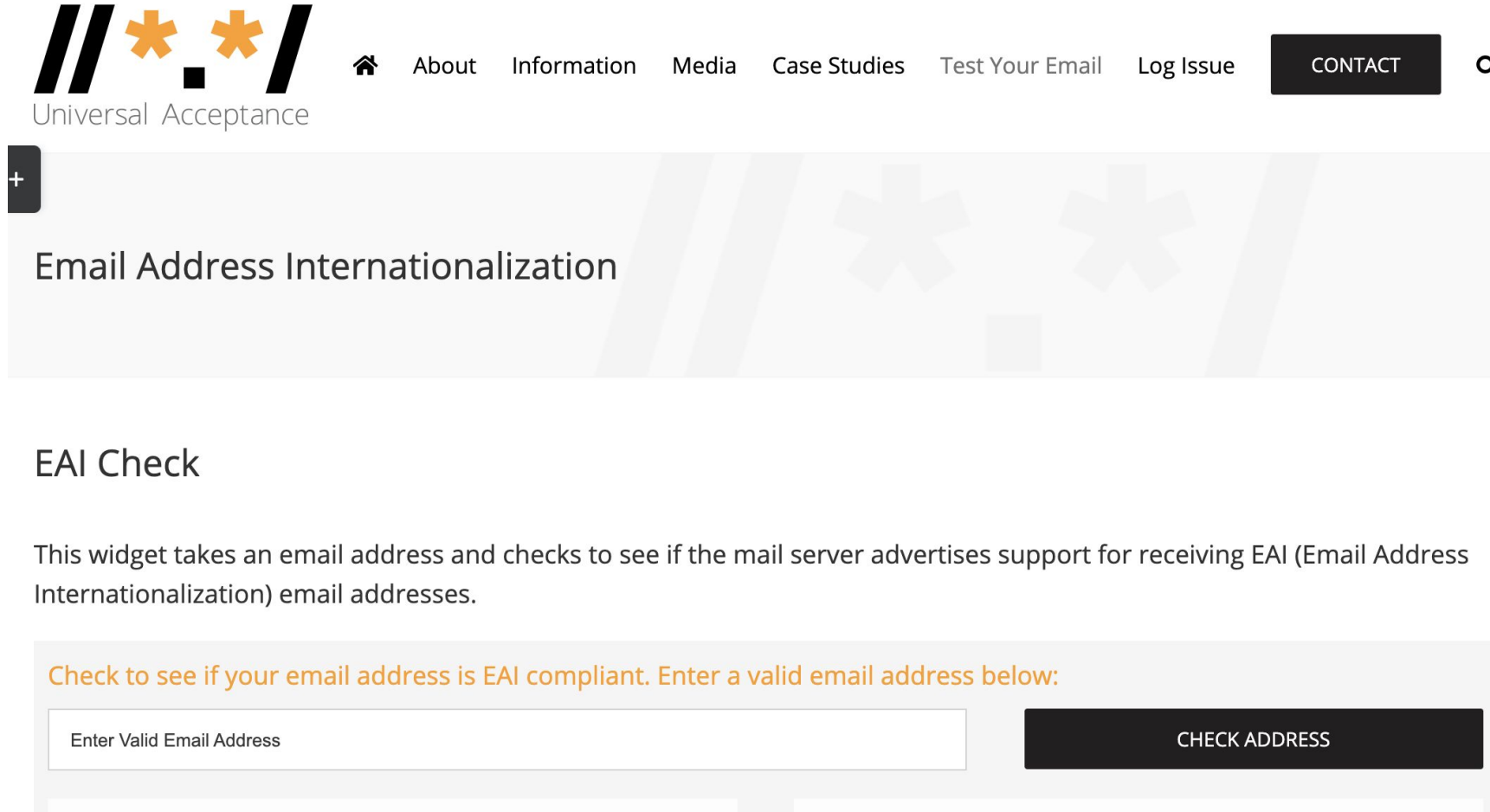
Quiz

Which of the following statement(s) are *False*:

a) Universal Acceptance (UA) is the state in which all valid domain names and email addresses are accepted, validated, stored, processed, and displayed correctly and consistently

b) To achieve Universal Acceptance, Internet applications and systems must treat all Top Level Domains (TLDs) in a consistent manner, including new generic TLDs and all internationalized TLDs

c) All domain names should be validated against the Internationalized Domain Names in Applications IDNA2003 Standard

d) The A-label represents a domain label in Unicode UTF8 format

e) The A-label format is used to represent mailbox names in EAI

Are Your Software Applications UA-Ready?

EAI Check

- ◉ Check if your email server supports Email Address Internationalization (EAI):
  - ○ https://uasg.tech/eai-check/

ICANN's Journey to UA Readiness - Model

- Stage 1: Update services to support both new short and long ASCII TLDs

- Stage 2: Update services to support non-ASCII Internationalized Domain Names (IDNs) in Unicode (U-label), and ASCII-based IDN representations in Punycode (A-label)

- Stage 3: Update infrastructure and services to support non-ASCII email addresses
  - Note: all components must support Email Address Internationalization (EAI) before infrastructure is compliant

- See details in ICANN's Case Study

STAGE 1
Establish support for new short and long ASCII-based TLDs

STAGE 2
Establish support for IDN TLDs in Unicode or Punycode

STAGE 3
Establish support for Email Address Internationalization (EAI)
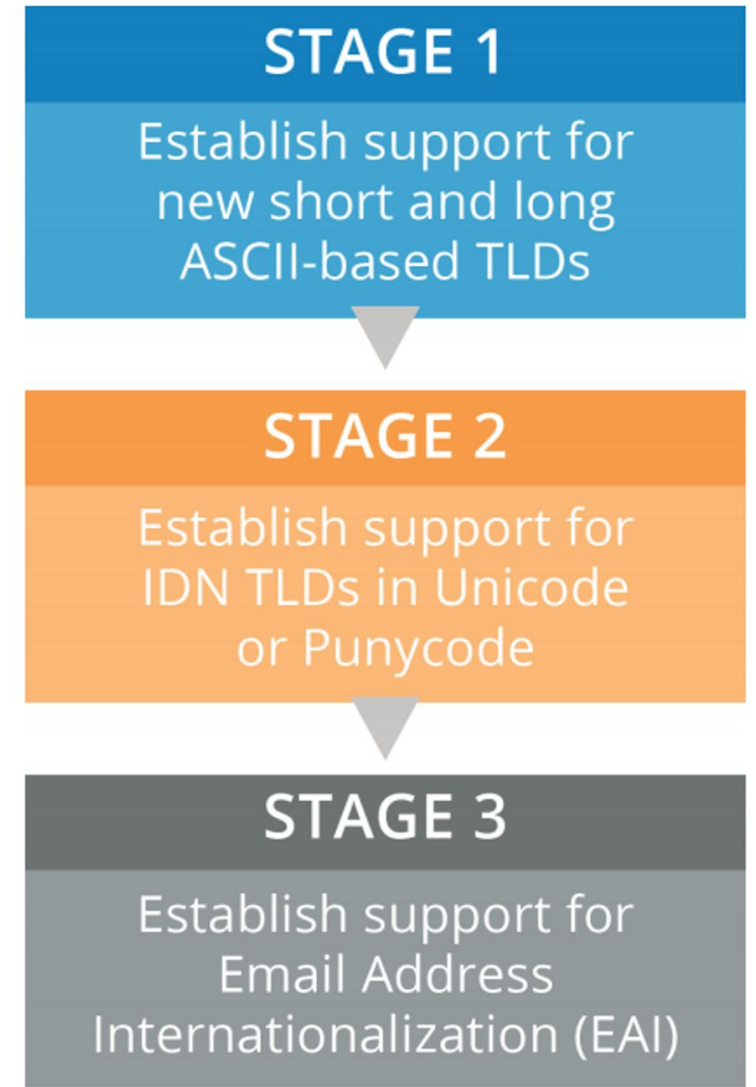
◉ UASG and ICANN continue to undertake gap analysis, remediation, training and outreach:
  ○ Gap analysis – Social media, browsers, programming languages, EAI tools, etc.
  ○ Remediation – Engaging technology forums (e.g. Github) and bug reporting
  ○ Training and outreach – Through local initiatives and ambassadors

We request the community to help address UA readiness and lead by example:

1. **Raise awareness** of the technical problems within the community

2. **Upgrade and use UA ready systems** as a community to create the necessary demand, e.g. upgrade email servers, use email in local language

3. **Advocate more broadly** to support UA in their systems (e.g. in e-govt. services; the private sector organizations, etc.)

Such activities may be undertaken in collaboration with UA Local Initiative and UA Ambassadors.

Get Involved!

Get Involved!

- For more information, email info@uasg.tech or UAProgram@icann.org

- Access all UA documents and presentations at https://uasg.tech

- Access details of ongoing work from wiki pages: https://community.icann.org/display/TUA

- Register to participate or listen in the UA discussion list at https://uasg.tech/subscribe

- Register to participate in UA working groups here

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 Major Email Software and Services: UASG021B
  - ○ Universal Acceptance Readiness Framework: UASG026
  - ○ Considerations for Naming Internationalized Email Mailboxes: UASG028
  - ○ Evaluation of EAI Support in Email Software and Services Report: UASG030

Engage with ICANN – Thank You and Questions

One World, One Internet

ICANN

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