



EAI Software Test Results

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1 June 2021



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Summary of Results

Research and development company, [Standcore LLC](#), tested seven software packages to determine how well they support internationalized email, otherwise known as Email Address Internationalization (EAI), and in two cases tested whether spam filters handled EAI mail. The results were varied: some passed most of the tests, some passed none at all, and only one passed every test. While EAI support is improving every year, there is still plenty of work to do.

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		

Name	Spam
Spamassassin 3.4.5	All L2
Mailchannels	Part L1
Spamjadoo (Xgenplus)	All L2



Chart Legend

Blank cells in the chart indicate a component that does not exist.

EAI level 1 (L1) - sends to and receives from EAI addresses	All or Most	Part	Few	Not tested
EAI level 2 (L2) - L1 plus provides local EAI addresses	All or Most	Part	None	Not tested

Testing Strategy

Tests were divided into five groups: Mail User Agent (MUA), Mail Submission Agent (MSA), Mail Transfer Agent (MTA), Mail Delivery Agent (MDA), and Spam Filter (SPM). The first four sets of tests were defined in UASG021B¹, to test how closely mail software follows the EAI specifications defined in RFCs 6530-6534 and 6855-6858. The spam tests defined as part of this work check for practical compatibility with EAI mail since there are no standards for spam filtering.²

We performed different groups of tests on different packages depending on the features they offer. We used an additional group of tests for Webmail, consisting of 60 of the 72 MUA tests, omitting ones that made no sense for webmail clients that are integrated with mail systems.

We conducted the MUA and web tests manually. For MUAs, we installed any required software and configured it to work with a reference mail server running an instrumented version of Courier. Then we performed the tests and recorded the results in a local database. Some of the tests such as EAI-MUA-046 through -049 check particular commands and options that the MUA sends to the mail server; our Courier server was patched to log the commands so we could see what the MUA sent.

We conducted the MSA, MTA, and MDA tests using scripts we wrote to perform each test and check the results. This made it easier to test consistently, and considerably sped up later tests. The SPM tests were partially automated (001 through 007) and partially manual. Many of the tests involved sending a test message and checking particular features of the message, in which our scripts pick up the test message from the system under test or from our server to which the server sent the message, as appropriate.

In practice, even software that does not implement EAI extensions often handles EAI mail well. We note some cases in the discussion of MDAs.

Terminology

In this report, when we refer to an *EAI address*, we mean an address with non-ASCII characters in the mailbox, which is the part preceding the “@” sign. An *EAI message* is one with an EAI address as an envelope sender and/or recipient, or with unencoded UTF-8 text

¹ See <https://uasg.tech/wp-content/uploads/documents/UASG021B-en-digital.pdf>

² If there were, the standards would be a roadmap for spammers to use to evade those filters.



in a message header. An *EAI mail system* is one that generally supports sending and receiving EAI messages.

Test Addresses

We registered several domains to use for test addresses: one in Chinese and one in Arabic. We created subdomains for our Courier test server and for mail accounts on our Sendmail and Halon servers and the Mailchannels spam proxy, e.g., 哈龙.电子邮件测试.中国 and 筛选.电子邮件测试.中国. We did not create mixed-script test addresses, but none of the packages do any script processing so we expected that any UTF-8 addresses would work the same.

Xgenplus provided EAI test addresses in Hindi.

For each package we tested whether they could:

- Send to and retrieve mail from EAI addresses (Level 1 EAI Readiness)
- Host an EAI address (Level 2 EAI Readiness)

In these summaries, we included the results of tests we did last year in 2020 and those done in 2019 by Catalyst.Net, Ltd. Our previous report was published as UASG document UASG030, available at <https://uasg.tech/wp-content/uploads/documents/UASG030-en-digital.pdf>, and Catalyst's report was published as UASG document UASG021B, available at <https://uasg.tech/wp-content/uploads/documents/UASG021B-en-digital.pdf>.

Summary of Test Results

	Name	MUA	MSA	MTA	MDA	MSP	Web-mail	Spam
	Sendmail 8.17 alpha		X	X				
	Thunderbird 89 beta	X						
	Halon		X	X	(X)			
	Dovecot				X			
	XgenPlus		X	X	X	C	X	X
	Mailchannels							X
	Spamassassin							X
	Coremail	P	P	P	P	P	P	
	MS Outlook.com	P	P	P	P	P	P	
	Yandex Mail	P	P	P	P	P	P	
	Roundcube	P						
	Apple Mail	P						



	Apple iOS Mail 14.x	P						
	Mozilla Thunderbird	P						
	MS Outlook	P						
	MS Exchange Server (hosted)		P	P	P			
	Exim		P	P				
	Postfix		P	P				
	Courier		C	C	C			
	Gmail	C	A	A	A			

- X Standcore tested this component
- (X) Standcore determined tests were not possible
- P Standcore test results from UASG030
- (P) Standcore determined tests would not be useful in UASG030
- C Catalyst.net test results from report UASG021B

Results of MUA Tests

We tested one MUA in this phase:

- Thunderbird 89 beta 4

Tests were manually performed to evaluate sending mail and retrieving mail from the Chinese and Arabic test accounts on our Courier server, and the MUA was tested on its ability to:

- Handle additional EAI readiness tasks including:
 - Correctly managing Unicode subject lines and Unicode folder names.
 - Consistently creating and using Mailto links.
 - Saving and using EAI addresses in the address book.
 - Using Unicode in message headers where expected.

Thunderbird 89 beta has fairly complete EAI level 1 support, but does not yet have level 2 support. A summary of the changes since last year's tests are in the table below.

	Thunderbird 89 b4	Thunderbird (2020 testing)
Client receives messages from EAI addresses	Yes	Sometimes
Client sends messages to EAI addresses	Yes	No
Unicode addresses displayed in Unicode (sent and received)	Yes (received)	Yes (received)
Address book handles EAI addresses normally (save, send, search)	Yes	Yes



Mailto links of EAI addresses handled normally (sent and received)	Sometimes (no for sent link, yes for received link)	Sometimes
Subject line can be Unicode	Yes	Yes
Folders can be named with Unicode	Yes	Yes
Message headers are Unicode where appropriate	No	No
EAI accounts can be set up to receive and send mail using IMAP	No	No
EAI accounts can be set up to receive and send mail using POP	No	No
Username can be Unicode	No	No
Server names and domains can be Unicode	No	No
Server names and domains can be A-label	Yes	No

Results of Webmail Tests

We tested the webmail service of Xgenplus. The webmail tests are a subset of the MUA tests, leaving out the tests that aren't relevant.

The webmail passed most of the tests. Unlike most other MUAs and webmail systems, Xgenplus will downgrade an EAI message to ASCII when sending to an ASCII mail system. The UTF-8 mailbox is replaced with a MIME-encoded version of the mailbox which, while hard for people to read, is valid and does work.

	Xgenplus (June 2021)
Client receives messages from EAI addresses	Usually -- email from Chinese addresses arrives, but not from the Arabic address, likely was spam filtering issue
Client sends messages to EAI	Yes
Unicode addresses displayed in Unicode (sent and received)	Yes
Address book handles EAI normally (save, send, search)	Yes
Mailto links of EAI handled normally (sent and received)	None
Subject line can be Unicode	Yes



Folders can be named with Unicode	Yes
Message headers are Unicode where appropriate	No

Results of MSA, MTA, and MDA Tests

MSA MTA summary	Sendmail 8.17 alpha	Halon	Xgenplus
MSA UTF8SMTP support	Yes	Yes	Yes
MSA 8BITMIME support	Yes	Yes	No
Sends EAI forward path	Yes	No, sent A-labels	Yes
Sends UTF-8 Subject	Yes	Yes	Yes
Reject or downgrade msg to non-EAI	Reject	No	Downgrade
ASCII messages sent without UTF8SMTP	Yes	Yes	No
MTA UTF8SMTP support	Yes	Yes	Yes
MTA 8BITMIME support	Yes	Yes	Yes
MTA Received indicates EAI	Yes	No	No
MTA EAI msgs to non-EAI are rejected	Reject	Reject	No

MDA summary	Dovecot	Xgenplus
IMAP EAI extensions advertised	No	Yes
IMAP EAI enable	No	Yes
IMAP AUTHENTICATE	Yes	Yes



IMAP UTF-8 username	No	Yes
POP LANG capability	No	No
POP UTF8 capability	No	Some

We performed the MSA, MTA, and MDA tests using python test scripts we wrote for the 2020 tests, updating the test scripts in a few cases as we discovered unexpected or buggy behavior. For example, we found the Xgenplus IMAP server sends an extra blank line after the contents of a message, which crashes the python IMAP library we use. We patched the library to deal with the blank lines and submitted the patch to be included in future versions of python.

Sendmail 8.17 alpha

We tested Sendmail 8.17 alpha 0 and alpha 2 on a system running FreeBSD, a platform suggested by its maintainer. We found a few bugs in the alpha 0 which we reported and were quickly fixed. As of sendmail 8.17 alpha 2 and later versions, sendmail has solid level 2 EAI support in its MSA and MTA, comparable to that in its open source peers Postfix and Exim.

Halon

We tested Halon version 4.6 running in a virtual machine at Amazon Web Services, a configuration recommended by the vendor. Halon handles mail using an extensive array of settings and a powerful scripting language that can add significant features to the standard configurations.

We tested two configurations based on Halon's default settings. For the MTA tests, we used an "inbound" configuration that accepts mail from the Internet on port 25, and after applying filtering rules, relays the mail to a fixed external server, in this case our own test server. For the MSA tests, we used an "outbound" configuration that accepts mail from authenticated users on port 587 and then relays it to the recipient's mail server. We made minimal changes to the defaults. For the inbound configuration, we disabled some of the filters to make the tests more reliable, and for the outbound configuration, we added an authentication rule that used a local file with fixed usernames and passwords.

For the MSA and MTA, Halon passed nearly all of the tests and is a good EAI L2 mail server.

Xgenplus

We tested the MSA, MTA, and MDA components. Most of the tests passed, and Xgenplus offers good EAI L2 features. It automatically downgrades mail sent to non-EAI systems, a fairly unusual feature. In the MSA and MDA components, we found a lot of small bugs not related to EAI but that might make it hard to use Xgenplus with other software, e.g., the MSA supports 8BITMIME but does not advertise it, the IMAP server misinterpreted some arguments to the SELECT command, and it returned the extra blank result lines as mentioned above.



Dovecot

We installed Dovecot 2.3.13 from the FreeBSD package. We configured it to use a fixed text file as the authentication mechanism and otherwise used the default configuration.

Dovecot has not implemented any of the EAI extensions in RFCs 6855 and 6856 and failed most of the MDA tests, so it technically does not have even L1 support. Nonetheless, even without the RFC extensions it is in practice an adequate MDA for EAI mail. It properly stores and retrieves EAI mail messages, and since it has IMAP legacy character set support, mail clients can use that to manage UTF-8 folder names and search strings. One limit we found was that its AUTHENTICATE command does not handle UTF-8 usernames or passwords even if the underlying authentication database in use does.

Spam Filter Tests

We created a new set of spam filter tests intended for two styles of spam filter. One is a filtering proxy, which provides an MX host for the client's domains, receives mail and filters it for spam, and then relays the filtered mail to the client's own mail server. The other is a host-based filter that can be called from the host's MTA as part of mail reception or delivery. Our first seven tests are specific to proxies, while the rest are for all filters.

The tests we created are described in the following table.

Test ID	Summary	Description	Action	Expected Result	Classification
EAI-SPM-001	SMTPUTF8 capability is advertised	When a client connects to the proxy (with the EHLO command), the listing of capabilities returned by the server must include SMTPUTF8 to indicate EAI support.	Connect to software (using EHLO command) and inspect traffic sent to client	Response to command is 250 and listing includes SMTPUTF8	Proxy
EAI-SPM-002	8BITMIME capability is advertised	When a client connects to the proxy (with the EHLO command), the listing of capabilities returned by the server must include 8BITMIME to indicate the ability to handle 8-bit data.	Connect to software (using EHLO command) and inspect traffic sent to client	Response to command is 250 and listing includes 8BITMIME	Proxy
EAI-SPM-003	SMTPUTF8 parameter is provided with MAIL command for EAI messages	When transmitting an EAI message with the MAIL command to an SMTPUTF8-capable proxy, the SMTPUTF8 parameter must be included. For this test case, the EAI message should be one with Unicode text in the local part of a originator or	Submit EAI message and inspect traffic sent to server	MAIL command includes SMTPUTF8 parameter	Proxy



		destination address header value.			
EAI-SPM-004	EAI reverse path values are transmitted to SMTPUTF8 proxy	Connections to a proxy server offering the SMTPUTF8 extension may submit envelopes with addresses in U-label form. This applies to the reverse-path of the MAIL command.	Submit message with reverse-path <Email> to server with SMTPUTF8 server	Message is transmitted	Proxy
EAI-SPM-005	EAI forward path values are transmitted to SMTPUTF8 proxy	Connections to a proxy server offering the SMTPUTF8 extension may submit envelopes with addresses in U-label form. This applies to the forward-path of the RCPT command.	Submit message with forward-path <Email> to proxy with SMTPUTF8 support	Message is transmitted	Proxy
EAI-SPM-006	EAI originator header values are transmitted to SMTPUTF8 server	Messages transmitted to a proxy server offering the SMTPUTF8 extension may send mailbox parts in UTF-8. This applies to the "From" and "Reply-to" fields.	Submit message with originator <Email>	Message is transmitted	Proxy
EAI-SPM-007	EAI destination address header values are transmitted to SMTPUTF8 server	Messages transmitted to an SMTP server offering the SMTPUTF8 extension may send mailbox parts in UTF-8. This applies to the "To", "Cc", and "Bcc" fields.	Submit message with destination address <Email>	Message is transmitted	Proxy
EAI-SPM-008	Sender whitelist supports UTF-8 mailbox	If the filter provides sender whitelisting, UTF-8 mailboxes are allowed	Add UTF-8 mailbox to whitelist, send message	Message is transmitted	All
EAI-SPM-009	Sender whitelist supports U-label domain	If the filter provides sender whitelisting, U-label domains are allowed	Add U-label domain to whitelist, send message	Message is transmitted	All
EAI-SPM-010	Sender blacklist supports UTF-8 mailbox	If the filter provides sender blocking, UTF-8 mailboxes are allowed	Add UTF-8 mailbox to blacklist, send message	Message is blocked	All
EAI-SPM-011	Sender blacklist supports U-label domain	If the filter provides sender blocking, U-label domains are allowed	Add U-label domain to blacklist,	Message is blocked	All



			send message		
EAI-SPM-012	Subject filters support UTF-8	If the filter provides Subject filters, UTF-8 strings are allowed as filter terms	Add UTF-8 term as a Subject filter. Send a message with that subject.	Message is filtered appropriately.	All
EAI-SPM-013	Header filters support UTF-8	If the filter provides Header filters, UTF-8 strings are allowed as filter terms	Add UTF-8 term as a Header filter. Send a message with that term in a header.	Message is filtered appropriately.	All
EAI-SPM-014	Body filters support UTF-8	If the filter provides Body filters, UTF-8 strings are allowed as filter terms	Add UTF-8 term as a Body filter. Send a message with that string in the body.	Message is filtered appropriately.	All

Mailchannels

Mailchannels offers a spam filtering proxy. We configured it to accept mail for an ASCII domain and an Internationalized Domain Name (IDN) domain and relay the mail to our test server. It passed all of the proxy-only tests but failed the rest due to bugs. At this point, Mailchannels is EAI L1 ready, but not L2 ready since we were unable to configure our IDN domain nor add UTF-8 addresses to their safelist or blocklist.

We reported all the bugs we found to the vendor who says they're working on fixing them, so we expect that when the bugs are fixed, Mailchannels will also be EAI L2 ready.

Spamjadoo (Xgenplus)

Spamjadoo is a filtering proxy that is both provided as part of the Xgenplus service and as a separate product. We tested it as a separate product, configured for an IDN domain that it relayed to our test server.

Spamjadoo passed every relevant test and is fully EAI L2 ready.

Spamassassin

We tested spamassassin version 3.4.5, installed from the FreeBSD package. Spamassassin has a very flexible design that allows extensive customization by system managers and users to manage the way it computes a spam score for each message. The system, and potentially each user, have a configuration file containing filtering rules and score weights. We added rules to the configuration file, e.g. `whitelist_from` rules for tests 008 and 009, then let it process test messages and looked at the spam scores and summary of filtering results to see whether the rules were correctly triggered.

Spamassassin passed every test and is fully EAI L2 ready.



Software Not Tested

In one case we found that a product did not include a component we planned to test.

Halon

Halon has MTA and MSA components, but no MDA. The vendor confirmed that and said that one would use it with a third party MDA such as Dovecot.

Previous Tests

The results of previous tests can be found in report [UASG030](#).

Detailed Results

The individual test results are available in spreadsheets, one per product tested, as Excel XLSX files.

Mozilla Thunderbird Beta

[Excel spreadsheet](#)

Xgenplus and Spamjadoo

[Excel spreadsheet](#)

Sendmail 8.17 alpha

[Excel spreadsheet](#)

Halon

[Excel spreadsheet](#)

Dovecot

[Excel spreadsheet](#)

Mailchannels

[Excel spreadsheet](#)

Spamassassin

[Excel spreadsheet](#)

Test Software

The scripts we used to manage the tests are available on Github at <https://github.com/jrlevine/eaitesttools>. They are offered with a permissive BSD two-clause license.