DMARC Training – SANOGxxiv

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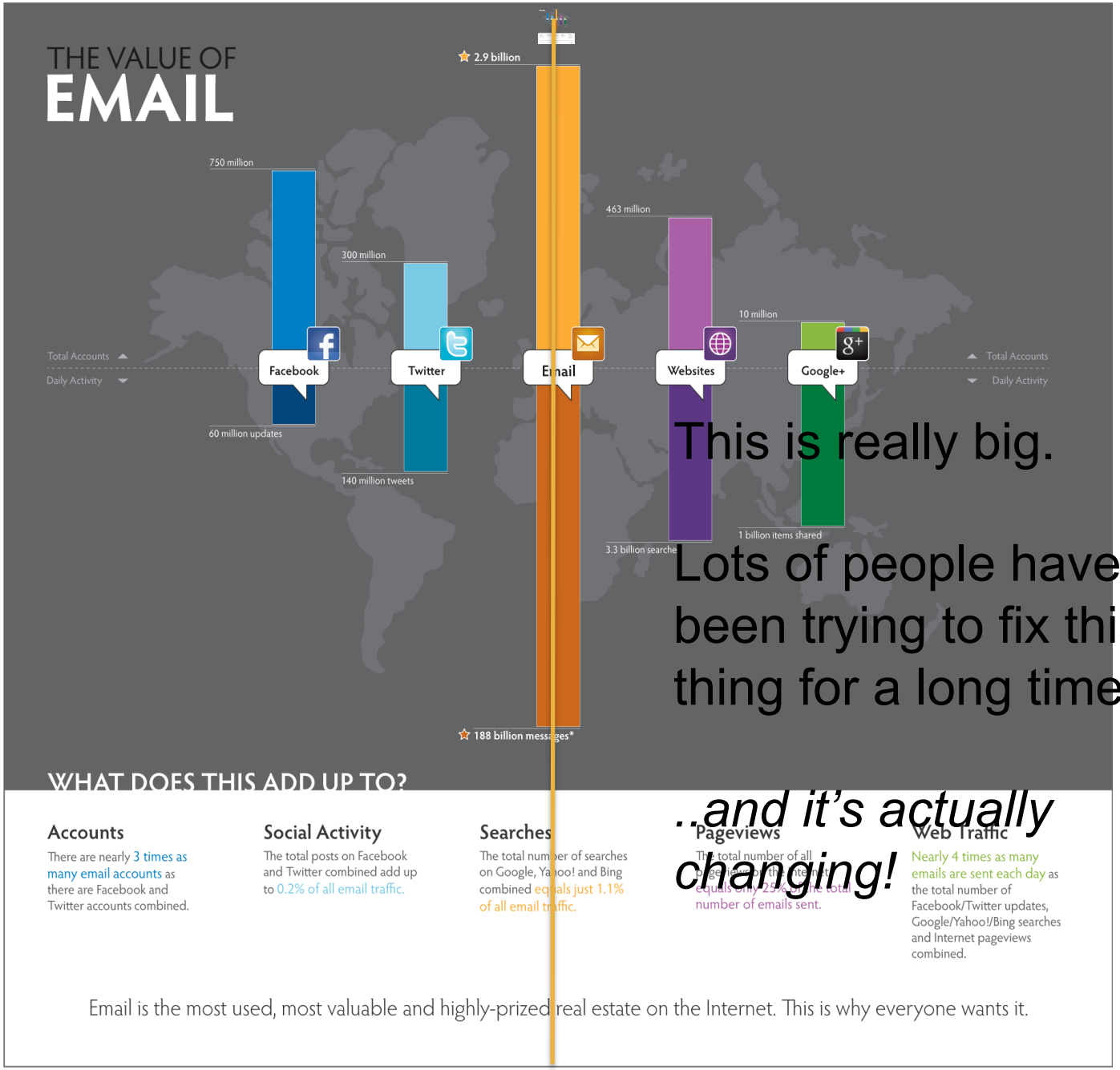
EMAIL REPORT CARD

WHERE ARE WE?

Just How Big Is This Thing?

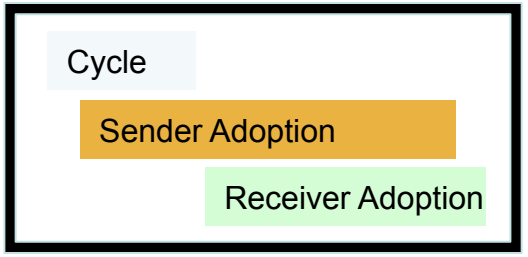


This is really big.

Lots of people have been trying to fix this thing for a long time.

..and it's actually changing!

Cyclical Adoption Cycles



2003-2006: building blocks (SPF, DomainKeys, DKIM)

"I've heard this helps"

Nice to have as anti-spam input, not reliable

2007-2009: prototype authenticated email model

PayPal innovates, Financial Services publishes recommendations

Yahoo & Gmail reject fake PayPal email, other big providers take note

2010-2011: make it work at internet scale

PayPal funds/organizes effort to standardize the model

Big webmail providers commit to support and implement

2012-2013: early adopters

Senders with fraud and clean infrastructures deploy

Big consumer mailboxes and those that can roll their own deploy

More at: http://forums.dmarcian.com/discussion/25/brief-history

DMARC Current Adoption

BIG RECEIVERS:

dmarcian automatically processes data for its users. The following table shows receivers that have supplied DMARC XML data to dmarcian.com, effectively showing the current DMARC receiver footprint.

Provider	Users
facebook.com	1.15 billion[1]
NetEase (163.com, 126.com, 188.com, yeah.net)	570 million[2]
google.com	425 million[3]
Microsoft Corp. (outlook.com)	400 million[4]
Mail.Ru	300 million[5]
Yahoo! Inc.	298 million[6]
linkedin.com	238 million[7]
Comcast	?
AOL	?
xs4all.nl	1 million[8]
dmarc.org	?
andreasschulze.de	1[9]
...many other low volume providers	?
Total: 3.382 billion	
(updated: 13 Sept 2013)	

"ORGANIC" RECEIVERS:

horizonlinux.org
Ivenue.com
junc.org
gcisdns.net
The Art Farm
dmarc.org
inteligis.ro
padz.net
newsbox.ro
CommuniGate, Inc
sapienti-sat.org
rosenkeller.org
mvps.org
laussat.info
thesandiegos.com
harrison-salmon.co.uk
llamas.net
castlehoward.co.uk
manda.tagmail.eu
prosper-ifa.co.uk
ceotex.de
bordo.com.au
midrange.com
vande-walle.eu
feha-imo.de
visp.mx
farron.co.uk
darkblue.co.uk
thockar.com
lehibe.eu
amstenrade.net
applemooz.nl
[core.at]
pascaro.com
croakingduck.com
pac-hs.co.uk
entourage.mvps.org
activesynergy.org
AGARI
middlestudlehurstfarm.co.uk
de-verbinding.org
nopourriel.fr
cisco.com
blr-esx.com
kestral.com.au
jrschneider.com
mbrown.co.uk
amfes.com
winstanleysbikes.com
MVPS.ORG
lists.mvps.org
score42.tagmail.eu
fdwebdesign.nl
telesiscomms.com
fcbank.com.ua
blackops.org
cuckoobag.com
knoors.nl
yaplik.cz

From: https://dmarcian.com/dmarc_adoption/

What DMARC Can (and Cannot) Do

DMARC fixes a fundamental flaw:

- Is this email really from where it says it's from?

DMARC makes *Domain Identifiers* a reality:

This email really does come from EXAMPLE.ORG!

So what:

- Strong exact-domain anti-phishing (*"Reject the fakers"*)
- Domain reputation, finally! (*"Do my users want this?"*)
- Easier decision making. Pull out the known good so that anti-spam can go crazy on the grey stuff.
- Build it once, tell senders exactly what hoops they need to jump through. *And these are not special hoops!*

Outline

Part 1

- Introduction to DMARC
  - Purpose and Goals
  - History
  - Roadmap
- DMARC Spec Overview
  - Identifier Alignment
  - DMARC Policy Records
  - Reporting
- Break

Part 2

- Information for Mailbox Providers
  - DMARC Policy Enforcement
  - Aggregate Reporting
  - Forensic Reporting
- Lessons Learned in Provider Deployments
- Time Permitting:
- Information for Domain Owners
  - The Reporting and Compliance Process
    - Initial Record Publishing
    - 3rd Party Deployment Profiles
    - Report Processing and Analysis
    - Initial Policy Ramp-up
    - Ongoing Monitoring

Things we won’t cover

- Why phishing is a problem.
- How DKIM, SPF, DNS, SMTP, or XML work.
- How to combat abuse of cousin domains or the display name field.
- Phishing website investigation or takedown services.

Who is in the audience?

- Mailbox providers?
- Domain owners?
- Domain owners who use 3rd party senders?
- 3rd party senders (ESPs, hosting providers, etc)?

What does the audience want?

Intro to DMARC

DMARC = Domain-based Message Authentication, Reporting, and Conformance

- Authentication – Leverage existing technology (DKIM and SPF)
- Reporting – Gain visibility with aggregate and per-failure reports
- Conformance – Standardize identifiers, provide flexible policy actions

Intro to DMARC – Purpose and Goals

- Open version of existing private mechanisms for preventing domain spoofing.
- Standardize use of authenticated identifiers.
- Provide insight into and debugging aids for your authentication practices.
- Encourage wider adoption of SPF & DKIM.
- Encourage iteration toward aggressive authentication policy.

Intro to DMARC – Non-Goals

- Address cousin domain abuse
- Address display name abuse
- Provide MUA treatment advice
- An enterprise security solution
- An incident response tool
- Provide delivery reporting

Intro to DMARC – History

- Private Prototype between Paypal and Yahoo – 2007
- Vendors being offering similar functionality – 2009 to present
- First Prototype DMARC records published – Feb ’11
- Draft specification released – Jan 30th 2012, revised April ’12
- Significant adoption since that time
- Currently (Summer 2014) forming an IETF WG to make the standard official

DMARC – Success Numbers for Senders & Recipients

- Nearly **2 billion** email accounts worldwide are protected

- Greater than **80%** of typical users are protected worldwide
  - Microsoft: Hotmail/Outlook/Live/Office 365
  - AOL
  - Gmail
  - Yahoo
  - Netease: 163.com/126.com
  - Mail.ru

- Over **80,000** active domains have deployed DMARC records

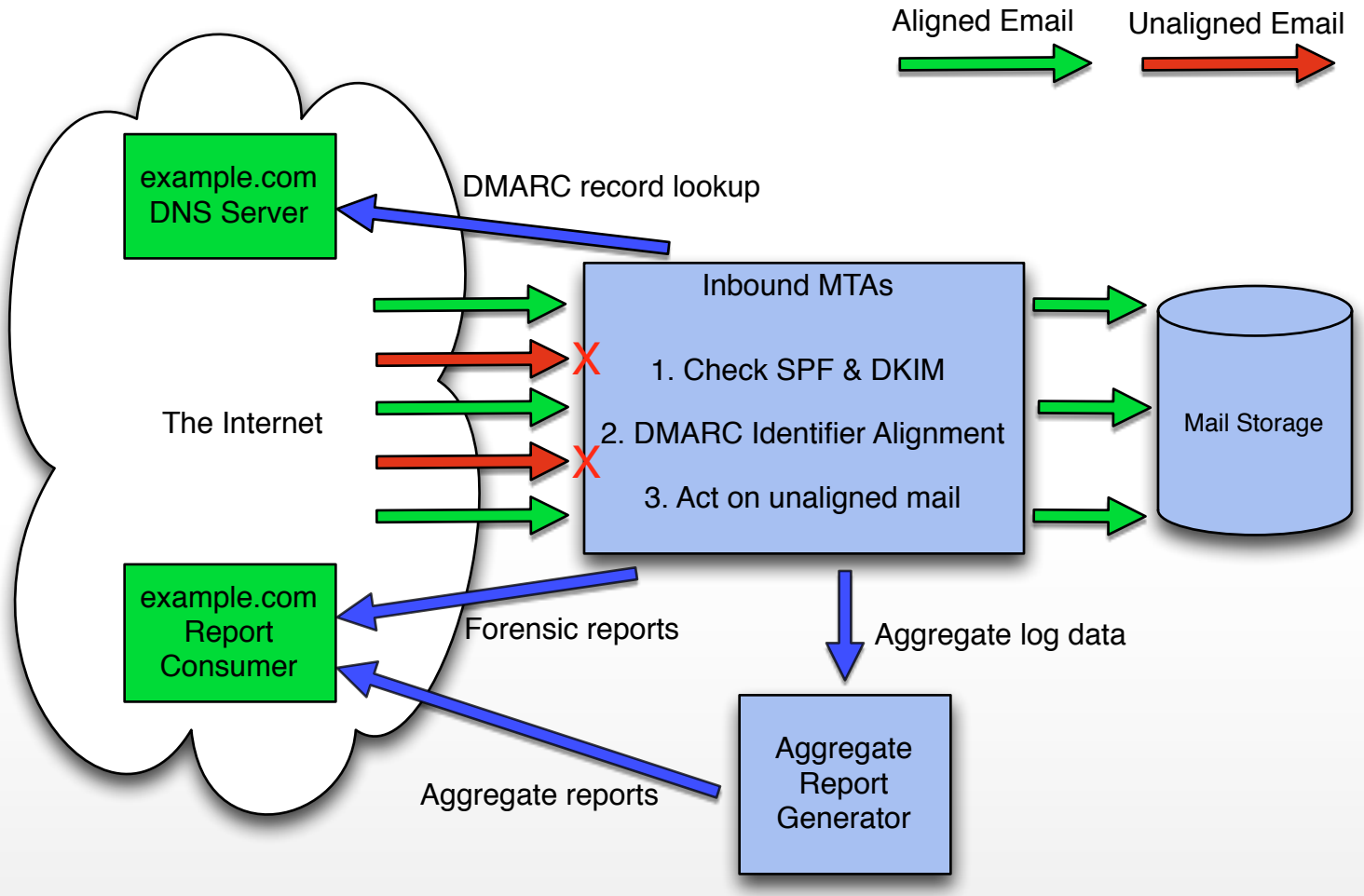
DMARC – Success Numbers for Brands

- Paypal:
  - More than **25 million** spoofed email messages were rejected during the 2013 holiday buying season.

- Twitter:
  - During the first 45 days of initial monitoring, nearly **2.5 billion** spoof messages were seen
  - Before DMARC: **~110 million** messages/day
  - After DMARC: **1,000**/day after publishing a "reject" policy

- Publishers Clearing House reports they used DMARC to block over **100,000** unauthenticated messages in a single 90 day period during 2013.

DMARC Spec Overview



DMARC Spec – Identifier Domain Alignment

- DMARC tests and enforces Identifier Domain Alignment
- Authenticated identifier domains are checked against Mail User Agent (MUA) visible "**RFC5322.From**" domain:
  - SPF: **RFC5321.From** domain
  - DKIM: "**d=**" domain
- Only one authenticated identifier domain has to align for the email to be considered "in alignment"

DMARC Spec – Identifier Alignment

- DMARC record publishers (domain owners) can require
  - strict identifier alignment (full domain matches exactly), or
  - permit relaxed alignment (organizational domain match)

DMARC Spec – Organizational Domains

- Delegation level + 1 atom
  - groups.facebook.com → facebook.com
  - aol.co.uk → aol.co.uk
  - foo.bar.example.ne.jp → example.ne.jp
  - a45.compute.amazonaws.cn → a45.compute.amazonaws.cn
  - a.b.example.co.in → example.co.in
- Uses **publicsuffix.org** for TLD list
- More robust methods being considered and discussed in the IETF appswg

DMARC Spec – Alignment Examples – Strict

```
Return-Path:postmaster@example.com
Authentication-Results: mx.mail.com; spf=pass (mail.com:
 domain of postmaster@example.com designates 10.1.1.1 as
 permitted sender) smtp.mail=postmaster@example.com;
 dkim=pass header.i=@example.com
DKIM-Signature: v=1; a=rsa-sha256; d=example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@example.com; t=1337318096;
 h=From:Subject:Date:To:MIME-Version:Content-Type;
 bh=0l5o8r4ftEPBr083MbUpe0mIrWKRs5yT46DR6CGk/Mk=;
 b=T6m3ZvppP3OLGNQVoR/llW+RxSbQiRlaCcwZpXTF/xjWk0xjYl/
 8S0UUvtFPHZ1l0cy+svp5ymrqBgnDEN/ZQEcfmzYEOg1BNL/
 I8zlMKPmVOf/9cLIpTVbaWi/G2VBYLXONpLsSymtoeqTBYO
 OJqoiNLzDNP01pVgZYunf8h90=;
From: "Postmaster" <postmaster@example.com>
```

- 5322.From domain = example.com
- SPF domain = example.com
- DKIM domain = example.com

DMARC Spec – Alignment Examples – SPF Pass

```
Return-Path:postmaster@example.com
Authentication-Results: mx.mail.com; spf=pass (mail.com:
 domain of postmaster@example.com designates 10.1.1.1
 as permitted sender) smtp.mail=postmaster@example.com
From: "Postmaster" <postmaster@example.com>
```

- 5322.From domain = example.com
- SPF domain = example.com
- DKIM domain → none

DMARC Spec – Alignment Examples – DKIM Only

```
Return-Path:postmaster@example.com
Authentication-Results: mx.mail.com; spf=neutral (mail.com:
 domain of postmaster@example.com does not designate
 10.1.1.1 as permitted sender)
 smtp.mail=postmaster@example.com; dkim=pass
 header.i=@example.com
DKIM-Signature: v=1; a=rsa-sha256; d=example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@example.com; t=1337318096; {. . .}
From: "Postmaster" <postmaster@example.com>
```

- 5322.From domain = example.com
- SPF domain → doesn't matter, SPF did not pass
- DKIM domain = example.com

DMARC Spec – Alignment Examples – Failure

```
Return-Path:postmaster@phish.com
Authentication-Results: mx.mail.com; spf=pass (mail.com:
 domain of postmaster@phish.com designates 10.1.1.1 as
 permitted sender) smtp.mail=postmaster@example.com;
 dkim=fail header.i=@example.com
DKIM-Signature: v=1; a=rsa-sha256; d=example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@example.com; t=1337318096; {. . .}
From: "Postmaster" <postmaster@example.com>
```

- 5322.From domain = example.com
- SPF domain = phish.com → not aligned
- DKIM domain → doesn't matter, DKIM authentication failed

DMARC Spec – Alignment Examples – Strict → Not Aligned

```
Return-Path:postmaster@foo.example.com
Authentication-Results: mx.mail.com; spf=pass (mail.com:
 domain of postmaster@example.com designates 10.1.1.1 as
 permitted sender) smtp.mail=postmaster@example.com;
 dkim=pass header.i=@bar.example.com
DKIM-Signature: v=1; a=rsa-sha256; d=bar.example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@facebookmail.com; t=1337318096; {. . .}
From: "Postmaster" <postmaster@example.com>
```

- 5322.From domain = example.com
- SPF domain = foo.example.com
- DKIM domain = bar.example.com

DMARC Spec – Alignment Examples – Relaxed

```
Return-Path:postmaster@foo.example.com
Authentication-Results: mx.mail.com; spf=pass (mail.com:
 domain of postmaster@example.com designates 10.1.1.1 as
 permitted sender) smtp.mail=postmaster@foo.example.com;
 dkim=pass header.i=@bar.example.com
DKIM-Signature: v=1; a=rsa-sha256; d=bar.example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@bar.example.com; t=1337318096; {. . .}
From: "Postmaster" <postmaster@example.com>
```

- 5322.From domain = example.com
- SPF domain = foo.example.com (org = example.com)
- DKIM domain = bar.example.com (org = example.com)

DMARC Spec – Alignment Examples – Relaxed

```
Return-Path:postmaster@bounce.example.com
Authentication-Results: mx.mail.com; spf=pass (mail.com:
 domain of postmaster@bounce.example.com designates 10.1.1.1
 as permitted sender)
 smtp.mail=postmaster@bounce.example.com; dkim=pass
 header.i=@bounce.example.com
DKIM-Signature: v=1; a=rsa-sha256; d=bounce.example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@bounce.example.com; t=1337318096; {. . .}
From: "Postmaster" <postmaster@foo.example.com>
```

- 5322.From domain = foo.example.com → org = example.com
- SPF domain = bounce.example.com → org = example.com
- DKIM domain = bounce.example.com → org = example.com

DMARC Spec – Alignment Examples – SPF Only

```
Return-Path: postmaster@bounce.example.com
Authentication-Results: mx.mail.com; spf=pass (mail.com:
 domain of postmaster@bounce.example.com designates 10.1.1.1
 as permitted sender)
 smtp.mail=postmaster@bounce.example.com
From: "Postmaster" <postmaster@foo.example.com>
```

- 5322.From domain = foo.example.com → org = example.com
- SPF domain = bounce.example.com → org = example.com

DMARC Spec – Alignment Examples – DKIM only

```
Return-Path:postmaster@example.com
Authentication-Results: mx.mail.com; spf=neutral (mail.com:
 domain of postmaster@example.com does not designate
 10.1.1.1 as permitted sender)
 smtp.mail=postmaster@example.com; dkim=pass
 header.i=@foo.example.com
DKIM-Signature: v=1; a=rsa-sha256; d=foo.example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@foo.example.com; t=1337318096; {. . .}
From: "Postmaster" <postmaster@example.com>
```

- 5322.From domain = example.com
- DKIM domain = foo.example.com → org = example.com

DMARC Spec – Alignment Examples – SPF Unaligned

```
Return-Path:postmaster@phish.com
Authentication-Results: mx.mail.com; spf=pass (mail.com:
 domain of postmaster@phish.com designates 10.1.1.1 as
 permitted sender) smtp.mail=postmaster@example.com;
 dkim=fail header.i=@example.com
DKIM-Signature: v=1; a=rsa-sha256; d=bar.example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@example.com; t=1337318096; {. . .}
From: "Postmaster" <postmaster@example.com>
```

- 5322.From domain = example.com
- SPF domain = phish.com
- DKIM n/a – failed

DMARC Spec – Alignment Exercises

Exercise 1 – Is SPF in Strict Alignment?

```
Return-Path:postmaster@example.com
Authentication-Results: mx.mail.com; spf=neutral (mail.com:
 domain of postmaster@example.com does not designate
 10.1.1.1 as permitted sender)
 smtp.mail=postmaster@example.com; dkim=pass
 header.i=@example.com
DKIM-Signature: v=1; a=rsa-sha256; d=example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@example.com; t=1337318096; {. . .}
From: "Postmaster" <postmaster@example.com>
```

Answer: No, SPF did not pass.

Is the email Aligned anyway?

Answer: Yes, DKIM is in Strict Alignment, so the email is Aligned regardless.

DMARC Spec – Alignment Exercises

Exercise 2 – Is SPF in Relaxed Alignment?

```
Return-Path: postmaster@foo.example.com
Authentication-Results: mx.mail.com; spf=pass (mail.com:
 domain of postmaster@example.com designates 10.1.1.1 as
 permitted sender) smtp.mail=postmaster@example.com;
 dkim=pass header.i=@bar.example.com
DKIM-Signature: v=1; a=rsa-sha256; d=bar.example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@facebookmail.com; t=1337318096; {. . .}
From: "Postmaster" <postmaster@example.com>
```

Answer: Yes, foo.example.com shares the same Organizational domain as example.com.

Additional question: Is DKIM in alignment?

Answer: Yes, but only if relaxed alignment is allowed

DMARC Spec – Alignment Exercises

Exercise 3 – Is DKIM in Strict Alignment?

```
Return-Path:postmaster@example.com
Authentication-Results: mx.mail.com; spf=neutral (mail.com:
 domain of postmaster@example.com does not designate
 10.1.1.1 as permitted sender)
 smtp.mail=postmaster@example.com; dkim=pass
 header.i=@foo.example.com
DKIM-Signature: v=1; a=rsa-sha256; d=foo.example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@foo.example.com; t=1337318096; {. . .}
From: "Postmaster" <postmaster@example.com>
```

Answer: No, foo.example.com does not exactly match example.com

Under what conditions would the email be Aligned?

Answer: Since SPF does not pass, the email would only be Aligned if Relaxed DKIM Alignment was allowed.

DMARC Spec – Alignment Exercises

Exercise 4 – Under what conditions would this email be considering in alignment?

```
Return-Path: postmaster@foo.example.com
Authentication-Results: mx.mail.com; spf=neutral (mail.com:
 domain of postmaster@example.com does not designate
 10.1.1.1 as permitted sender)
 smtp.mail=postmaster@foo.example.com; dkim=fail
 header.i=@bar.example.com
DKIM-Signature: v=1; a=rsa-sha256; d=bar.example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@bar.example.com; t=1337318096; {. . .}
From: "Postmaster" <postmaster@example.com>
```

Assuming DKIM and SPF were actually valid, under what conditions would this email be considered Aligned?

Answer: If Relaxed Alignment was allowed for either DKIM or SPF, the email would be Aligned.

DMARC Spec – Policy Records

- TXT records in DNS
  - _dmarc.example.com
- Check for a record at the exact 5322.From
  - If no record is found, check for a record at the Organizational domain of the 5322.From
- Policy action options:
  - “none” – simply monitor and supply feedback
  - “quarantine” – process email with high degree of suspicion
  - “reject” – do not accept email that fails DMARC check

DMARC Spec – Policy Record Components

Tag	Purpose	Example
v	Protocol Version	v=DMARC1
p	Policy for the domain	p=quarantine
sp	Policy for subdomains	sp=reject
pct	% of messages subject to policy	pct=20
adkim	Alignment mode for DKIM	adkim=s
aspf	Alignment mode for SPF	aspf=r
rua	Reporting URI for aggregate reports	rua=mailto:aggrep@example.com
ruf	Reporting URI of forensic reports	ruf=mailto:authfail@example.com
rf	Forensic reporting format	rf=afrf
fo	Forensic reporting trigger	fo=1
ri	Aggregate reporting interval	ri=14400

DMARC Spec – Policy Record Defaults

Tag	Purpose	Example
v	Protocol Version	*no default, this is must be explicit*
p	Policy for the domain	*no default, this is must be explicit*
sp	Policy for subdomains	*inherits p= setting*
pct	% of messages subject to policy	100
adkim	Alignment mode for DKIM	r (relaxed)
aspf	Alignment mode for SPF	r (relaxed)
rua	Reporting URI for aggregate reports	*none*
ruf	Reporting URI of forensic reports	*none*
rf	Forensic reporting format	afrf
fo	Forensic reporting trigger	0 (all mechanisms failed)
ri	Aggregate reporting interval	86400 (24h)

DMARC Spec – Example Policy Records

Everyone's first DMARC record

```
v=DMARC1; p=none; rua=mailto:aggregate@example.com;
```

DMARC Spec – Example Policy Records

Begin some enforcement. . .

```
v=DMARC1; p=quarantine; pct=10;
 rua=mailto:agg@example.com;
```

or, with forensic reports:

```
v=DMARC1; p=quarantine; pct=10;
 rua=mailto:agg@example.com;
 ruf=mailto:fail@example.com;
```

DMARC Spec – Example Policy Records

Well controlled mail streams can do 100% reject:

```
dig -t TXT _dmarc.facebookmail.com

v=DMARC1; p=reject; pct=100;
 rua=mailto:postmaster@facebook.com,mailto:d@rua.agari.com;
 ruf=mailto:d@ruf.agari.com;
```

DMARC Spec – Policy Record Exercises

Exercise 1 – Is this a valid record?

```
p=none; pct=50; rua=postmaster@example.com;
```

Answer: No. The v= tag is required as the first component.

DMARC Spec – Policy Record Exercises

Exercise 2 – What DNS TXT record will be queried for mail from foo.example.com?

Answer: _dmarc.foo.example.com

If no record is found, what will happen?

Answer: _dmarc.example.com will be queried.

DMARC Spec – Policy Record Exercises

Exercise 3 – Given this record for _dmarc.example.com:

```
v=DMARC1; p=none; rua=postmaster@example.com;
```

Is this email Aligned?

```
Return-Path:postmaster@foo.example.com
Authentication-Results: mx.mail.com; spf=pass (mail.com:
 domain of postmaster@example.com designates 10.1.1.1 as
 permitted sender) smtp.mail=postmaster@foo.example.com;
 dkim=pass header.i=@bar.example.com
DKIM-Signature: v=1; a=rsa-sha256; d=bar.example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@bar.example.com; t=1337318096; {. . .}
From: "Postmaster" <postmaster@example.com>
```

Answer: Yes. Alignment is Relaxed by default.

DMARC Spec – Policy Record Exercises

Exercise 4 – Given this record for _dmarc.example.com:

```
v=DMARC1; p=none; rua=postmaster@example.com; adkim=s; aspf=r;
```

Is this email Aligned?

```
Return-Path:postmaster@example.com
Authentication-Results: mx.mail.com; spf=neutral (mail.com:
 domain of postmaster@example.com does not designate 10.1.1.1
 as permitted sender) smtp.mail=postmaster@example.com;
 dkim=pass header.i=@foo.example.com
DKIM-Signature: v=1; a=rsa-sha256; d=foo.example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@foo.example.com; t=1337318096; {. . .}
From: "Postmaster" <postmaster@example.com>
```

Then what will happen to the email?

Answer: No. SPF did not pass. DKIM passed, but DKIM Alignment is in strict mode and the DKIM domain does not exactly match the From domain.

Answer: No policy action will be taken. The results will be included in the requested aggregate report and the message will be processed as normal.

DMARC Spec – Policy Record Exercises

Exercise 5 – Given this record for _dmarc.example.com:

```
v=DMARC1; p=none; rua=postmaster@example.com; ruf=postmaster@example.com
        adkim=s; aspf=s; sp=reject;
```

Is this email Aligned?

```
Return-Path:postmaster@example.com
Authentication-Results: mx.mail.com; spf=pass (mail.com:
 domain of postmaster@example.com designates 10.1.1.1 as
 permitted sender) smtp.mail=postmaster@example.com;
 dkim=pass header.i=@foo.example.com
DKIM-Signature: v=1; a=rsa-sha256; d=foo.example.com;
 s=s1024-2011-q2; c=relaxed/simple; q=dns/txt;
 i=@foo.example.com; t=1337318096; {. . .}
From: "Postmaster" <postmaster@bar.example.com>
```

Answer: No. Both SPF and DKIM are in Strict Alignment mode and neither exactly match the From domain.

If there is no record at _dmarc.bar.example.com, is this email aligned?

Answer: Trick question! It depends on whether or not there is a DMARC record at _dmarc.bar.example.com.

Then what will happen to the email?

Answer: It will be rejected due to the subdomain policy action sp=reject. The requested aggregate report, and a forensic report will be sent.

Protecting Parked Domains

- No mail is sent from this domain
  - SPF: v=spf1 -all
- No mail is received by this domain
  - “Null” MX: “MX 0 .”
- But tell me about any attempts to abuse this domain
  - DMARC: v=DMARC1; p=reject; rua=report@example.com
- Example: gmail.co (Columbian TLD mis-spelling for gmail.com):
  - v=spf1 -all
  - v=DMARC1; p=reject; rua=mailto:mailauth-reports@google.com

DMARC Spec – Reporting

Aggregate Reports

- Each report covers one 5322.From domain.
- You should get one from each supporting mailbox provider that sees email with your From domain.
- Daily by default, adjustable with ri= tag.

  For instance: hourly : `ri=3600`

XML Format

- Organized by sending IP address
- Contains
  - Authentication Results (DKIM, SPF)
  - Alignment Results
  - Policy actions taken
  - Reasons for not taking policy actions

Just publish a record to see one

DMARC Spec – Reporting

XML Format

The policy they found.

```
<policy_published>
        <domain>facebookmail.com</domain>
        <adkim>r</adkim>
        <aspf>r</aspf>
        <p>reject</p>
        <sp>none</sp>
        <pct>100</pct>
</policy_published>
```

DMARC Spec – Reporting

XML Format

An example record.

```
<record>
  <row>
    <source_ip>106.10.148.108</source_ip>
    <count>1</count>
    <policy_evaluated>
      <disposition>none</disposition>
      <dkim>pass</dkim>
      <spf>fail</spf>
    </policy_evaluated>
  </row>
  <identifiers>
    <header_from>facebookmail.com</header_from>
  </identifiers>
  <auth_results>
    <dkim>
      <domain>facebookmail.com</domain>
      <result>pass</result>
    </dkim>
    <spf>
      <domain>NULL</domain>
      <result>none</result>
    </spf>
  </auth_results>
</record>
```

DMARC Spec – Reporting

Forensic Reports

- One per DMARC failure
- AFRF or IODEF formats
- Should at least include ‘call-to-action’ URIs
- Throttling
- Privacy issues
  - Might be redacted
  - Might not be supported by all receivers that otherwise support DMARC

DMARC Spec – Reporting

Verifying 3rd party report destinations

If the record for example.com contains reporting URIs at other domains:

```
mailto:aggregate@foo.com
```

Report generators should verify that foo.com expects the reports by looking for:

```
example.com._report._dmarc.foo.com
```

The 3rd party can change the URI to a different address in their domain:

```
v=DMARC1; rua=mailto:reports@foo.com
```

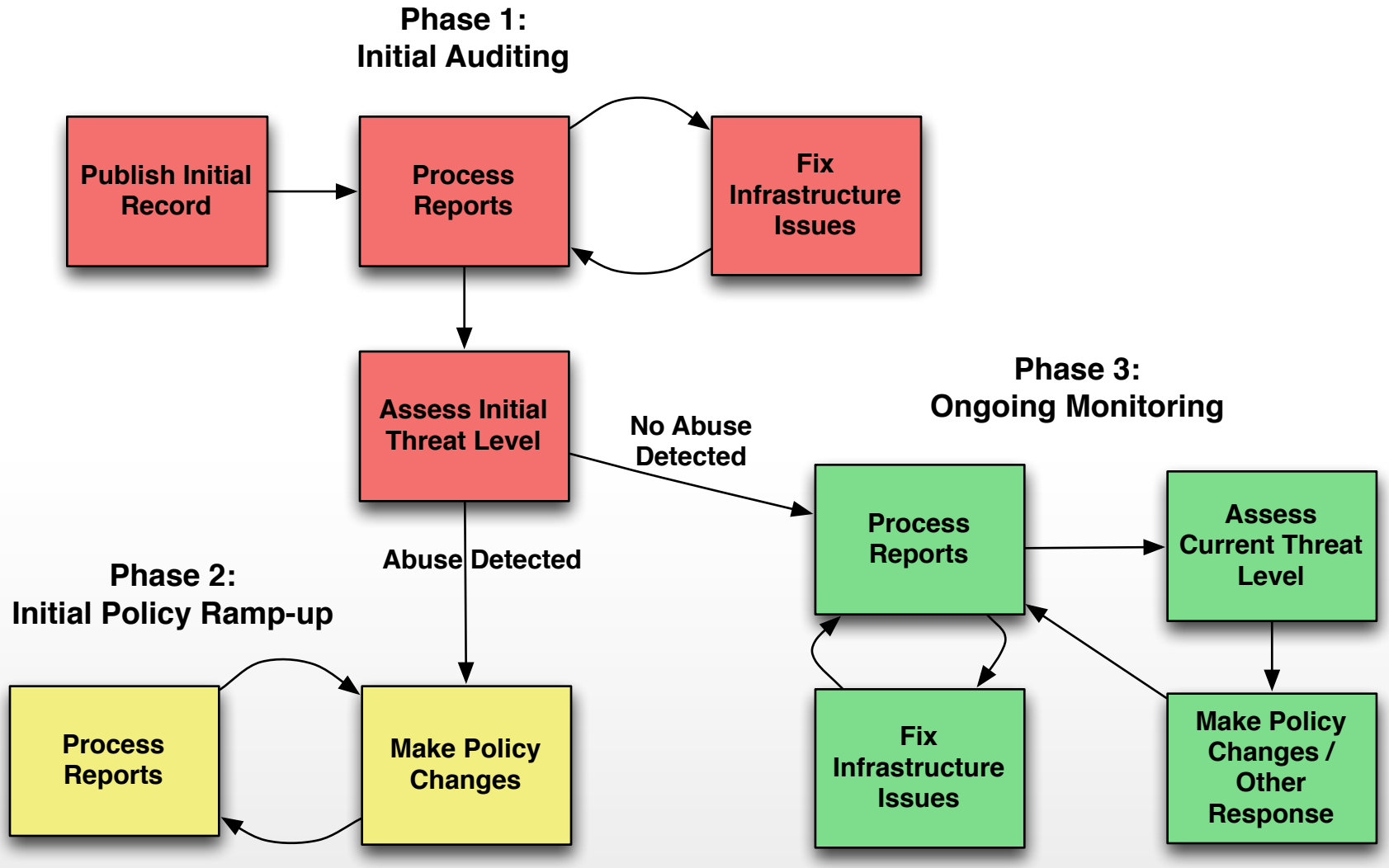
Break

For Domain Owners (Brands)

Information for Domain Owners

- The Reporting and Compliance Process
  - Initial Record Publishing
  - 3rd Party Deployment Profiles
  - Report Processing and Analysis
  - Rolling out Policies
  - Long Term Monitoring

The Reporting and Compliance Process For Domain Owners

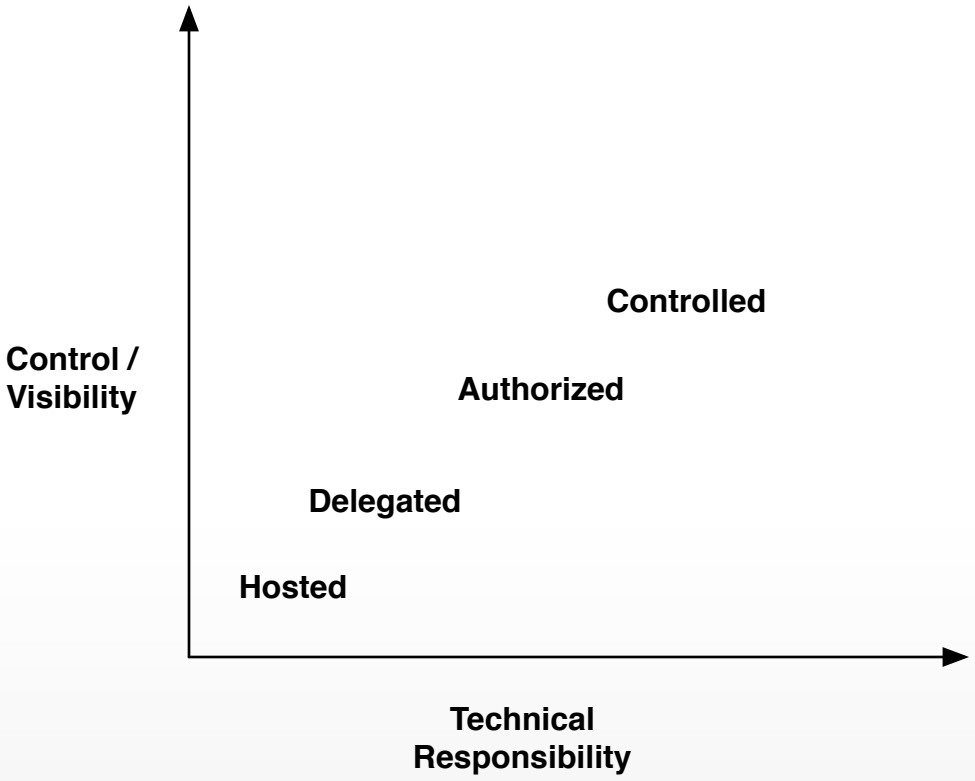


Initial Record Publishing

Everyone's first DMARC record

```
v=DMARC1; p=none; rua=mailto:aggregate@example.com;
```

3rd Party Deployment Profiles



Controlled – The Domain Owner fully controls their own DNS, and wants as much control over their email as possible.

Authorized – The Domain Owner lets the 3rd party dictate the content of some DNS records, while still retaining some operational control.

Delegated – The Domain Owner delegates control of their DNS to the 3rd party, and wants to be mostly hands-off with their email.

Hosted – The Domain Owner allows the 3rd party to handle everything, and has little control

3rd Party Deployment Profiles

Controlled

The Domain Owner retains control of the domain or subdomain, provides a DKIM signing key to 3rd party and publishes the public key, and includes the appropriate information in their SPF record.

Pro

- This scenario allows 3rd parties to send as the organizational domain if desired.
- The Domain Owner retains operational control.

Cons

- Coordination between the domain owner and the 3rd party mailer is required to ensure proper DKIM key rotation, accurate SPF records, etc.
- Risk of coordination overhead/issues increases as the number of bilateral relationships increase for domain owners and vendors.

3rd Party Deployment Profiles

Controlled

Contractual points

- Process for DKIM key rotation. Obligations of each party, including testing.
- SPF record requirements and process for adding new hosts.

3rd Party Deployment Profiles

Authorized

Similar to Controlled Profile, except the 3rd party creates the DKIM key pair and generally takes a more active role in dictating record content. This approach is useful for Domain Owners where a different 3rd party is providing DNS and other services for the domain.

Pros

- Can streamline provisioning for the 3rd party.
- One less task for the Domain Owner.

Cons

- Can create additional management issues for Domain Owners who use multiple 3rd parties.
- Possible additional contractual point for key strength requirements.

3rd Party Deployment Profiles

Delegated

The Domain Owner delegates a subdomain to 3rd party mailer and relies on contractual relationship to ensure appropriate SPF records, DKIM signing, and DMARC records.

Pros

- Reduces Domain Owner implementation issues to mostly contractual.
- The 3rd party is responsible for SPF records, DKIM signing and publishing, etc.
- Domain owner may still be responsible for ensuring Identifier Alignment.

Con

- The Domain Owner potentially gives up day to day control and visibility into operations and conformance.

3rd Party Deployment Profiles

Delegated

Contractual points

- Creation and maintenance of SPF, DKIM and DMARC records
- (At least every 6 months) Rotation of DKIM keys and minimum length of key (1024 recommended)
- Investigation of DMARC rejections
- Handling of DMARC Reports
- Requirements for reporting back to the Domain Owner
- Indemnification (if any) for mail lost due to improper records or signatures.

3rd Party Deployment Profiles

Hosted

The 3rd party is also providing DNS, webhosting, etc for the Domain Owner and makes the process mostly transparent to the domain owner.

Pro

- Very easy for less sophisticated Domain Owners.
- Can be mostly automated by the 3rd party.

Con

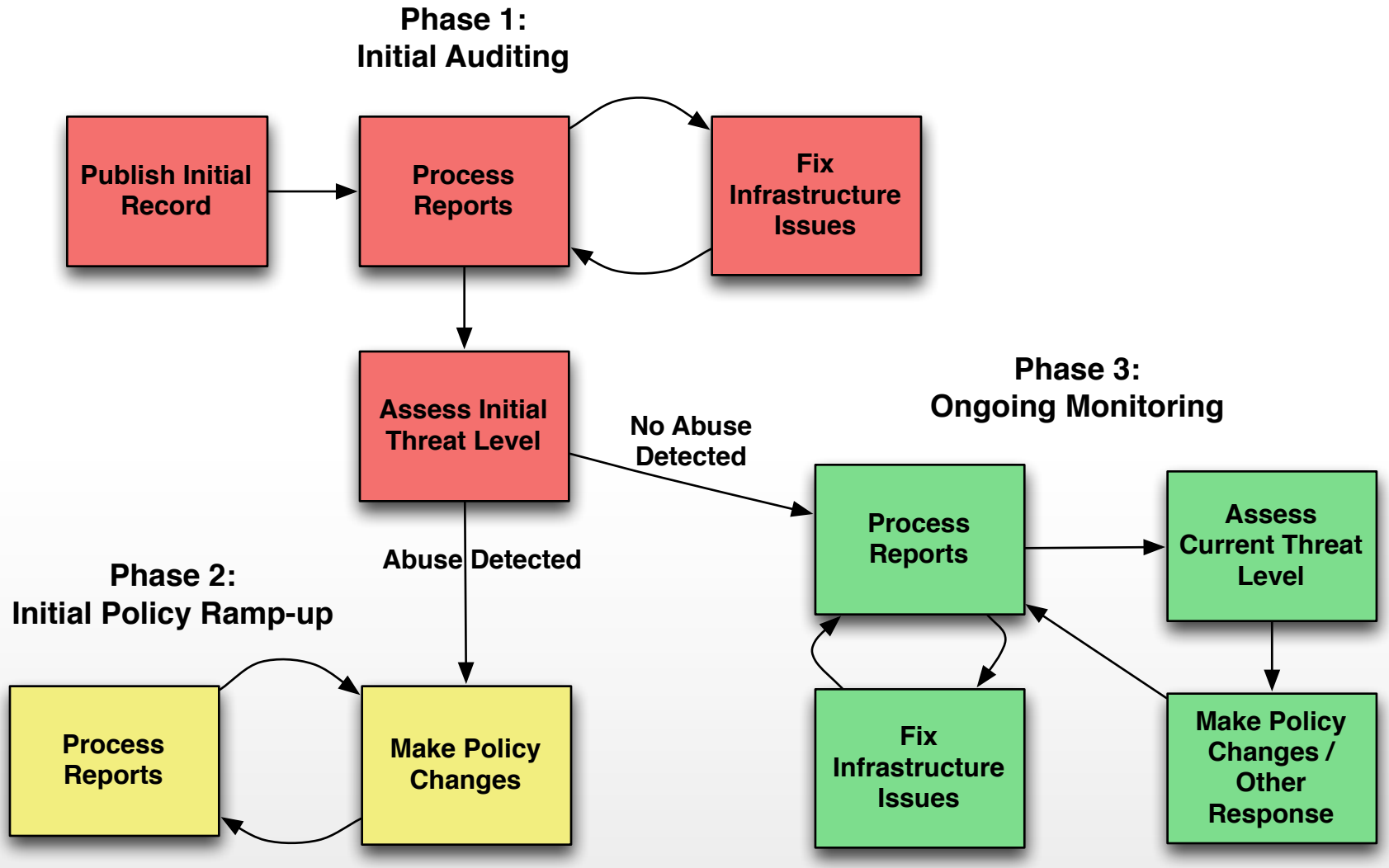
- The domain owner is significantly more dependent on the 3rd party.

3rd Party Deployment Profiles

3rd Party responsibilities

	Controlled	Authorized	Delegated	Hosted
Provide SPF record content	Y	Y	Y	Y
Maintain SPF records	N	N	Y	Y
Maintain DKIM records	N	N	Y	Y
Create DKIM Keys	N	Y	Y	Y
Rotate DKIM Keys	Y	Y	Y	Y
Maintain DMARC Records	N	N	Y	Y
Process DMARC reports	N	?	?	Y

Report Processing and Analysis



Report Processing and Analysis

Report Parsing Tools

http://dmarc.org/resources.html

If you develop report parsing tools you are willing to share, please send a note to the dmarc-discuss list and let us know.

Report Processing and Analysis

Step 1: Categorize the IPs in the Aggregate Report

- Your Infrastructure
- Authorized 3rd Parties
- Unauthorized 3rd Parties *

* - You should consider everything an Unauthorized 3rd Party by default.

Report Processing and Analysis – Infrastructure Auditing

Step 2: Infrastructure Auditing

For both your Infrastructure and Authorized 3rd Parties

- Identify owners
- LOE for Deploying Domain Authentication
- LOE for Identifier Alignment
- Business case / Justification

Report Processing and Analysis

Step 3: Identify Malicious Email

Research Unauthorized 3rd Parties and label the Abusers

- Use public data sources
- Vendor services
- Look for known failure cases
- Forensic reports

Report Processing and Analysis

Step 4: Perform Threat Assessment

Categories

- Your Infrastructure
- Authorized 3rd parties
- Unauthorized 3rd parties
- Abusers

Calculate the Sum of Unaligned Email from each Category

Report Processing and Analysis

Step 4: Perform Threat Assessment

Phish = Unaligned Email From Abusers

Definite False Positives = Unaligned Email from Your Infrastructure + Unaligned Email from Authorized 3rd parties

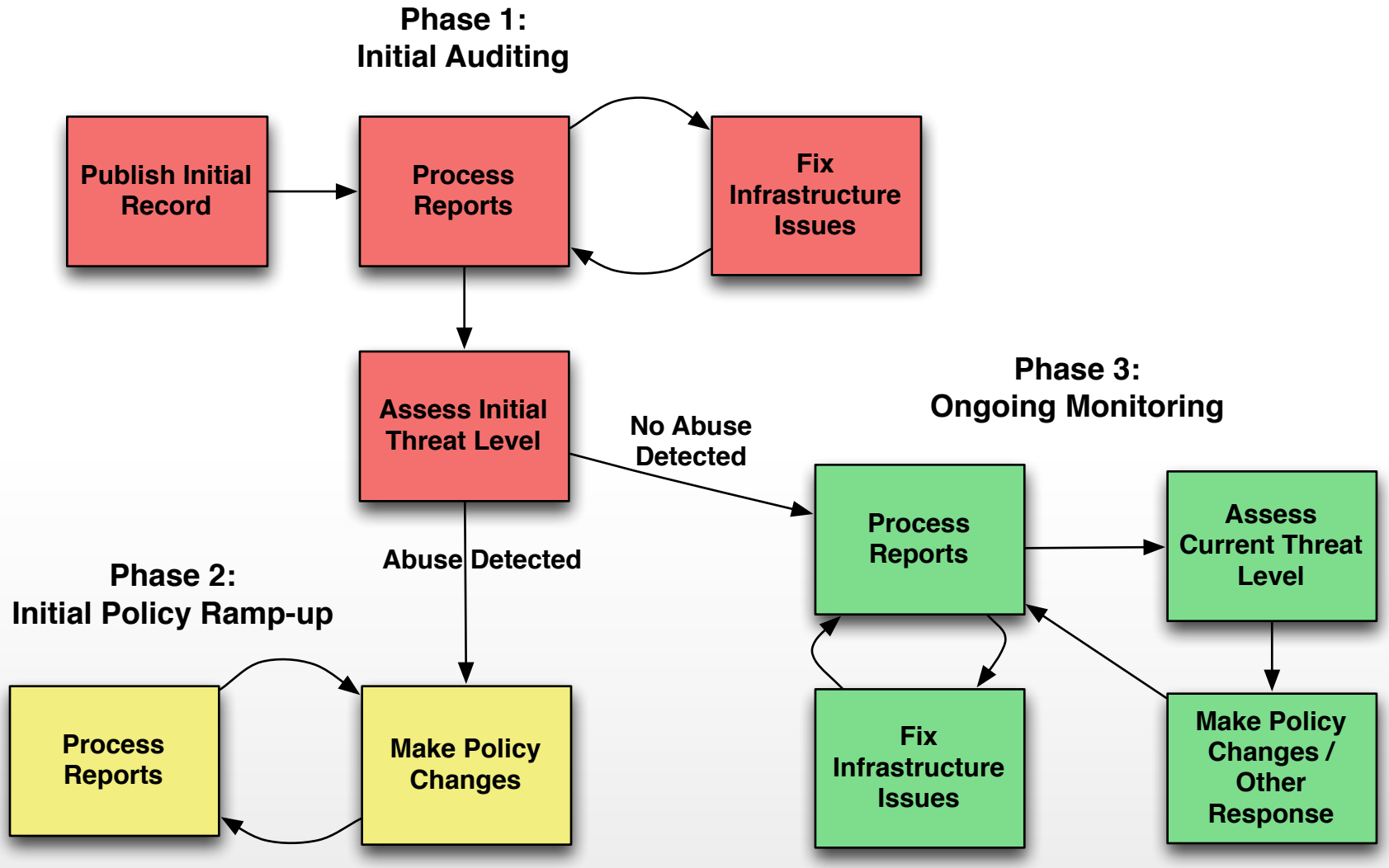
Potential False Positives = Unaligned Email from Unauthorized 3rd parties

Consider:

- Phish vs. False Positives
- Phish vs. Total Aligned Email

If there is no Phish, you don't have a Domain Spoofing problem and don't need to move forward with DMARC policies.

Initial Policy Ramp-up



Initial Policy Ramp-up

Step 1: Verify Authentication and Alignment for all of your Infrastructure and all Authorized 3rd Parties.

Step 2: Update your record to:

```
p=quarantine; pct=10;
```

Do not:

- Skip ‘quarantine’ and go straight to ‘reject’
- Change the policy action from ‘none’ without setting a ‘pct’

Initial Policy Ramp-up

Step 3: Monitor your reports for issues and address them.

Make a ‘go forward / go back’ decision.

Step 4: Update your record to increase the ‘pct’.

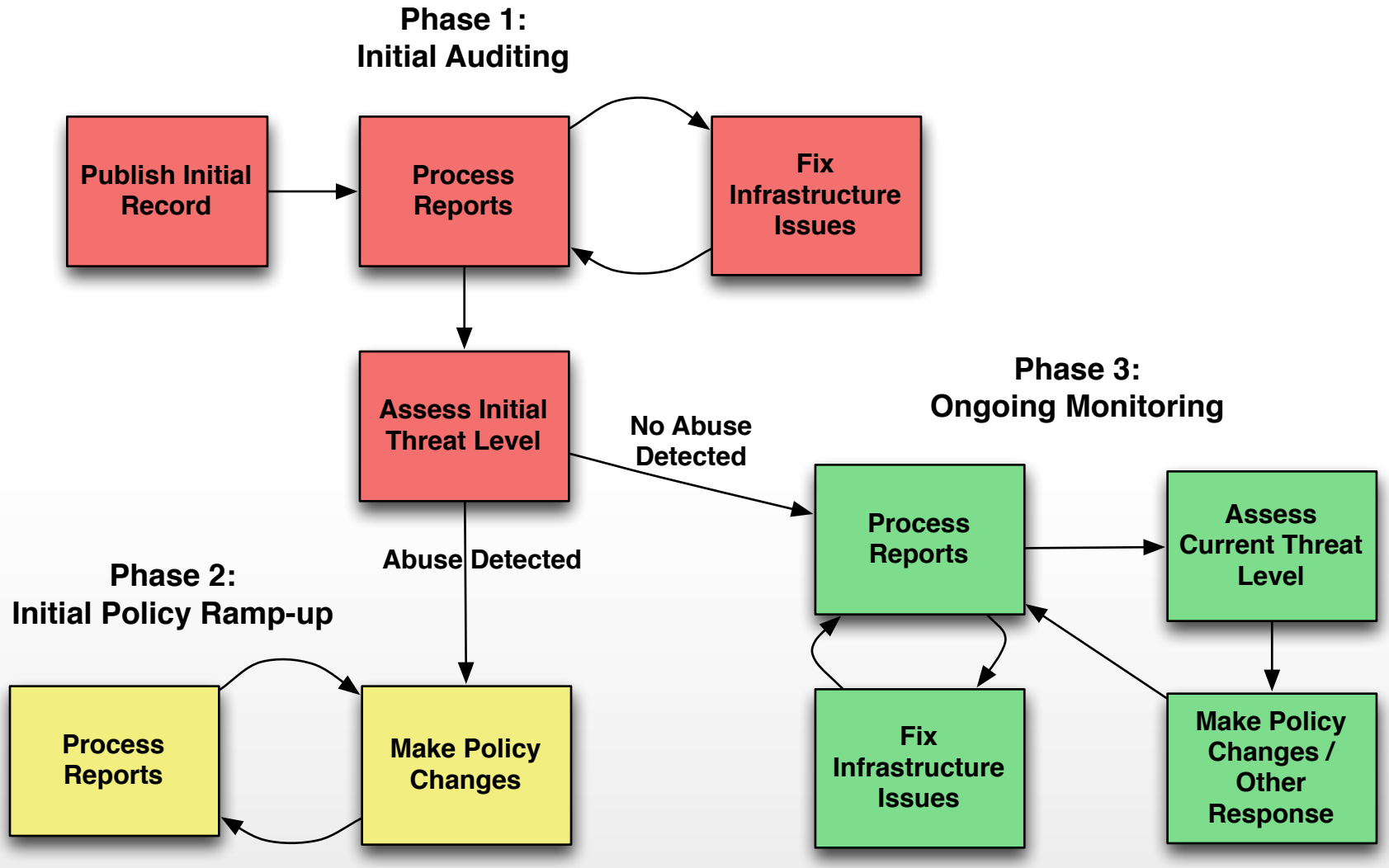
Rinse and repeat until you get to ‘pct=100’.

Initial Policy Ramp-up

Step 5: If needed, update your record to:

```
p=reject
```

Ongoing Monitoring



Ongoing Monitoring

- Categorize new IPs in Aggregate reports
  - Your Infrastructure
  - Authorized 3rd Parties
  - Unauthorized 3rd Parties
  - Abusers

- Reassess the Threat Level
  - Increases in phish
  - Changes in unaligned email volume
  - Make changes accordingly
  - Takedowns or other phish responses

Ongoing Monitoring

Be on the look out for:

- Infrastructure changes
- New products / new subdomains
- New authorized 3rd parties
- Mergers and acquisitions

For Mailbox Providers

Information for Mailbox Providers

Are you ready for DMARC?

- Do you need DMARC?
  - Understand what DMARC does for the messaging ecosystem.
  - Who are you receiving mail from?
- Review your SPF and DKIM practices.
  - Why validate both?
- Develop a local-policy strategy.
  - Special cases
  - Trusted domains
- Commit to Reporting
- Outbound?

Information for Mailbox Providers

Policy Enforcement in Review

- Evaluate SPF & DKIM according to the RFC.
  - Bonus points: use Authentication-Results
- Select applicable authentication results using alignment.
  - This only determines whether the results are used.
- No aligned and passing results? DMARC validation has failed – time to enforce!
  - None: message disposition is unchanged; “report only”
  - Quarantine: don’t deliver to the inbox.
  - Reject: don’t deliver at all.

Information for Mailbox Providers

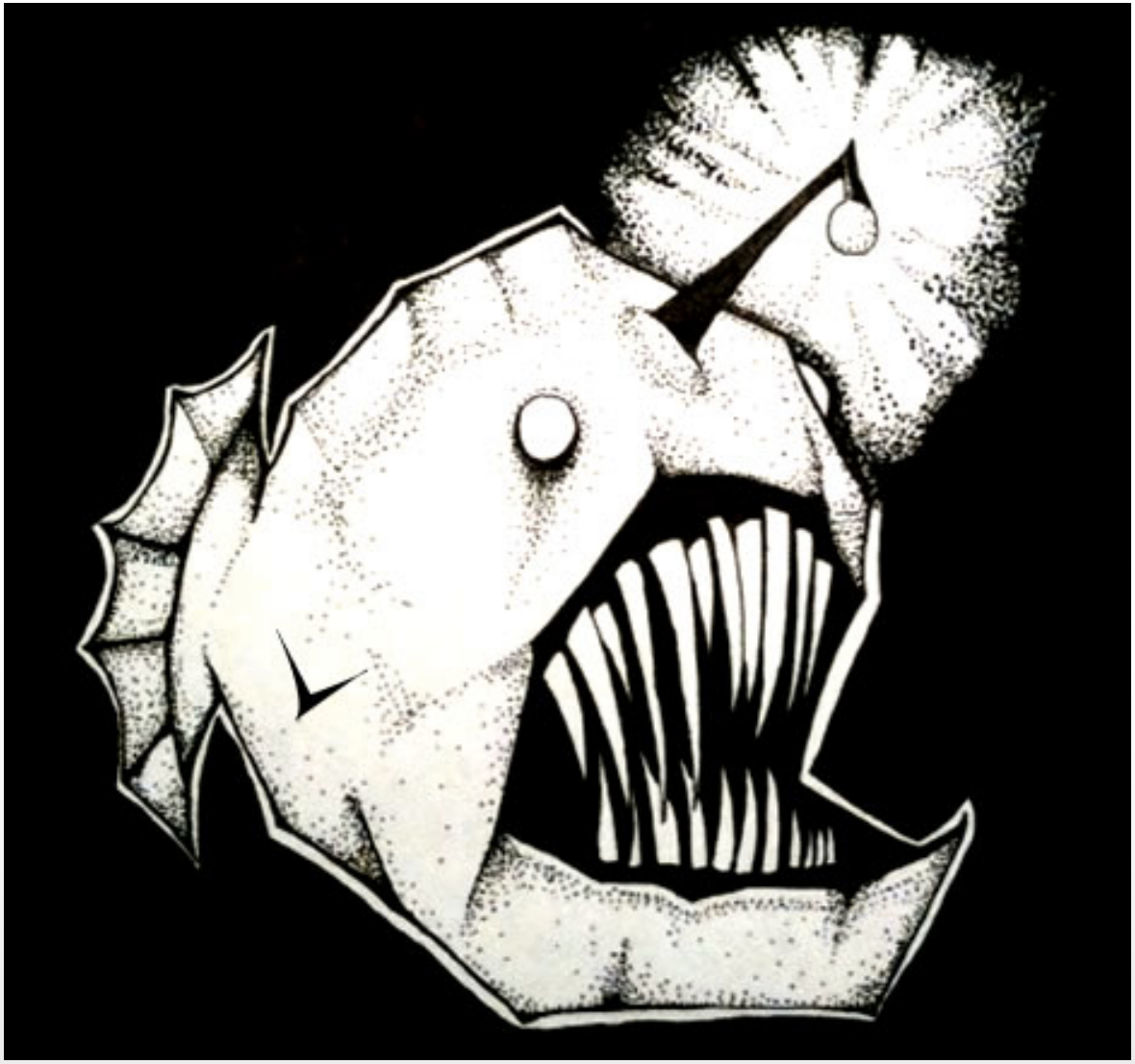
Reporting in Review

Aggregate Reporting

- XML data correlating IPs, domains, and authentication results.
- Requires ability to aggregate & store data extracted from inbound messages. This can require a lot of storage.
- Specification is currently least-documented part of DMARC, join dmarc-discuss and ask questions.

Failure Reporting

- Copies of messages failing DMARC validation sent to the sender or their agent.
- Don’t queue. Sending as close to receipt as possible maximizes value.



M3AAWG 26th General Meeting |

Information for Mailbox Providers

Operational Considerations

usually

- DMARC policy is the sender's policy and should have higher priority than local and other policy.
- Consider ways to mitigate the impact of MLMs, forwarders, and so on.
  - These waters are deep. Fish with large teeth. Be deliberate, researched, and iterative.

Information for Mailbox Providers

Reporting and Privacy

Forensic reports can send an unaltered message to someone other than the intended recipient.

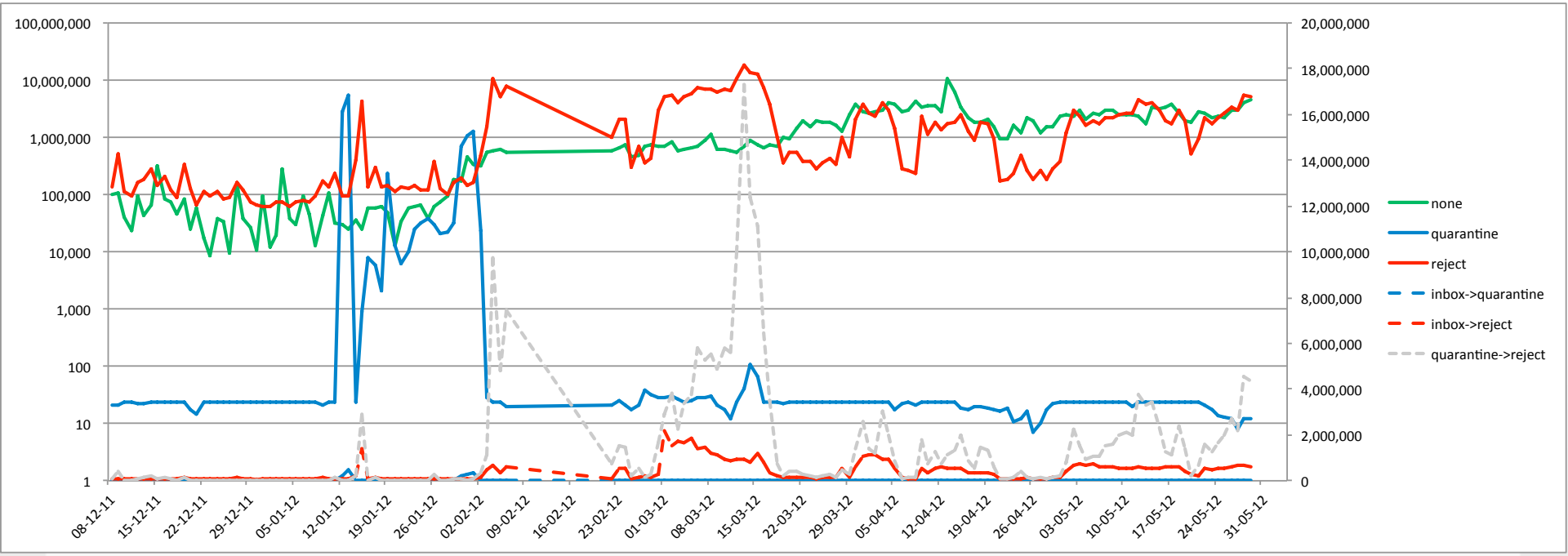
It may not be from a bad actor.

- A privacy analysis pertaining to the EU has been done and can be privately shared. Contact me if you are interested.

- Understand applicable privacy regimes before sending reports.
  - Corporate
  - Federal/Legal

Information for Mailbox Providers

Effect on Inbound Email @ Hotmail



- Based on private-channel policy.
- Policies move from quarantine to reject based on comfort.
- Steady growth in reject rate is good, wish magnitude were bigger.

Resources

Dmarc.org

Resources page for tools: dmarc.org/resources.html

Courtesy of Cloudmark

LESSONS LEARNED & KNOWN ISSUES/PITFALLS

Rollout Considerations – Overview

- DMARC has many moving parts
  - Both in protocol and technically
  - Plan rollout carefully
  - Partial controlled rollouts to gain experience
    - Find & work with sender partners (banks!)
    - Get vendor support if available
- Many benefits even with partial implementations
- ISPs: you are a *receiver*, not a *sender*

Rollout Planning – Infrastructure

- Most platforms have sufficient headroom, but
- Strong Requirements:
  - MTA support for DKIM, SPF, DMARC
  - MTA can reject in-line after DATA
  - Log storage
    - Aggregate: efficient custom logs only few % extra for typical MTA. Archive?
    - Forensic: archive full messages?
  - Will actually save a few % message storage

Rollout Considerations – Technical

- Performance impact: not a major issue
  - Apply DMARC (DKIM/SPF) only on relevant traffic
  - No benefit in authenticating obvious spam, so
  - Use DNSBLs / IP reputation to reject really bad stuff
  - DKIM crypto impact dwarfed by content scans etc
  - Consider implementing reporting out-of-band
  - But: potentially measurable extra DNS traffic

Rollout Considerations – Technical

- Allow for exceptions
  - SPF and DKIM don't always play well with forwarded traffic & mailing lists
  - Use IP-reputation data to (de) select candidates
    - But keep in mind that ISP outbounds are a favorite for phishers to use
- Controlled rollout
  - Apply only to select domains at first
  - Allow overriding pct & p= value locally

Rollout Considerations – Policy

- Pro arguments
  - Supports ISP and sender “duty of care”
- Receiver has final control over how DMARC is applied
- Protection measures that balance security & privacy
- When in doubt, partial implementation is better than no implementation at all

Rollout Considerations – Policy

- Privacy issues – general
  - DMARC does not consider *content* or *recipient*
  - Senders participate *voluntarily* and *have authority on* how their domain is used
- Privacy issues – reporting
  - Aggregate reporting generally acceptable
  - Forensic reporting risky under EU rules
  - When in doubt, DO implement but DON'T report