CSE508 Network Security (PhD Section)

4/7/2015 **Email**

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Email Overview

MUA: Mail User Agent

Thunderbird, webmail, Pine, …

MSA: Mail Submission Agent

SMTP (port 587)

Often same as initial MTA

MTA: Mail Transfer Agent

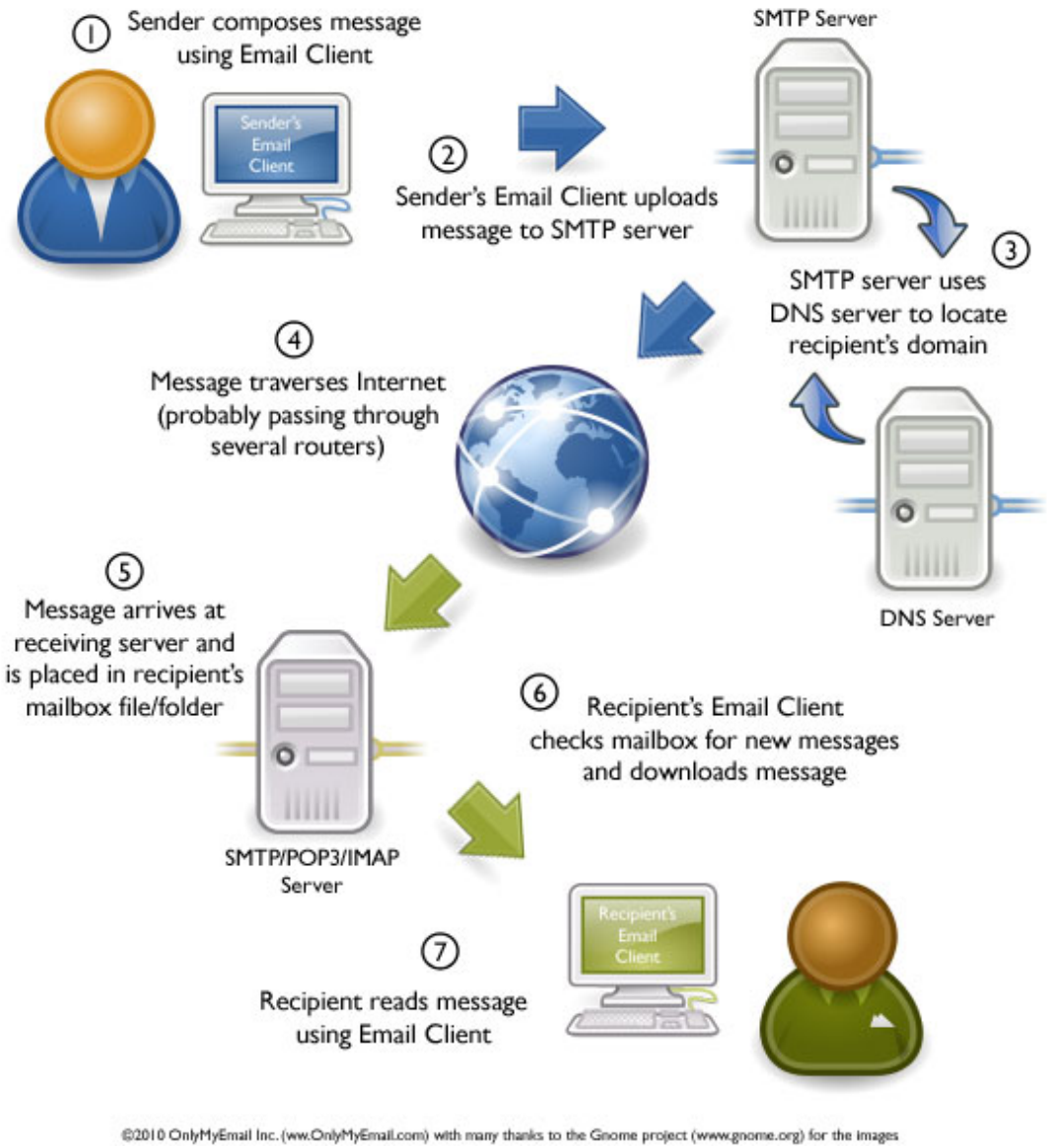
SMTP (port 25)

MDA: Mail Delivery Agent

IMAP, POP3, local, …

Typical flow:

MUA ➔ MSA ➔
MTA ➔ … ➔ MTA ➔
MDA ➔ MUA



SMTP Transport Example

```
S: 220 smtp.example.com ESMTP Postfix
C: HELO relay.example.org
S: 250 Hello relay.example.org, I am glad to meet you
C: MAIL FROM:<bob@example.org>
S: 250 Ok
C: RCPT TO:<alice@example.com>
S: 250 Ok
C: RCPT TO:<theboss@example.com>
S: 250 Ok
C: DATA
S: 354 End data with <CR><LF>.<CR><LF>
C: From: "Bob Example" <bob@example.org>
C: To: "Alice Example" <alice@example.com>
C: Cc: theboss@example.com
C: Date: Tue, 15 January 2008 16:02:43 -0500
C: Subject: Test message
C:
C: Hello Alice.
C: This is a test message with 5 header fields and 4 lines in the message body.
C: Your friend,
C: Bob
C: .
S: 250 Ok: queued as 12345
C: QUIT
S: 221 Bye
```

Email/Messaging Security and Privacy Goals

Protect message content

Verify communicating parties' identities

Fight spam

Fight phishing

- Spear-phishing

Hide communication patterns

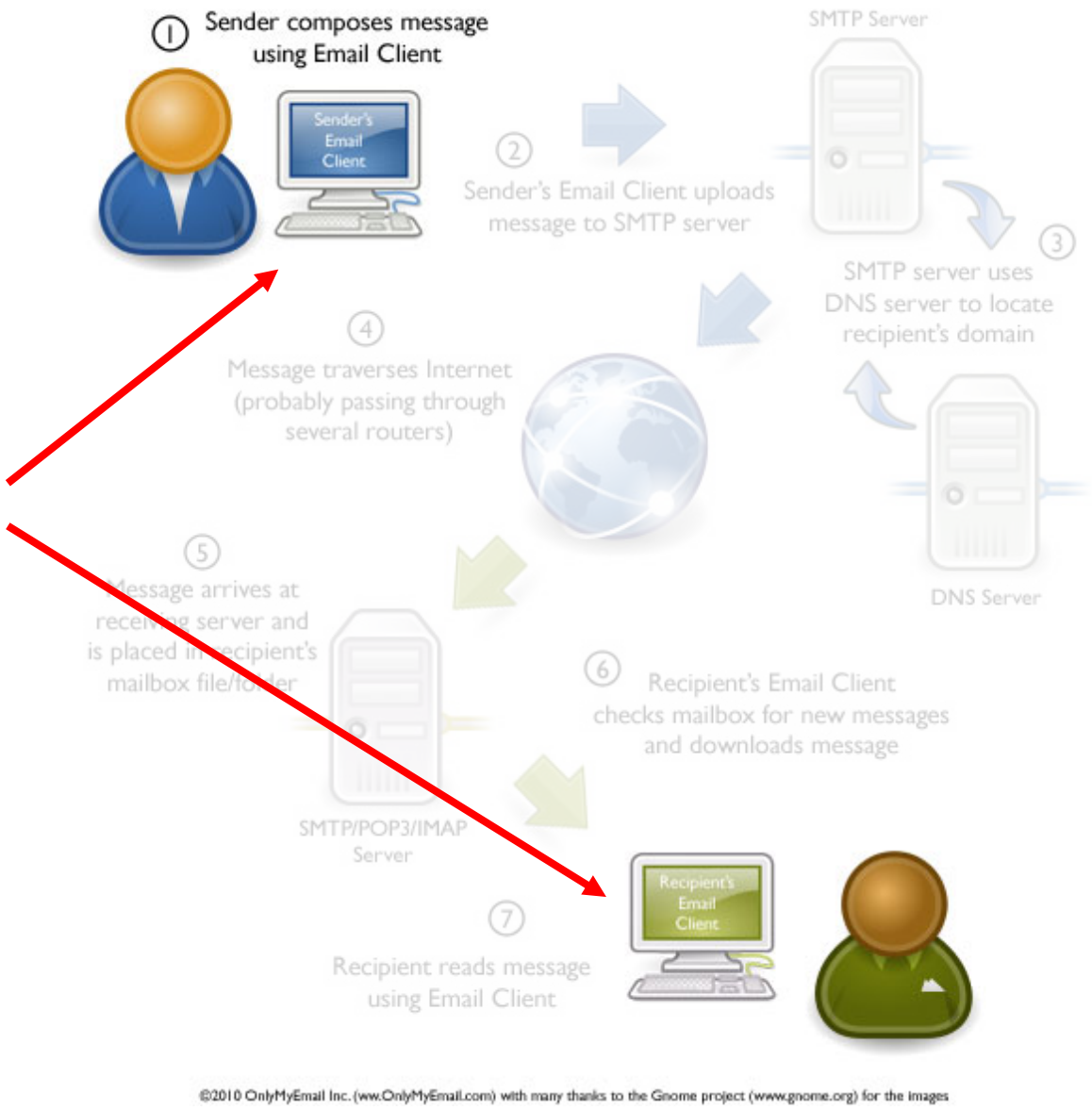
- (subject of future lecture)

Who can read my email?

Adversaries with local or remote access to my devices

Intruders, spouse, administrator, …

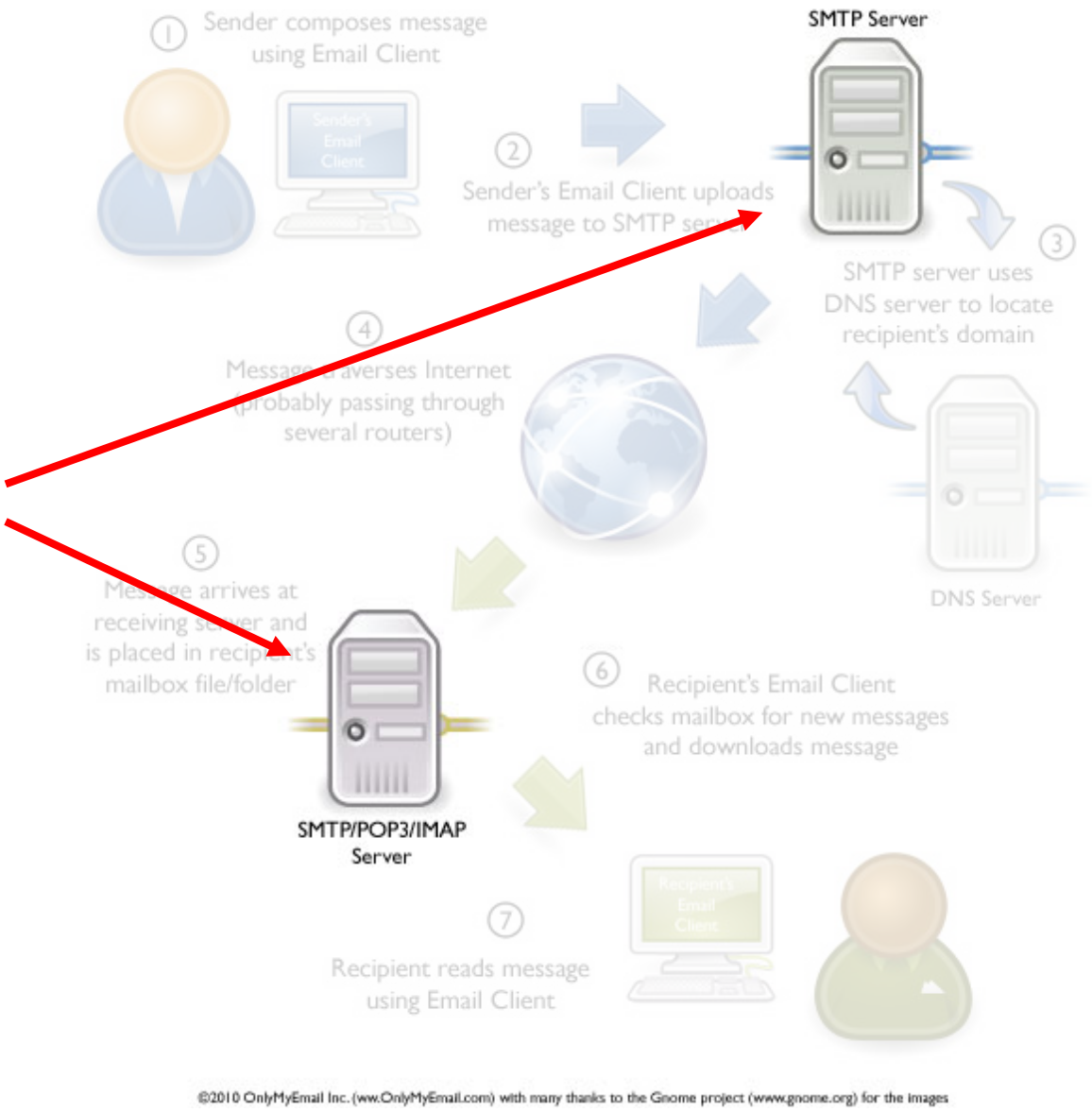
Malware, stolen credentials, physical access, …



Who can read my email?

Adversaries with local or remote access to MTAs and other intermediary servers

Intruders, administrators, other insiders, LEAs, …



Who can read my email?

Adversaries with access to any intermediate network

Intruders, administrators, other insiders, LEAs, …

Passive eavesdropping, MitM

Confidentiality Threats Recap:

Stored messages

Compromised system (either local or remote)
Malware, intruder, insider, stolen/lost device, …

Compromised authentication
Password theft, brute-force phone pin, …

Messages in transit

Eavesdropping

Displayed messages

Screendump, reflections, shoulder surfing, …

Securing Email Transit

These days encryption is mandatory for email transmission and retrieval

MUA ➔ MSA: STARTTLS (port 587/25), SMTPS (port 465)

MDA ➔ MUA: POP3S (port 995), IMAPS (port 993)

```
mikepo@capcom:~> nc smtp.gmail.com 25
220 mx.google.com ESMTP i185sm2356739qhc.49 - gsmtp
HELO
250 mx.google.com at your service
MAIL FROM:<mikepo@example.org>
530 5.7.0 Must issue a STARTTLS command first.
```

MTA ➔ MTA

Another story…

STARTTLS: Opportunistic Encryption

Many MTAs still do not support TLS

MTAs do their best to deliver messages

- A recipient MTA might present a self-signed certificate (common in antispam and email AV systems)
- There is no PKI for email…

MitM is trivially easy

- STARTTLS command is sent over a plaintext channel (!)
- Analogous to SSL stripping, but in this case the client has no indication that this happened
- Just assumes that the receiving MTA does not support TLS

Eavesdropping is still possible

- Better than nothing: bulk passive eavesdropping not possible

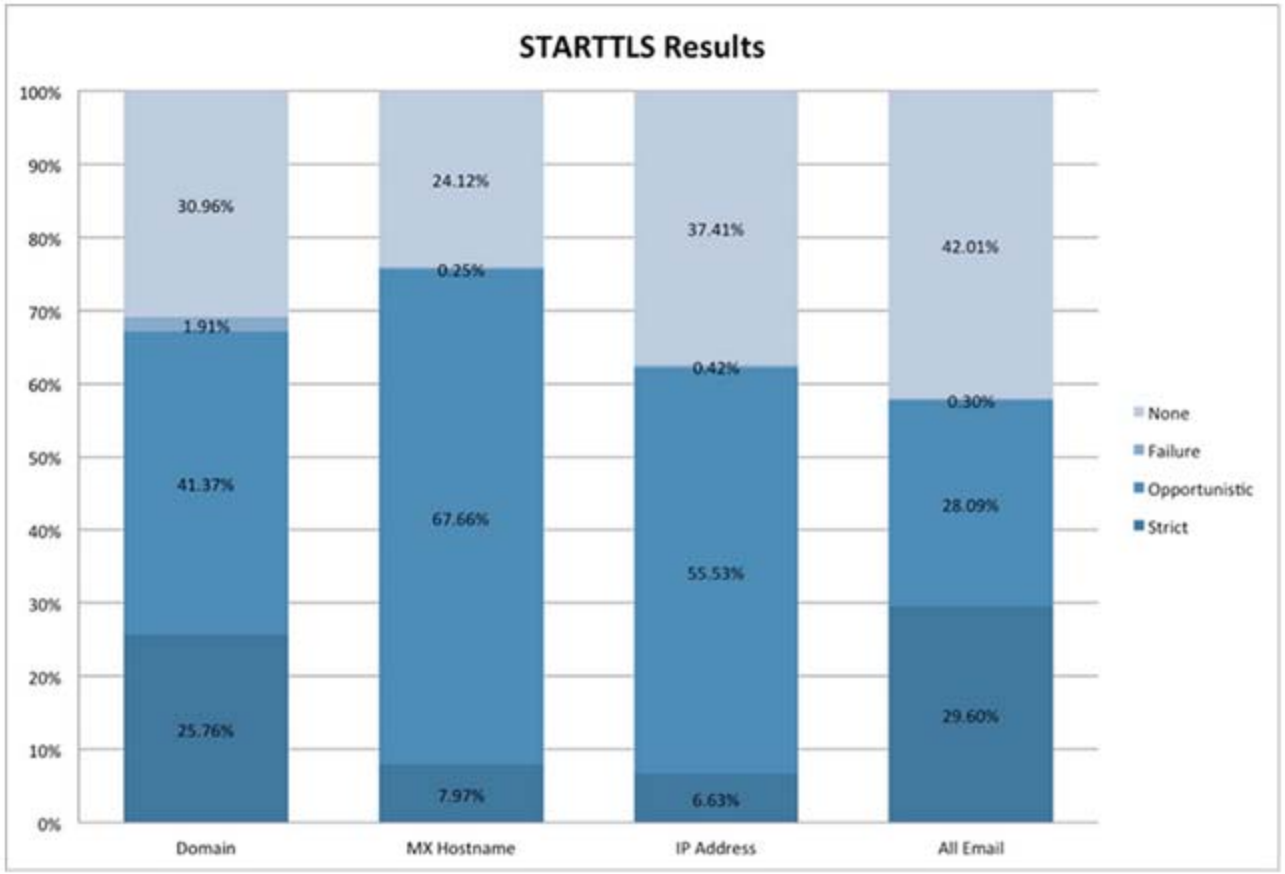


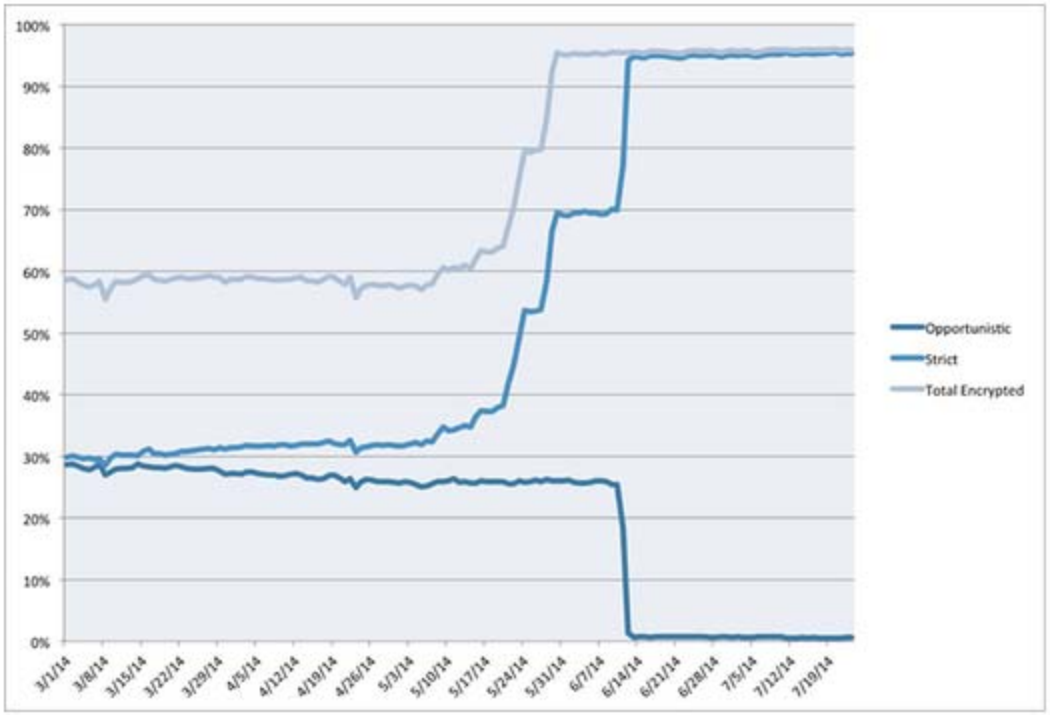
Figure 1 - Overall STARTTLS Results

Figure 1 shows the overall results of STARTTLS behavior. From the 'All Email' bar on the left we can see that nearly 60% of all emails are sent via an encrypted connection, but only about 30% pass strict validation. 60% is an encouragingly high percentage, but this number is potentially skewed since the bulk of email volume is sent to a small number of large mailbox providers. We need to aggregate the data in a few different ways in order to compensate for this and get a clearer picture of STARTTLS behavior across all email

Massive Growth in SMTP STARTTLS Deployment

August 19, 2014 at 10:01am

When we posted in May about the state of STARTTLS deployment, we had no idea that we would see such significant changes to email encryption across the industry in just a few short months. We previously reported that only 28.6% of our outbound notification emails were successfully encrypted and passed strict certificate validation (58% if you count opportunistic encryption). Since STARTTLS encryption requires both sides to deploy it, we encouraged others to take the next step. As a result of recent changes by major providers, most notably Microsoft and Yahoo, 95% of our notification emails are now successfully encrypted with both Perfect Forward Secrecy and strict certificate validation.



Notes by Protect the Graph

All Notes

Get Notes via RSS

Embed Post

Safer email – Transparenc ×

https://www.google.com/transparencyreport/saferemail/

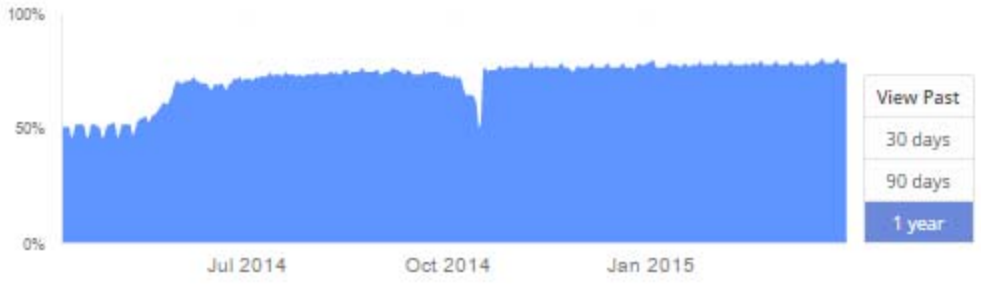
How much email was encrypted in transit?

Generally speaking, use of encryption in transit increases over time, as more providers enable and maintain their support. Factors such as varying volumes of email may explain other fluctuations.

Outbound

79%

Messages from Gmail to other providers.



Inbound

56%

Messages from other providers to Gmail.

Download data

Google, Yahoo SMTP email severs hit in Thailand

Staff writer | September 12, 2014 | telecomasia.net

Internet users in Thailand have been hit by a massive man-in-the-middle attack aimed grabbing email login credentials from fake SMTP servers.

The attack has been verified on Google's and Yahoo's email servers and on two of the country's largest fixed-line ISPs, though preliminary analysis suggest that all SMTP servers are targeted.

The STRIPTLS attack as it has become known works by inserting a man-in-the-middle at the ISPs. This is done via a transparent proxy.

LATEST NEWS

- Big data to push TV future
- Irdeto, Alibaba firm up pira China
- CJ Hellovision launches Ulti
- Pay TV revenues surge in e markets
- Broadcom unveils chipset f China
- TV remains prime screen in homes
- Global ad spend seen rising
- Indosat narrows losses for

31
DEC/12
1

On SMTP, STARTTLS and the Cisco ASA

During the course of trying to increase the security of my e-mail while in transit, I was working on enabling TLS in Postfix to opportunistically encrypt connections to SMTP servers. While verifying my configuration, I ran into an interesting issue.

In order to test my configuration out I was sending e-mails to a Gmail address via Postfix, unfortunately I wasn't seeing any logging in Postfix indicating that TLS was being used. So I attempted to investigate whether STARTTLS was actually being advertised by manually connecting to Google's SMTP servers using telnet:

```
telnet aspmx.l.google.com 25
Trying 2607:f8b0:4001:c02::1a...
Connected to aspmx.l.google.com.
Escape character is '^]'.
220 ************************************
EHLO example.com
250-mx.google.com at your service,
[2001:4870:800e:301:f24d:a2ff:fe08:e920]
250-SIZE 35882577
250-8BITMIME
250-XXXXXXXA
250 ENHANCEDSTATUSCODES
```

Every server I connected to in Google's MX record was not advertising STARTTLS. On a whim, I attempted to connect to Google's SMTP servers from an entirely different network:

```
telnet 173.194.68.26 25
Trying 173.194.68.26...
Connected to qa-in-f26.1e100.net (173.194.68.26).
Escape character is '^]'.
220 mx.google.com ESMTP l3si4081429qct.164
EHLO stomp.colorado.edu
250-mx.google.com at your service, 1
250-SIZE 35882577
250-8BITMIME
250-STARTTLS
250 ENHANCEDSTATUSCODES
```

Pages

Nagios Plug-ins

About

Categories

IPv6

MySQL

OpenConnect

OpenManage

OpenVPN

Privacy

SNMP

Sysadmin

- Linux
  - Augeas
  - Backups
  - BIND
  - Fedora
  - FreeIPA
  - Hardware
  - NetworkManager
  - Red Hat
  - Rsyslog
  - SELinux
  - SMTP
  - Unbound
  - Virtualization
  - VNC
  - Web Browsers
- Mac OS X

End-to-End Email Encryption

Two major standards: **PGP** and **S/MIME**

- Similar, but incompatible
- Both rely on public-key cryptography
- Both support signing and/or encryption
- Main difference: how certificates are signed

Typical workflow

- Encrypt message with a random symmetric key
- Encrypt symmetric key with the public key(s) of recipient(s)
- Digitally sign a hash of the message

Metadata still in the clear!

- Email headers
- Appended “Received:” records
- Subject line

Pretty Good Privacy

PGP (Phil Zimmermann) -> OpenPGP (RFC 4880)

- Gnu Privacy Guard (GPG): GPL implementation

Offers authentication and confidentiality

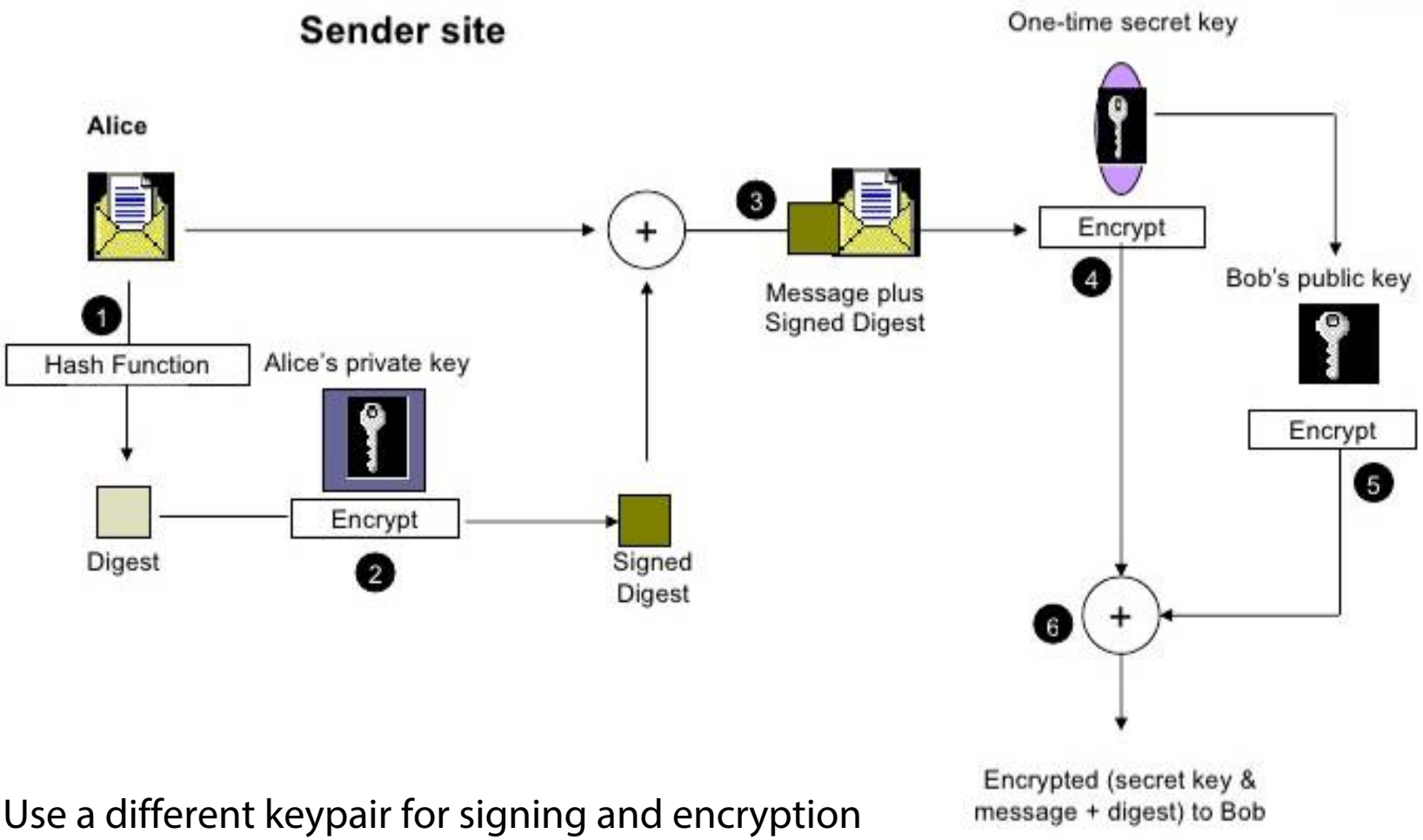
Sign plaintext, then encrypt

- sender's identity remains hidden: only recipient can verify signature

Encrypt, then sign ciphertext

- Verify signature without decryption (e.g., at a gateway)
- Anyone can sign a message even if they can't decrypt it: include sender/recipient identities in plaintext message

PGP Encryption



Use a different keypair for signing and encryption

http://www.slideshare.net/rvenkatesh25/network-security-primer

PGP Signed Message Example

```
From: alice@wonderland.com
Date: Mon, 16 Nov 1998 19:03:30 -0600
Subject: Message signed with PGP
MIME-Version: 1.0
Content-Type: text/plain; charset=US-ASCII
Content-Transfer-Encoding: 7bit
Content-Description: "cc:Mail Note Part"

-----BEGIN PGP SIGNED MESSAGE-----

Bob,

This is a message signed with PGP, so you can see how much overhead PGP
signatues introduce.  Compare this with a similar message signed with S/MIME.

Alice

-----BEGIN PGP SIGNATURE-----
Version: PGP for Personal Privacy 5.0
Charset: noconv

iQCVAwUBM+oTwFcsAarXHFeRAQEsJgP/X3noON57U/6XVygOFjSY5lTpvAduPZ8M
aIFalUkCNuLLGxmtsbwRiDWLtCeWG3k+7zXDfx4YxuUcofGJn0QaTlk8b3nxADL0
O/EIvC/k8zJ6aGaPLB7rTIizamGOt5n6/08rPwwVkRB03tmT8UNMAUCgoM02d6HX
rKvnc2aBPFI=
=mUaH
-----END PGP SIGNATURE-----
```

http://www.slideshare.net/rvenkatesh25/network-security-primer

PGP Additional Features

Compression

- Sign -> Compress -> Encrypt
- Compression after encryption is pointless (no redundancy)
- Signature does not depend on the compression algorithm

Email Compatibility

- Ciphertext contains arbitrary 8-bit octects
- Some email systems may interpet some of them as control commands
- Solution: base64 encoding (33% overhead)

Segmentation

- Transparent message segmentation and reassembly for very large messages
- Segments mailed separately

Encrypted Email: Two Main Challenges

Public key authenticity

Assurance that a public key is correct and belongs to the person or entity claimed

- Has not been tampered with or replaced by an attacker

Public key discovery

How can we find the public key of a person/entity?

- Especially the very first time we contact them

PGP: Web of Trust

Decentralized trust model

- In contrast to the centralized hierarchical model of PKI
- Users create their own certificates

Users validate other users' certificates, forming a "web of trust"

- No trusted authorities: trust is established through friends
- Adjustable "skepticism" parameters: # fully and # partially trusted endorsers required to trust a new certificate (1 and 3 for GnuPG)
- Key signing parties

Main problems

- Privacy issues: social graph metadata
- Bootstrapping: new users are not readily trusted by others
- When opinions vary, "stronger set" wins: impersonation through collusion/compromised keys
- Scalability: WoT for the whole world?


HEY, I JUST GOT HOME FROM THE PARTY
THE ONE WITH THE IRC FOLKS?
YEAH.
HOW WAS IT?
GOT TOO DRUNK. I SCREWED UP, BAD.
WHAT HAPPENED?
THERE WAS A GIRL. NO IDEA WHO SHE WAS. DON'T EVEN KNOW HER NAME. I WAS TOO DRUNK TO CARE.
AND WHAT, YOU SLEPT WITH HER?
NO.
I SIGNED HER PUBLIC KEY.
SHIT, MAN.

S/MIME

Based on standard X.509 certificates

- Analogous operation to SSL: trusted CA sign certificates
- Traditional PKI

Uses multipart MIME to include cryptographic information in the message

Widely supported by most email readers (e.g., iOS)

Works well within corporations

- Certificate distribution through Active Directory infrastructure

S/MIME Signed Message Example

```
From: alice@wonderland.com
Date: Mon, 16 Nov 1998 19:03:08 -0600
Subject: Message signed with S/MIME
MIME-Version: 1.0
Content-Type: multipart/mixed; boundary="simple boundary"


--simple boundary
Content-Type: text/plain; charset=US-ASCII
Content-Transfer-Encoding: 7bit
Content-Description: "cc:Mail Note Part"

Bob,

This is a message signed with S/MIME, so you can see how much overhead S/MIME
signatures introduce.  Compare this with a similar message signed with PGP.

Alice


--simple boundary
Content-Type: application/octet-stream; name="smime.p7s"
Content-Transfer-Encoding: base64
Content-Disposition: attachment; filename="smime.p7s"

MIIQQwYJKoZIhvcNAQcCoIIQNDCCEDACAQExCzAJBgUrDgMCGgUAMAsGCSqGSIb3DQEHAaCCDnww
ggnGMIIJL6ADAgECAhBQQRR9a+DX0FHXfQOVHQhPMA0GCSqGSIb3DQEBBAUAMGIxETAPBgNVBAcT
CEludGVybmV0MRcwFQYDVQQKEw5WZXJpU2lnbiwgSW5jLjE0MDIGA1UECxMrVmVyaVNpZ24gQ2xh
c3MgMSBDQSAtIEluZGl2aWR1YWwgU3Vic2NyaWJlcjAeFw05NzAxMjcwMDAwMDBaFw05ODAxMjcy
MzU5NTlaMIIBFzERMA8GA1UEBxMISW50ZXJuZXQxFzAVBgNVBAoTDlZlcmlTaWduLCBJbmMuMTQw
MgYDVQQLEytWZXJpU2lnbiBDbGFzcyAxIENBIC0gSW5kaXZpZHVhbCBTdWJzY3JpYmVyMUYwRAYD
```

http://www.slideshare.net/rvenkatesh25/network-security-primer

Finding Public Keys

Public PGP key servers

- pgp.mit.edu
- keyserver.pgp.com

Cache certificates from received emails

Integration with user management (LDAP)

Ad-hoc approaches

- List public key on home page
- Print on business card
- Exchange through another medium on a case by case basis

Association with social profiles/identities

- keybase.io

MIT PGP Key Server

https://pgp.mit.edu

MIT PGP Public Key Server

Help: Extracting keys / Submitting keys / Email interface / About this server / FAQ
Related Info: Information about PGP /

Extract a key

Search String: Do the search!

Index: Verbose Index:

Show PGP fingerprints for keys

Only return exact matches

Submit a key

Enter ASCII-armored PGP key here:

Michalis Polychronakis (m

https://keybase.io/mikepo

Keybase

Join Login

Michalis Polychronakis

keybase.io/mikepo

8EBD 8F30 8899 8AFF

polychronakis tweet

polychronakis gist

mikepo has an invitation available
If you know mikepo, you can ask them for an invitation to Keybase.

Encrypt

Verify

mikepo from the **command line**

```
# first
keybase join  # if you're new, or
keybase login # if you're not.

# then
keybase push  # if you already have a public key, or
keybase gen   # if this is all new to you
```

Tracking (6)

 hargikas

 mstamat

 gianluca_string

Trackers (6)

 hargikas

 kontaxis

 mstamat

Biggest Issue: Usability

Non-trivial setup

- S/MIME: complex certificate enrollment process
- PGP: user is responsible for everything

Key management

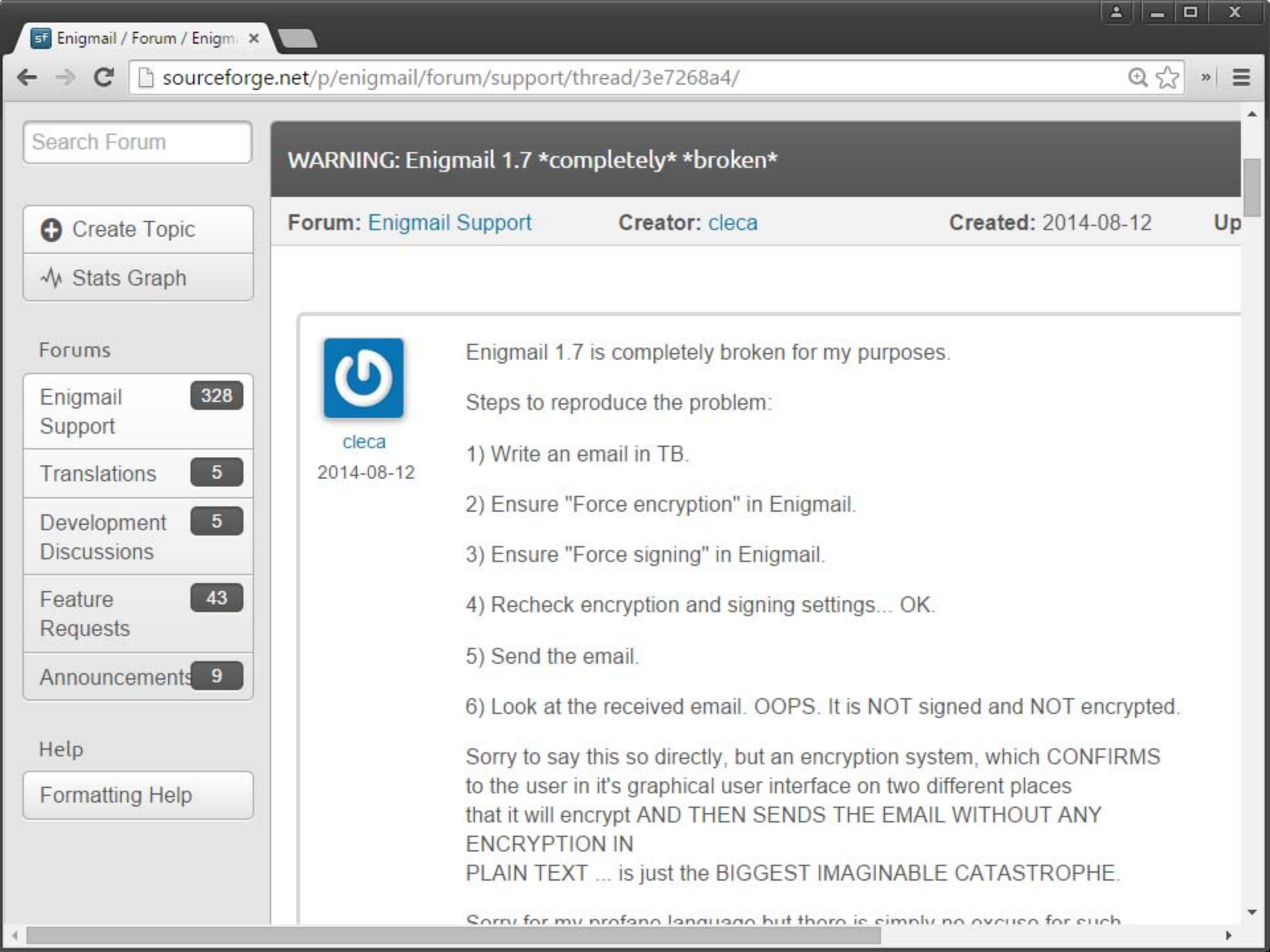
Key revocation

Public key fingerprints

Poor mail client integration

- Can lead to catastrophic failures: e.g., Enigmail+Thunderbird silent encryption failure

(Let alone key discovery and trustworthiness issues)


Enigmail / Forum / Enigm
sourceforge.net/p/enigmail/forum/support/thread/3e7268a4/
Search Forum
Create Topic
Stats Graph
Forums
Enigmail Support 328
Translations 5
Development Discussions 5
Feature Requests 43
Announcements 9
Help
Formatting Help
WARNING: Enigmail 1.7 *completely* *broken*
Forum: Enigmail Support
Creator: cleca
Created: 2014-08-12
Up
cleca
2014-08-12
Enigmail 1.7 is completely broken for my purposes.
Steps to reproduce the problem:
1) Write an email in TB.
2) Ensure "Force encryption" in Enigmail.
3) Ensure "Force signing" in Enigmail.
4) Recheck encryption and signing settings... OK.
5) Send the email.
6) Look at the received email. OOPS. It is NOT signed and NOT encrypted.
Sorry to say this so directly, but an encryption system, which CONFIRMS
to the user in it's graphical user interface on two different places
that it will encrypt AND THEN SENDS THE EMAIL WITHOUT ANY
ENCRYPTION IN
PLAIN TEXT ... is just the BIGGEST IMAGINABLE CATASTROPHE.

Runa A. Sandvik on Twitte

Twitter, Inc. [US] https://twitter.com/runasand/status/573613717004247040

Search Twitter

Have an account? Log in

Runa A. Sandvik
@runasand

Follow

Swedish media org @Aftonbladet publishes its GPG private key for a second time (first time was in 2012):

Anders Nilsson @nilssonanders
Sweden's biggest newspaper #Aftonbladet includes their private key in guide to PGP mail them (via @_zulln) bit.ly/1FfHAOI

RETWEETS 42

FAVORITES 15

2:39 PM - 5 Mar 2015

End-to-End vs. Cloud-to-Cloud

IMAP: one of the oldest “cloud” services!

- Keep messages at the server
- Conveniently access them from multiple devices

Useful cloud-based email features

- Powerful search, collaborative SPAM filtering, …
- Need access to the **plaintext**! Gmail cannot index encrypted messages…

Tradeoff: privacy vs. convenience

- Active research on searchable encryption

Encrypted Webmail?

Several recent efforts to transparently combine the convenience of webmail with PGP encryption

- Is this really possible in a *secure* way?

JavaScript crypto is not a good idea

- Secure JS code delivery?
- Secure key storage?
- Secure runtime (it's a *web browser*!)?

Google end-to-end: implement crypto functionality within a browser extension

- More control
- Still not trivial

Lavabit

My Fellow Users,

I have been forced to make a difficult decision: to become complicit in crimes against the American people or walk away from nearly ten years of hard work by shutting down Lavabit. After significant soul searching, I have decided to suspend operations. I wish that I could legally share with you the events that led to my decision. I cannot. I feel you deserve to know what's going on--the first amendment is supposed to guarantee me the freedom to speak out in situations like this. Unfortunately, Congress has passed laws that say otherwise. As things currently stand, I cannot share my experiences over the last six weeks, even though I have twice made the appropriate requests.

What's going to happen now? We've already started preparing the paperwork needed to continue to fight for the Constitution in the Fourth Circuit Court of Appeals. A favorable decision would allow me resurrect Lavabit as an American company.

This experience has taught me one very important lesson: without congressional action or a strong judicial precedent, I would _strongly_ recommend against anyone trusting their private data to a company with physical ties to the United States.

Sincerely,
Ladar Levison
Owner and Operator, Lavabit LLC

Defending the constitution is expensive! Help us by donating to the Lavabit Legal Defense Fund here.

Lavabit: *"so secure that even our administrators can't read your e-mail"*

But they could, if they wanted to…

"Basically we generate public and private keys for the user and then encrypt the private key using a derivative of the plain text password. We then encrypt user messages using their public key before writing them to disk."

"Because we need the plain text password to decrypt a user's private key, we don't support secure password authentication. We decided to support SSL instead (which encrypts everything; not just the password)."

http://highscalability.com/blog/2013/8/13/in-memoriam-lavabit-architecture-creating-a-scalable-email-s.html

SPAM

Spam lifecycle

Gathering addresses

- Valid, active addresses are precious
- Stolen address books, web crawling, …

Message content

- Evade anti-spam filters: content obfuscation
- V1agra, Via'gra, Vi@graa, vi*gra, \/iagra

Spam email delivery

- Webmail accounts (sweatshops, stolen)
- Open relays/proxies (not common anymore)
- Malware: most spam comes from infected machines/botnets

Fighting Spam

Content-based filtering

- False positives vs False negatives
- Local vs. cloud-based

Blacklisting

- DNSBLs: domains of known spammers, open relays, zombie machines, hosts that shouldn't be sending emails (e.g., ISPs DHCP pools), …

Honeypots

Outbound filtering (block port 25)

Email authentication

SPF: Origin Authentication

SMTP allows anyone to send an email with an arbitrary “From” address

Sender Policy Framework

- DNS TXT record with hosts that are allowed to send email from the domain
- Receiving SMTP servers compare IP address that attempts to send an email with allowed addresses of the domain(s) provided in the HELO and MAIL FROM commands
- Helps to block spam at it source

```
mikepo@styx:~> dig google.com TXT
;; ANSWER SECTION:
google.com.             3600    IN      TXT     "v=spf1
include:_spf.google.com ip4:216.73.93.70/31 ip4:216.73.93.72/31 ~all"
```

DKIM: Email Validation

DomainKeys Identified Mail: digitally sign some email headers and message body

Allows the recipient to verify that

- The email is sent from the domain it claims to be sent from
- It has not been tampered with

Domain's public key is stored in a DNS TXT record

```
X-Google-DKIM-Signature: v=1; a=rsa-sha256; c=relaxed/relaxed;
d=1e100.net; s=20130820; h=x-gm-message-state:mime-version:date:message-
id:subject:from:to :content-type;
bh=0BSnrwLTQ7KblIwINxoPJN40a/K5PZCIV8atL6a1Dvg=;
b=Nch9yEorgibAjkh90ukDL6SU0FYn70qP6AMsWFfpLO+W3iroMoVdKIjKk8Cv6Gc1TW ...

mikepo@styx:~> dig 20130820._domainkey.1e100.net TXT
;; ANSWER SECTION:
20130820._domainkey.1e100.net. 86400 IN TXT     "k=rsa\;
p=MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAnOv6+Txyz+SEc7mT719QQtOj6g
2MjpErYUGVrRGGc7f5rmE1cRP1lhwx8PVoHOiuRzyok7IqjvAub9kk9fBoE9u ...
```

SPF + DKIM = DMARC

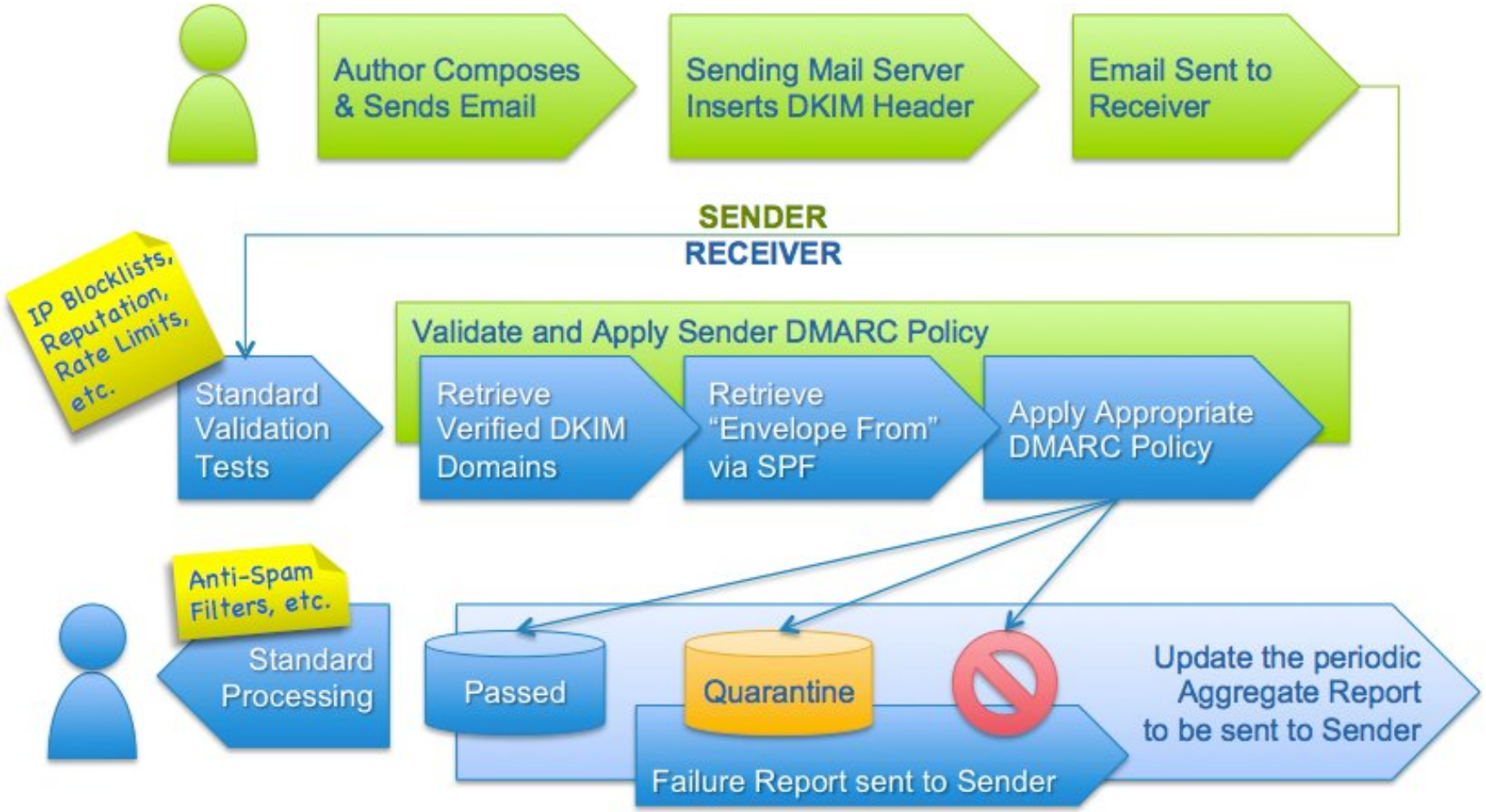
Domain-based Message Authentication, Reporting & Conformance (DMARC)

- Standardizes how email receivers perform email authentication using SPF and DKIM
- Tells receivers what to do if neither of those authentication methods passes – such as junk or reject the message

DMARC policies are published as DNS TXT records

```
mikepo@styx:~> dig _dmarc.google.com TXT
;; ANSWER SECTION:
_dmarc.google.com.      600     IN      TXT     "v=DMARC1\;
p=quarantine\; rua=mailto:mailauth-reports@google.com"
```

DMARC Email Authentication Process



http://dmarc.org/overview/

TorrentLocker spam has DMARC enabled

Use of email authentication technique unlikely to bring any advantage.

Last week, *Trend Micro* researcher Jon Oliver (who presented a paper on *Twitter* abuse at VB2014) wrote an interesting blog post about a spam campaign that was spreading the 'TorrentLocker' ransomware and which, unusually, was using DMARC.

TorrentLocker is one of the most prominent families of encryption ransomware — a worryingly successful kind of malware that first appeared two years ago. The malware initially implemented its cryptography rather poorly, but has since become one of the most successful of its kind.

DMARC is an email technology that builds on both SPF and DKIM. Both these technologies allow a domain owner to take some responsibility for the emails sent from their domain: SPF by listing those IP addresses used to send email; DKIM by digitally signing the emails.

DMARC adds to SPF and DKIM a mechanism that allows a domain owner to advise senders what to do about

SPF, DKIM, DMARC

SPF validates MAIL FROM vs. its source server

- "Envelope" information

DKIM validates the "From:" message header

- Plus other message headers and mail body

Not effective against spammers who

- Use their own domains
- Use legitimate email services, such as webmail
- Pretend to be another user on the same domain

Good for whitelisting and verifying email from trusted sources (.gov, banks, …)

- *Besides spam, we also care about phishing…*

Phishing

Spoofed emails pointing to spoofed webpages

- Financial institutions, could services, and other targets

Asking for credentials, credit card numbers, and other sensitive information

- “Your Fedex package information”
- “Your account has been suspended”
- “Your credit card statement”

Deception

- From: info@paypa1.com
- http://www.bankofamerica.com.attacker.net/

The Root of the Problem…

Subject: Important! You must change your XXXXXXX password
Date: XXXXXXXXX
From: XXXXXXXXXXX

[This is not a spam mail, this email is from me, XXXXXXXXXXX]

Member of XXXXXXXXX Department,

PLEASE CHANGE YOUR XXXXXX PASSWORD!

We just upgraded the security of XXXXXX. Your current password is no longer working. You must change your password if you want to log into XXXXXX. [...]

To change your XXXXX password:
http://XXXXXXXXX.XXX -> forgot your password -> follow the instructions

Phishing Countermeasures

Stop confusing users

- Institutions shouldn't include links in emails

User education

- Don't trust links in emails – type the address in your browser
- (analogous to: don't trust phone calls that ask for your info – always call the number at the back of your card)

Augmenting password logins

- Two-step login
- Show user-specific information before asking for password

Anti-phishing filters, tools, …

Spear Phishing

Well-prepared, personalized, convincing messages targeted to particular individuals

- Seemingly coming from trusted colleagues
- May contain *personal* information about their target

Highly effective, used extensively in targeted attacks

- Document attachments exploiting 0day vulnerabilities

Many recent incidents

Maybe rethink email altogether?

Recent secure messaging apps offer further benefits

EFF's Secure Messaging Scorecard

- Encrypted in transit?
- Encrypted so the provider can't read it?
- Can you verify contacts' identities?
- Are past communications secure if your keys are stolen?
- Is the code open to independent review?
- Is security design properly documented?
- Has there been any recent code audit?

Many encouraging efforts

- OTR, TextSecure, Pond, …

https://www.eff.org/secure-messaging-scorecard