GREEN LOCKS FOR YOU & ME

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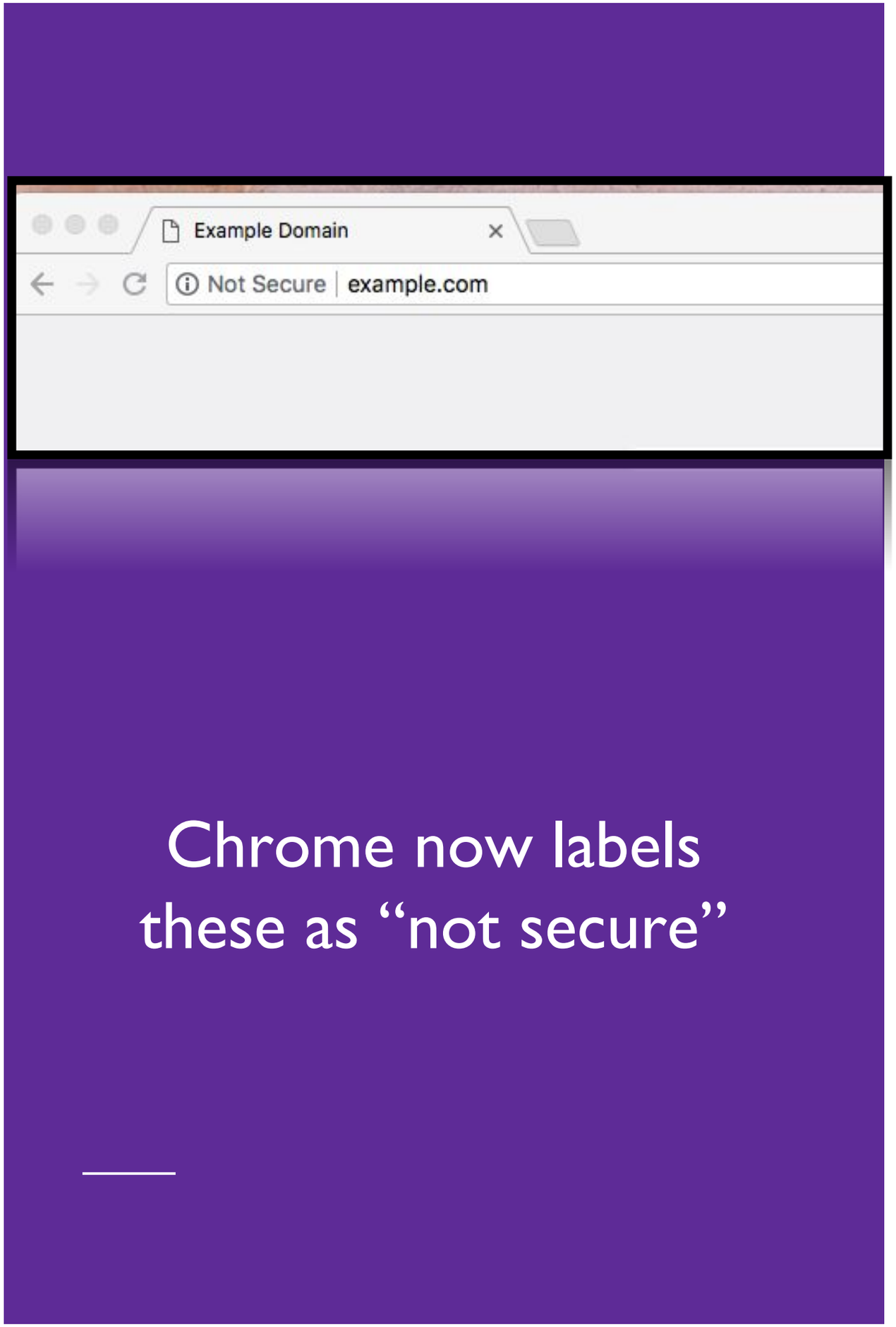
@wendyck

SeaSec East
September 5, 2018

WEBSITES WITHOUT HTTPS



Chrome now labels these as “not secure”

A milestone for Chrome security: marking HTTP as “not secure”

Emily Schechter
Chrome Security Product Manager

Published Jul 24, 2018

Security has been one of Chrome's core principles since the beginning—we're constantly working to keep you safe as you browse the web. Nearly two years ago, we announced that Chrome would eventually mark all sites that are not encrypted with HTTPS as "not secure". This makes it easier to know whether your personal information is safe as it travels across the web, whether you're checking your bank account or buying concert

https://www.blog.google/products/chrome/milestone-chrome-security-marking-http-not-secure/

SITES WITH HTTPS

Green lock indicating SSL

HOW DO I SECURE MY WEBSITE?

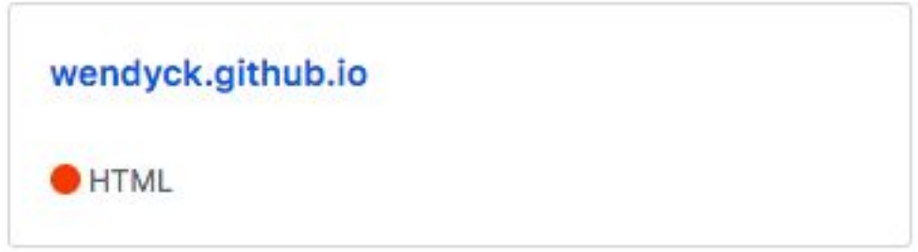
- Lets Encrypt and Cloudflare are two of the services offering free certificates to websites
- Both work well with Github pages, which is what this talk will demonstrate
- There are lots of other hosting options like WordPress as well

SETTING UP THE CERTIFICATE AND DOMAIN

- Github Pages TLS with custom domains announcement: https://blog.github.com/2018-05-01-github-pages-custom-domains-https/

- Directions: https://help.github.com/articles/using-a-custom-domain-with-github-pages/

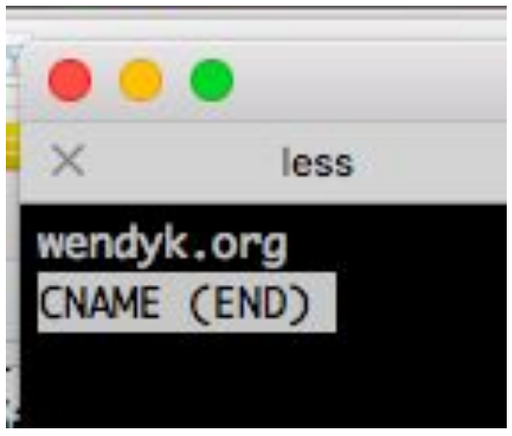
On GitHub, create your repo:
[USERNAME].github.io



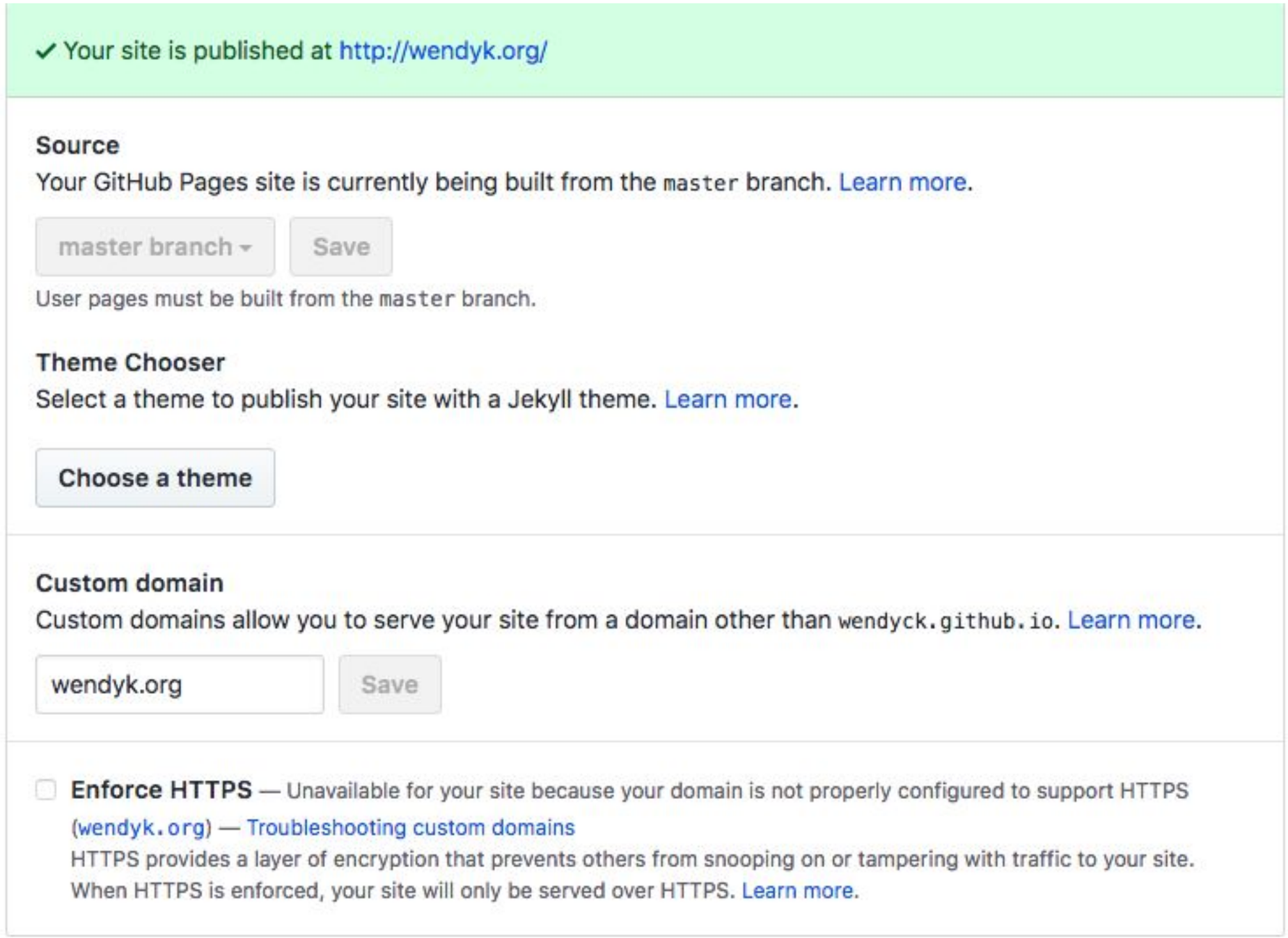
Check out the repo to your local machine (I like GitHub Desktop)
create a index.html (your homepage!) and any other webpage files

```
Revisionist:wendyck.github.io wck$ ls -ltr
total 40
-rw-r--r--  1 wck  staff  1076 Mar 10 14:27 LICENSE
-rw-r--r--  1 wck  staff    10 Mar 10 14:46 CNAME
drwxr-xr-x@ 4 wck  staff   128 Mar 11 07:34 imgs
-rw-r--r--  1 wck  staff  2999 Mar 21 18:09 keybase.txt
-rw-r--r--  1 wck  staff  3018 Apr 28 07:16 index.html
-rw-r--r--  1 wck  staff  4031 May 30 17:54 talks.html
Revisionist:wendyck.github.io wck$
```

Create a new text file named CNAME at the root of the repo and put your domain name into it

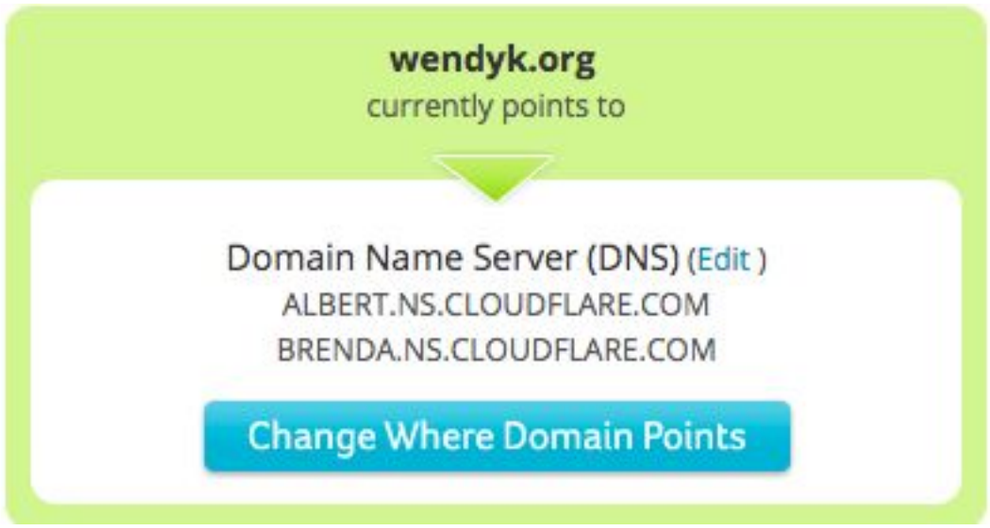


Go to the Settings for your new repo and scroll down to custom domain



SET UP NAME SERVERS

- If you're using Cloudflare, point to their DNS servers, and configure there
- Make sure you set your domain on the repo on GitHub **FIRST**



GitHub directions:
Apex Domain DNS Configuration:
Create configure an ALIAS, ANAME, or A record at your DNS provider

Configuring `A` records with your DNS provider

1. Contact your DNS provider for detailed instructions on how to set up `A` records.

2. Follow your DNS provider's instructions to create `A` records that point your custom domain to the following IP addresses:

   - 185.199.108.153
   - 185.199.109.153
   - 185.199.110.153
   - 185.199.111.153

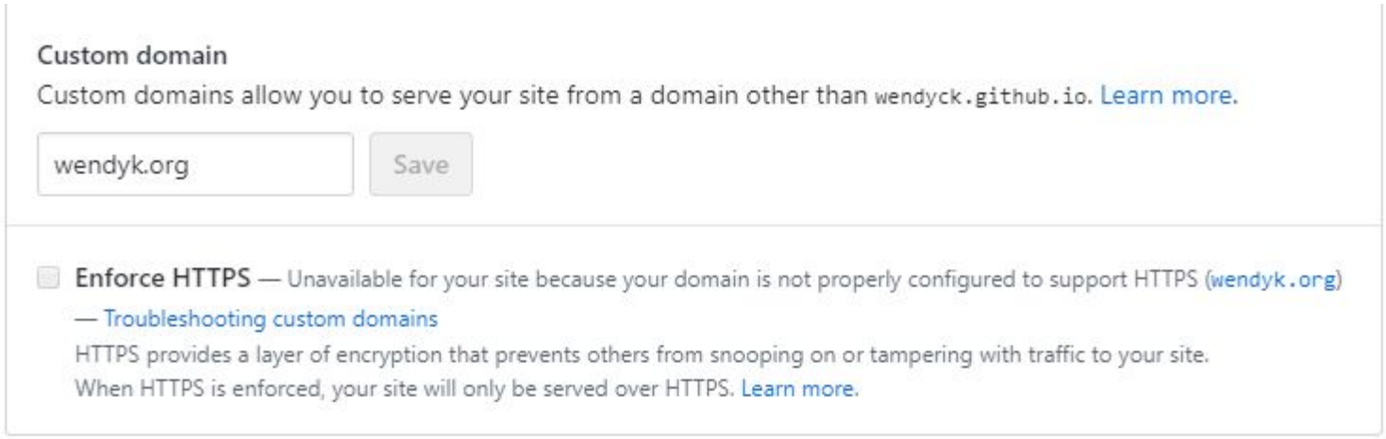
Tip: Your DNS changes can take over a full day to update and the wait varies among DNS providers.

Set the “A” record values to be the IP addresses that GitHub provides in their help pages (https://help.github.com/articles/setting-up-an-apex-domain/)

Type	Name	Value	TTL	Status	
A	wendyk.org	points to 185.199.111.153	Automatic		✕
A	wendyk.org	points to 185.199.110.153	Automatic		✕
A	wendyk.org	points to 185.199.109.153	Automatic		✕
A	wendyk.org	points to 185.199.108.153	Automatic		✕

about the orange clouds there....

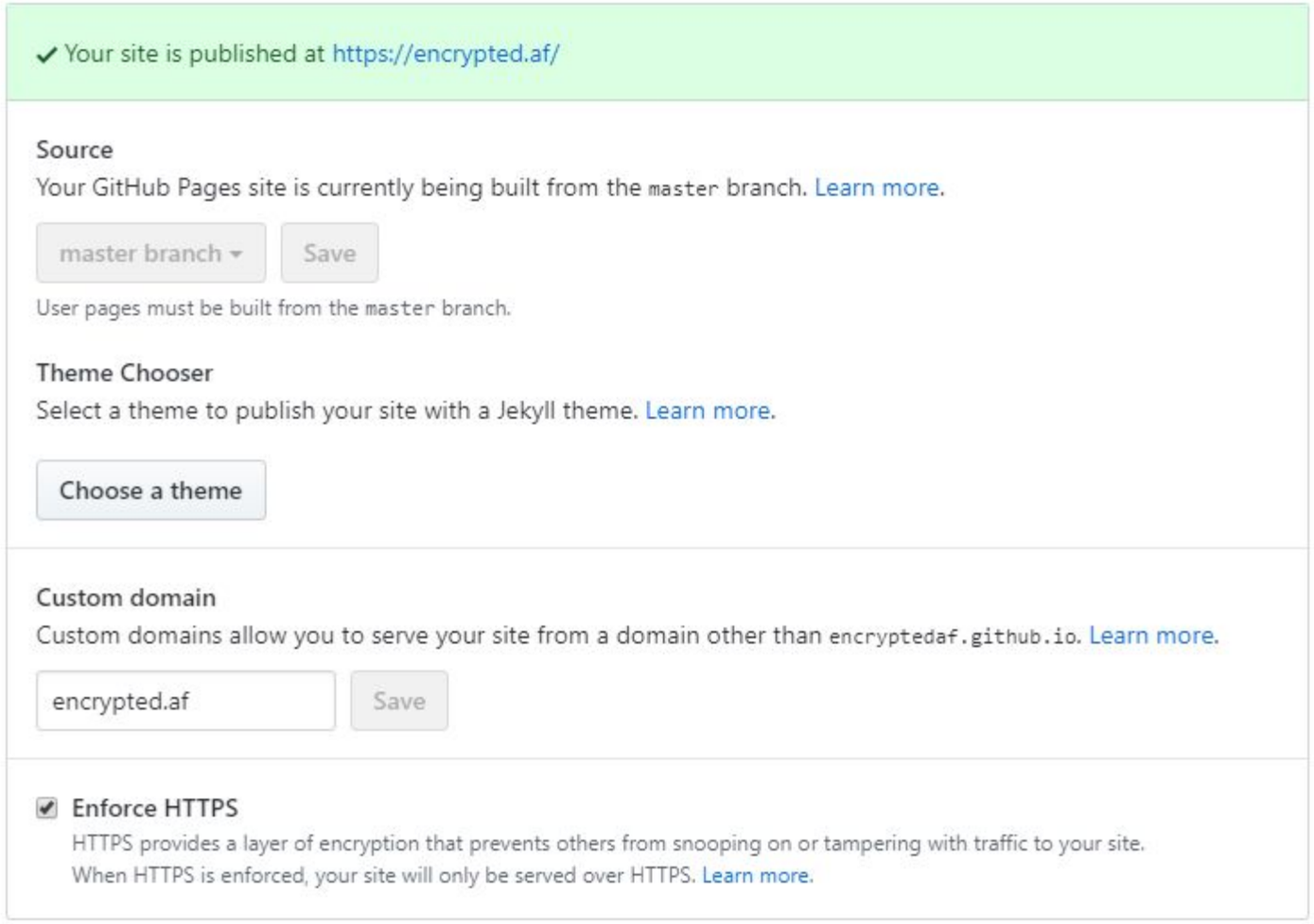
Sites behind Cloudflare's CDN do not look like they're configured correctly to GitHub



Type	Name	Value	TTL	Status
A	wendyk.org	points to 185.199.108.153	Automatic	
A	wendyk.org	points to 185.199.109.153	Automatic	
A	wendyk.org	points to 185.199.110.153	Automatic	
A	wendyk.org	points to 185.199.111.153	Automatic	
A	www	points to 185.199.108.153	Automatic	
A	www	points to 185.199.109.153	Automatic	

Type	Name	Value	TTL	Status
A	encrypted.af	points to 185.199.108.153	Automatic	
A	encrypted.af	points to 185.199.109.153	Automatic	
A	encrypted.af	points to 185.199.110.153	Automatic	
A	encrypted.af	points to 185.199.111.153	Automatic	

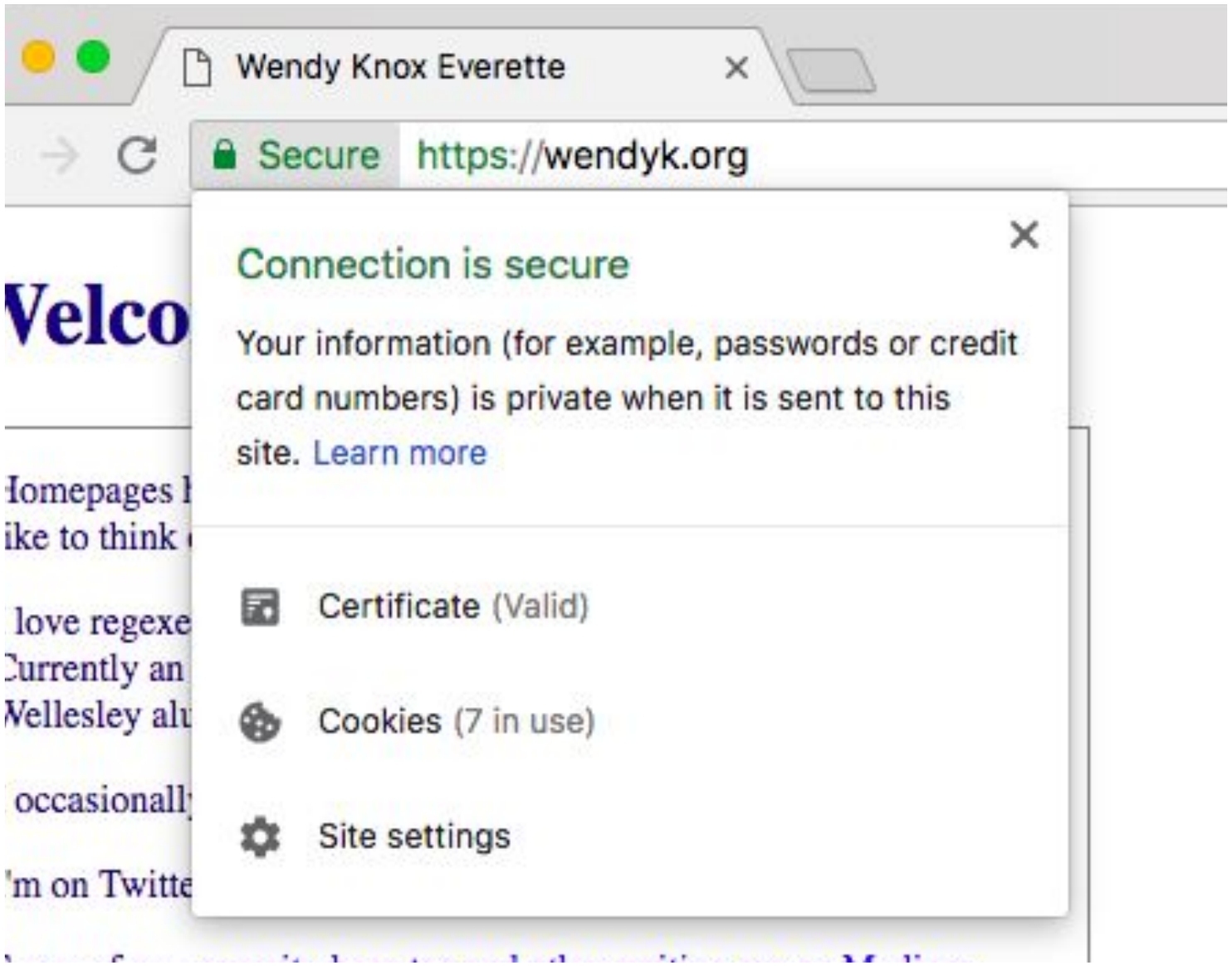
Site that is not behind Cloudflare's CDN

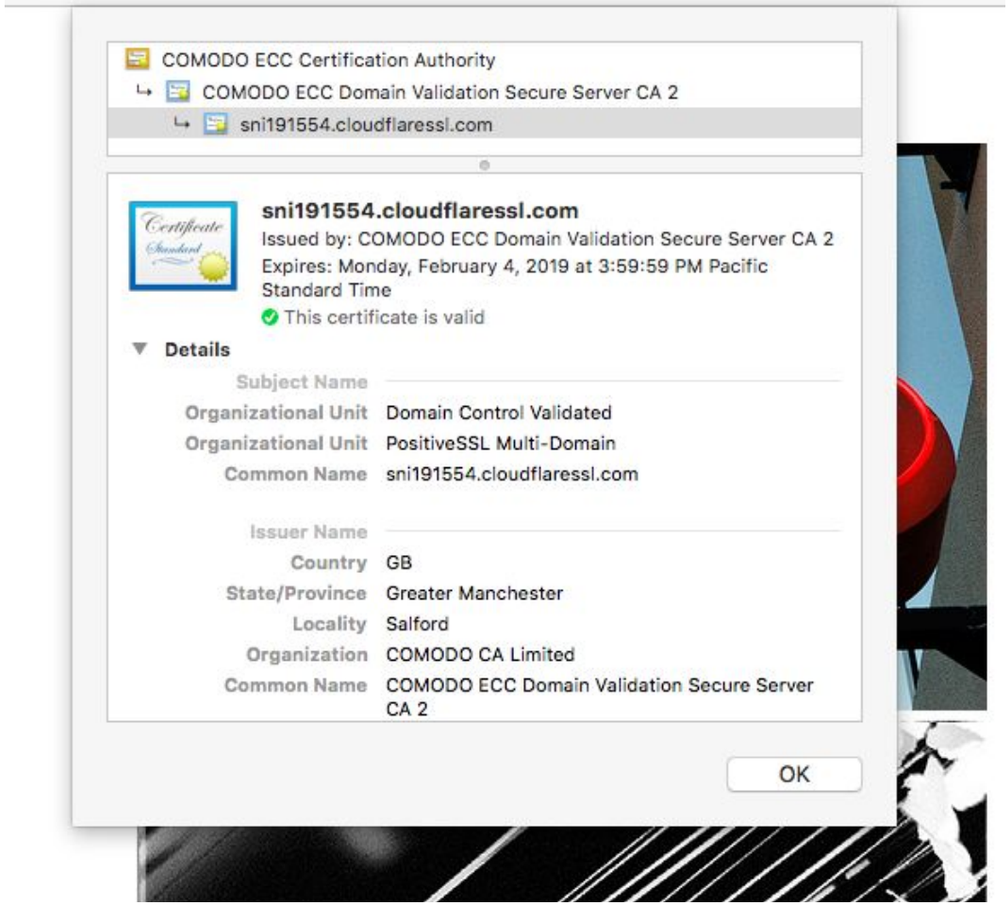


Before & after turning off Cloudflare CDN - GitHub looks for the second set of IP addresses for your domain

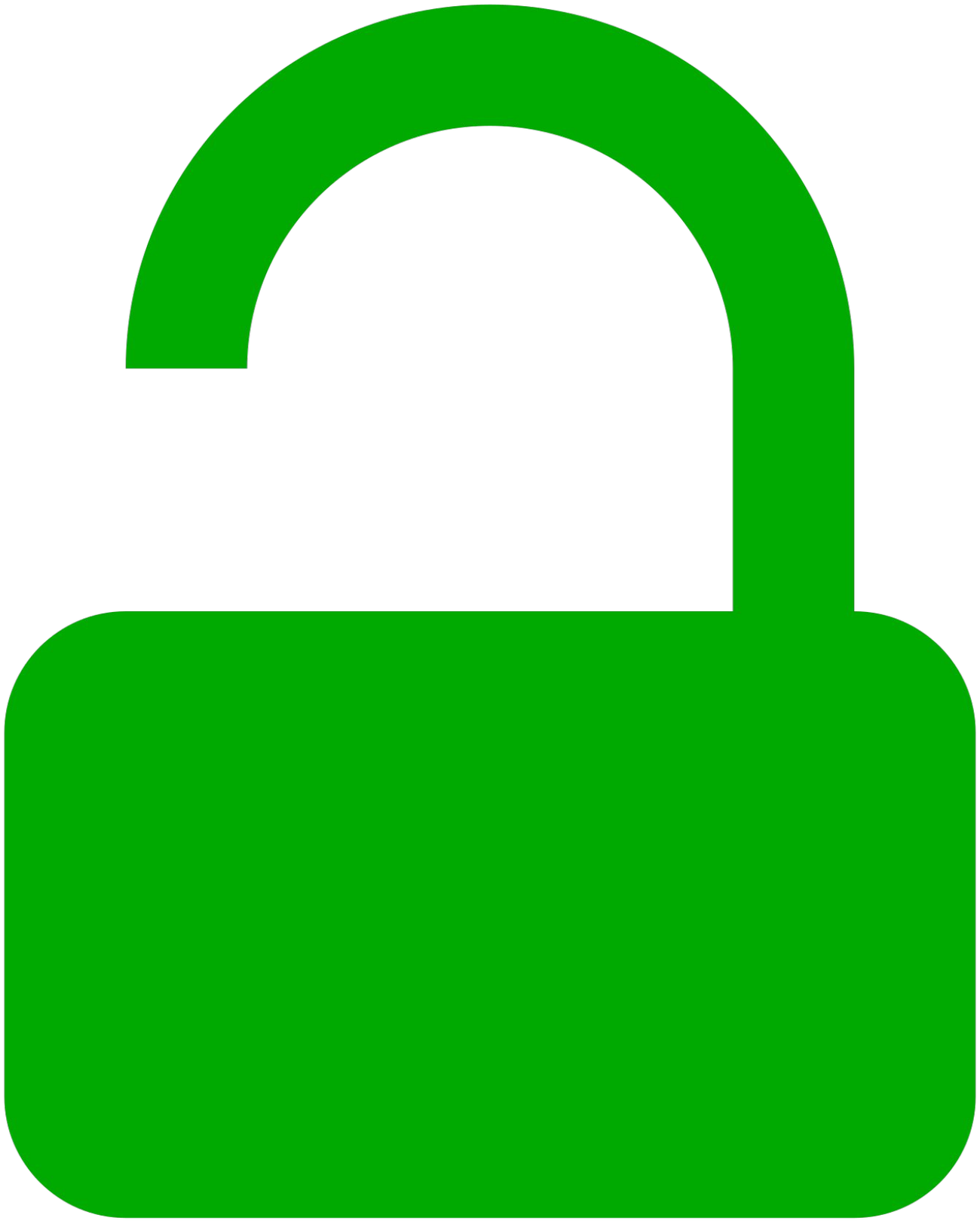
```
; <<>> DiG 9.10.6 <<>> encrypted.af +nostats +nocomments +nocmd
;; global options: +cmd
;encrypted.af.                  IN      A
encrypted.af.           299    IN      A       104.27.145.221
encrypted.af.           299    IN      A       104.27.144.221
Revisionist:wendyck.github.io wck$ dig encryptedaf.github.io +nostats +nocomments +nocmd
```

```
Revisionist:encryptedaf wck$ dig +noall +answer encrypted.af
encrypted.af.           299    IN      A       185.199.110.153
encrypted.af.           299    IN      A       185.199.111.153
encrypted.af.           299    IN      A       185.199.108.153
encrypted.af.           299    IN      A       185.199.109.153
```


Wendy Knox Everette
Secure
https://wendyk.org
Connection is secure
Your information (for example, passwords or credit card numbers) is private when it is sent to this site. Learn more
Certificate (Valid)
Cookies (7 in use)
Site settings



CLOUDFLARE FREE ACCOUNT CERTIFICATE



A sidebar about DNS debugging tools

DNS lookup tools

Mac/Linux:

- dig
- https://toolbox.googleapps.com/apps/dig

Windows

- nslookup
- https://network-tools.com/nslook/

NEXT… SO YOU HAVE EMAIL ON YOUR PERSONAL DOMAIN: HOW DO PREVENT IT FROM BEING SPOOFED?

Why bother? Some statistics from a Usenix paper

“email phishing has involved in nearly half of the 2000+ reported security breaches in recent two years, causing a leakage of billions of user records”

Scanned Alexa top 1 million from February 2017 to January 2018

Found very low adoption rates of SPF and DMARC:

- SPF 44.9%
- DMARC 5.1%

End-to-End Measurements of Email Spoofing Attacks
Hang Hu and Gang Wang, Virginia Tech
https://www.usenix.org/conference/usenixsecurity18/presentation/hu

DO I NEED TO DO THIS?

I'd assumed at first that since I was using Google Apps Gmail for my email that it couldn't be used to spoof. Turns out I was wrong

SPF -
SENDER PERMITTED FROM

- https://blog.returnpath.com/how-to-explain-spf-in-plain-english/

- Lets a domain owner specify the only IP addresses that can send email for that domain

- Up to recipients to check for matches

DKIM - DOMAINKEYS IDENTIFIED MAIL

- https://blog.returnpath.com/how-to-explain-dkim-in-plain-english-2/

- Allows us to cryptographically sign our emails! the elements of the email to be signed are encrypted with our private key….verification that email is legitimate through cryptographic authentication

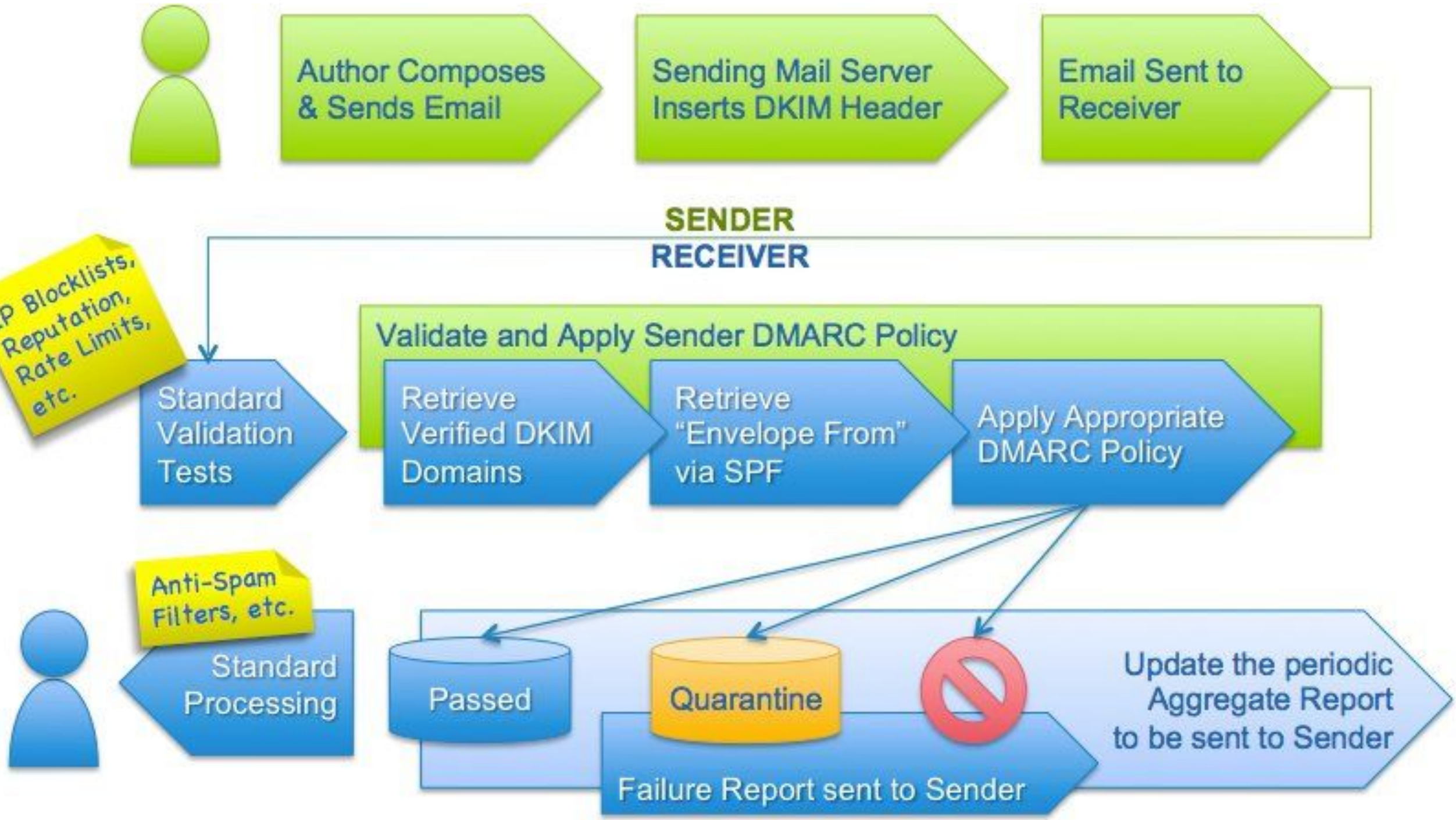
- Public key to decrypt is available in DNS

- Unfortunately not really widely adopted yet - but GSuite supports it

DMARC - DOMAIN-BASED MESSAGE AUTHENTICATION, REPORTING & CONFORMANCE

- Builds on DKIM & SPF

- Ensures spoofed emails are blocked



https://dmarc.org/overview/

let's begin...

- We will figure out the IP addresses for SPF
- Then get our private key for DKIM
- Then create an initial DMARC policy
- Finally, going back to Cloudflare, we will add some new DNS records- 3 TXT records to set up DMARC/DKIM/SPF using the information we generated

GENERATE DKIM PUBLIC KEYS

- This is will go into your DNS settings in a TXT record

- For GSuite, go to the admin dashboard, then Apps (in the left sidebar) > Gmail > Authenticate email

- https://support.google.com/a/answer/174124?hl=en

Authenticate email

The domains you select will use the DKIM (DomainKeys Identified Mail) protocol for authenticating outgoing emails.

wendyk.org

Status: Authenticating email

You must update the DNS records for this domain.
To start authenticating email for the domain selected above, enter the following DNS TXT record into your domain provider's DNS settings page. Then click "Start authentication."

DNS Host name (TXT record name):

google._domainkey

TXT record value:

v=DKIM1; k=rsa;
p=MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAgWg2SDt7hAog9UKm8BQTs28Pq4BWK0jIL
KXiP0nAnqfURMixf/IGMjJppOzbrCOCvW8gp0IN5udIGVZyFdpAbZa+Y+ubCS7n5cW+772pwgN15zFDDq
FhDuEztKuibUwMC6Mdb0vBv9+sWqyqzOx5uf2OIRtljbcWiTX8I5bOfRRCU790Pjn8tYuadDSXBAu4Bp4N
Diy2kSE1yh//sJde1IFwrQ2zTCLLxz+IZ2Ux49zrL5jRvkQwdb0NSu6iZwJNROQIjpbQXZ03yZFCNDOz2xJE
OKMvpQiw9WJVxDO67Jbb3dy6f9R+1ksOe9gAJ7Za7eMjm2ROEv8CEs+cenRYBwIDAQAB

Generate new record

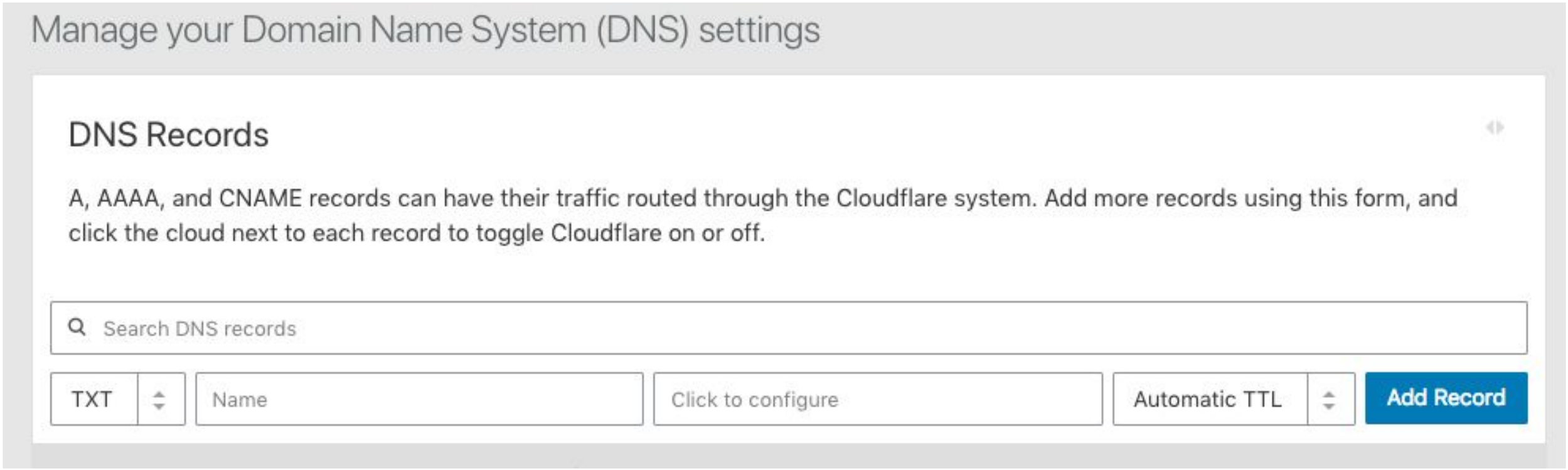
Note: It may take up to 48 hours for DNS changes to fully propagate.

STOP AUTHENTICATION

CREATE TXT RECORD

- Name of the TXT record will be “google._domainkey”

- Value will be the full contents of the string that starts with “v=DKIM1; k=rsa; p=…..”



CLOUDFLARE DNS ENTRY: Select TXT from the dropdown

DKIM DNS entry is all set:

TXT	google._domainkey	v=DKIM1; k=rsa; p=MIIBIjANBgkqhkiG9w0BA...	Automatic	✕

DKIM TAGS

Legend

The DKIM legend lists all supported tags with their default values and short explanation. Refer to RFC6376 for more in depth information. As the RFC states any unsupported tags MAY be present and MUST be ignored.

Tag	Name	Default	Translation
v	Version	DKIM1	Version of the DKIM key record (plain-text; RECOMMENDED). This tag MUST be the first tag in the record if present. Warning: some ISPs may mark the DKIM authentication check as neutral if the version tag is invalid.
h	Hash algorithms	* (allow all)	Acceptable hash algorithms (plain-text; OPTIONAL). A colon-separated list of hash algorithms that might be used. Unrecognized algorithms MUST be ignored. The currently recognized algorithms are "sha1" and "sha256".
k	Key type	rsa	Key type (plain-text; OPTIONAL). Unrecognized key types MUST be ignored. Currently only "rsa" is recognized.
n	Notes	(empty)	Notes that might be of interest to a human (OPTIONAL). Not interpreted in any way.
p	Public key	(none)	Public-key data (base64; REQUIRED). An empty value means that this public key has been revoked. This is the only required tag.
s	Service type	* (allow all)	Service Type (plain-text; OPTIONAL). A colon-separated list of service types to which this record applies. Unrecognized service types MUST be ignored. Currently only "email" is recognized.
t	Flags	(no flags set)	Flags (plain-text; OPTIONAL). A colon-separated list of names. Unrecognized flags MUST be ignored. The defined flags are as follows: "y" - this domain is testing DKIM (test mode) "s" - verifiers MUST check for domain alignment (strict mode)

Learn More:

- https://us.dmarcian.com/dkim-inspector/
- https://support.symantec.com/en_US/article.TECH131385.html

```
DKIM-Signature: v=1; a=rsa-sha256; c=relaxed/relaxed;
        d=wendyk.org; s=google;
        h=mime-version:from:date:message-id:subject:to;
        bh=J4wOdPKBCGKDJu2gipRt6L/Ys5LW5rWG1r1oeQZ/Woo=;
        b=dir909v+lNJ4mjzATO5fmgeXWdFzN6n+JNkPLtuxBcOeTF4JYYhMQR6s7JwN7k3/ou
         67gPvacuG7ZZAn5v5aMv8TOI06XFCXv71CowSwfDz8rbF7B57RvoW5aog/vpy3s1/lPr
         hMT9Kk3MULXbJQF48Qv/LbpMRsJDzlIizpgIxxrgDjZyKH4oWxZlLfOl2g4FGBjNv5I3
         wHmQu/Ewgm040IsC4kGvXyFEKG2Yvw6U5BV1auM0UCZKKk/MuncvQcKAVmEnfUPUarsS
         ioGBrncFJf4d2AEtGW18JXqnGNvfK2ZqB922hYLsxOcaMb6+tAWaXNUcBaym48xCgSpC
         k+FQ==
X-Google-DKIM-Signature: v=1; a=rsa-sha256; c=relaxed/relaxed;
        d=1e100.net; s=20161025;
        h=x-gm-message-state:mime-version:from:date:message-id:subject:to;
        bh=J4wOdPKBCGKDJu2gipRt6L/Ys5LW5rWG1r1oeQZ/Woo=;
        b=G7F+urifcvii9E+0NH7fn86HjxzcpLkDtU6VFW/grlFM7v17RsMdGjb7JfIHujJzy4
         sCywy2zRTodm5/erlaYBpvPlHNDZzKIJzOS+Ti/giwuRDd7usuybQdEFE+9FU+zO3xiL
         fwe2rSG0FsExe9LHR1arJaavE4oM12rKjC0BBuFgvcIyAnWEA3LIDK8BStXFD6F0OvvJ
         AftnZiR++4+zbBo0af9olLMVBIcdQD/Y1Z4F56CZu3nsozlTraRbd7P7ihgES+4EUueh
         gRjU02zfnIgXCR1XqG8UpLpDFNYN3KvNvxG96ppuNrxtVUM4Gfagc3s8LGfbSTNP/FQV
         O8mQ==
```

ENTER SPF SETTINGS

TXT	wendyk.org	v=spf1 include:_spf.google.com ~all

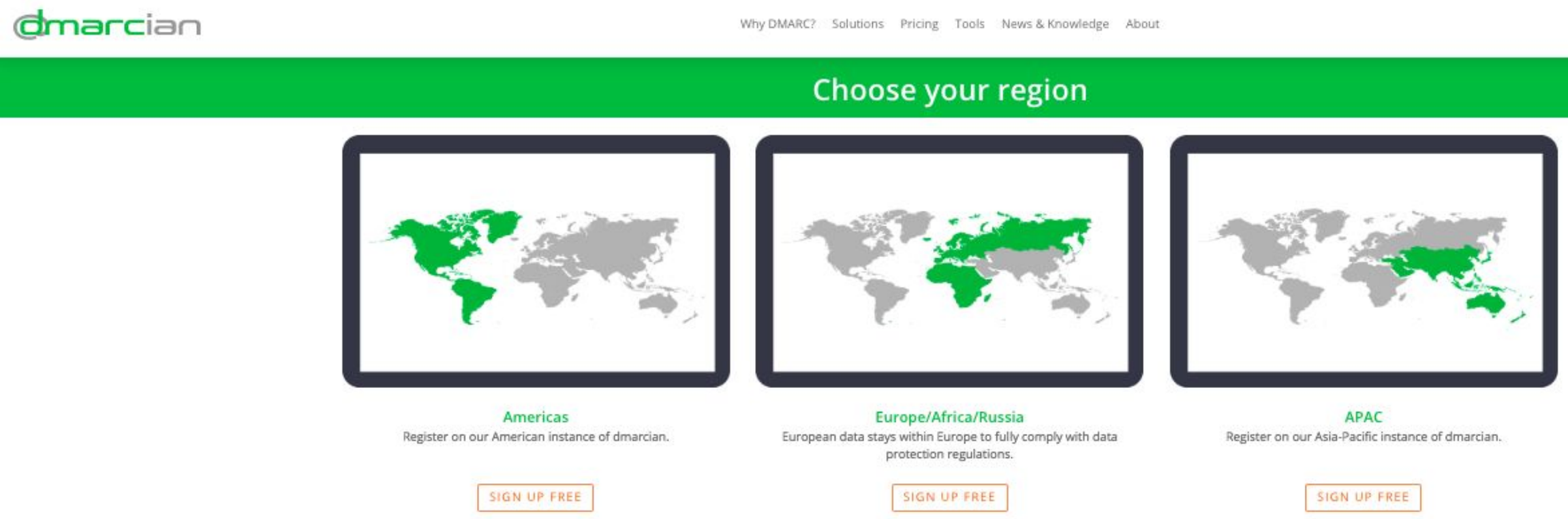
Create an SPF record for your domain:
“v=spf1 include:_spf.google.com ~all”

https://support.google.com/a/answer/33786?hl=en

wait for those to propagate, and make sure nothing broke….

NOW WE'RE READY TO SET UP DMARC….

SIGN UP FOR DMARCIAN



https://dmarcian.com/register/

dmarcian

Add Domains | Add DMARC | Get Compliant | Publish Policy

Add DMARC data

To begin collecting DMARC data, publish the following DMARC record for your domain:

```
v=DMARC1; p=none; rua=mailto:ditp3aec@ag.dmarcian.com;
```

Publish this as a TXT record located at _dmarc. You can use the same DMARC record for all of your domains.

Once you publish DMARC records, you should begin to see data within two or three days for active sending domains.

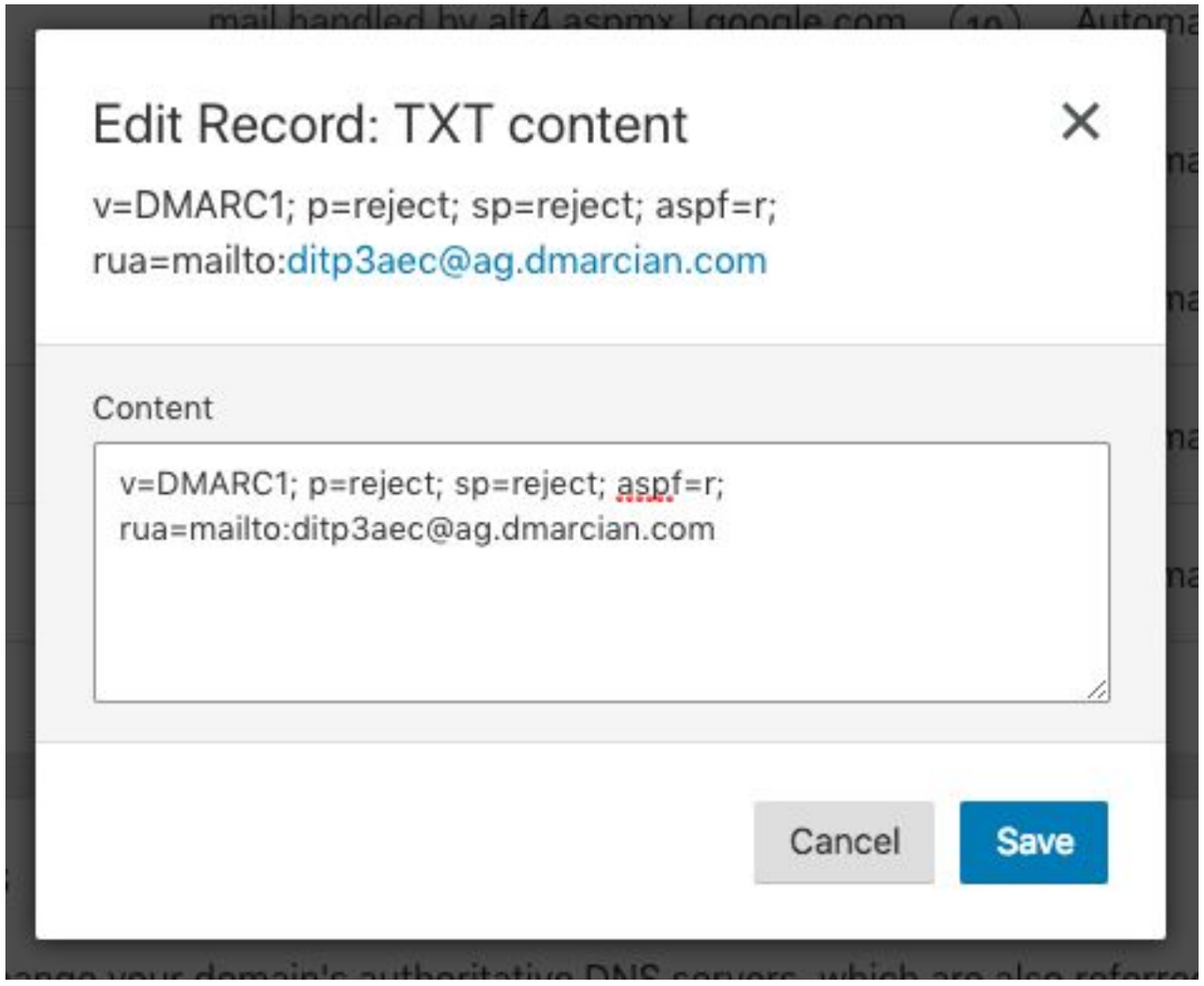
For more information about publishing DMARC records, visit How to publish a DMARC record.

ADD DMARC SECTION

DMARC OPTIONS

Tag Name	Purpose	Sample
v	Protocol version	v=DMARC1
pct	Percentage of messages subjected to filtering	pct=20
ruf	Reporting URI for forensic reports	ruf=mailto:authfail@example.com
rua	Reporting URI of aggregate reports	rua=mailto:aggrep@example.com
p	Policy for organizational domain	p=quarantine
sp	Policy for subdomains of the OD	sp=reject
adkim	Alignment mode for DKIM	adkim=s
aspf	Alignment mode for SPF	aspf=r

https://www.dmarcanalyzer.com/how-to-create-a-dmarc-record/


Edit Record: TXT content
v=DMARC1; p=reject; sp=reject; aspf=r;
rua=mailto:ditp3aec@ag.dmarcian.com
Content
v=DMARC1; p=reject; sp=reject; aspf=r;
rua=mailto:ditp3aec@ag.dmarcian.com
Cancel
Save

DMARC “POLICY”

- Tells webserver what to do with email that fails SPF & DKIM

- Start with p=none - this will give you reporting with no action taken on emails. Important so you don’t block all **your** emails

- once that works, move to p=quarantine

- Can then move to p=reject

  https://dmarcian.com/start-dmarc/

REPORTING DMARC DATA

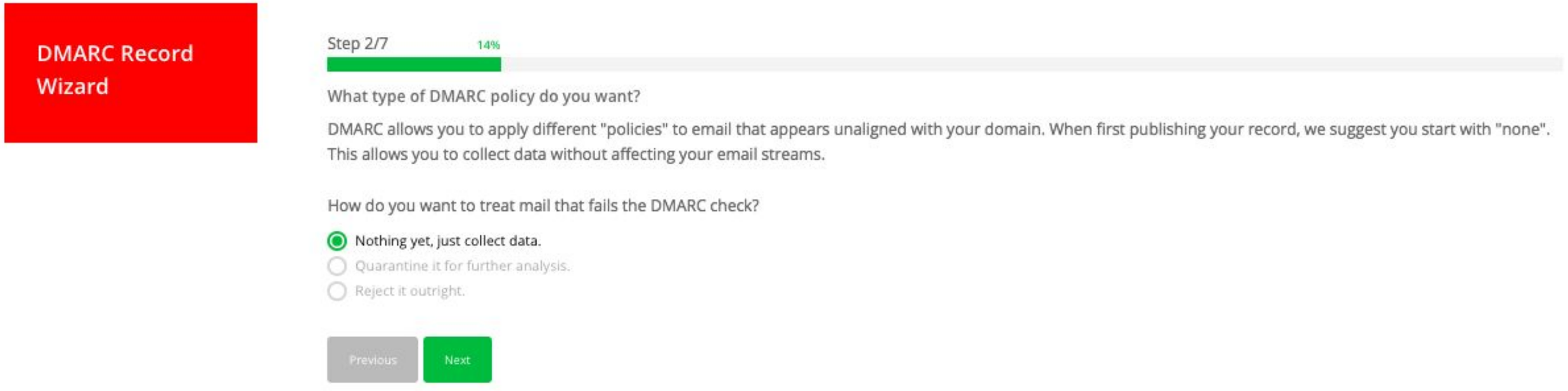
- This is where reports of failures are sent. Can be any valid email address.

- If we send reporting to a DMarcian email, will show up in your DMarcian account

- rua=mailto:ditp3aec@ag.dmarcian.com

This is complicated! How do I build this string?

https://dmarcian.com/dmarc-record-wizard/



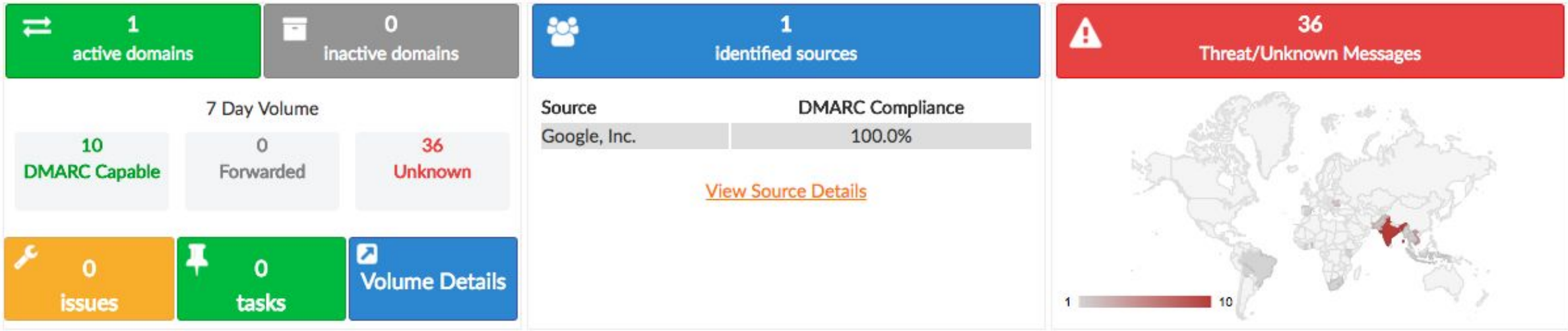
VIEWING YOUR DMARC REPORTS

REPORTS

- You could provide your own email in the “rua” tag to receive reports & crunch your own graphs….

- Or we can send reports to DMarcian and use their tools. You can see reports on DMarcian’s Monitor tab

Domain Overview



Sources shows where email sent with your domain is from.

Threat/Unknown are emails from servers that don't match your SPF/DKIM settings

Add Domains | Add DMARC | Get Compliant | Publish Policy | Monitor

Get Compliant

Once you have DMARC data for your domains, start getting DMARC capable sources of email into compliance with DMARC.

Top sources & compliance by volume

Source	DMARC	SPF	DKIM
Google, Inc.	100	100	100

To view more about your sources of email and related DKIM & SPF compliance information, use the Source Viewer.

dmarcian's mission – help people deploy DMARC

Domain Overview

Summary

7 Day Summary

Active Domains	Inactive Domains
1	0

Sources

Source	DMARC	SPF	DKIM
Google, Inc.	100%	100%	100%

View Source Data

Threat / Unknown

0 Alerts
0 Tasks
0 Issues

Domain Groups Click cells for details

Selected Domains... Go

0 domains selected

Export as CSV | Add Domains

Domains: 1 selected

From: 2018-04-28

To: 2018-05-05

Compliance Filter: None

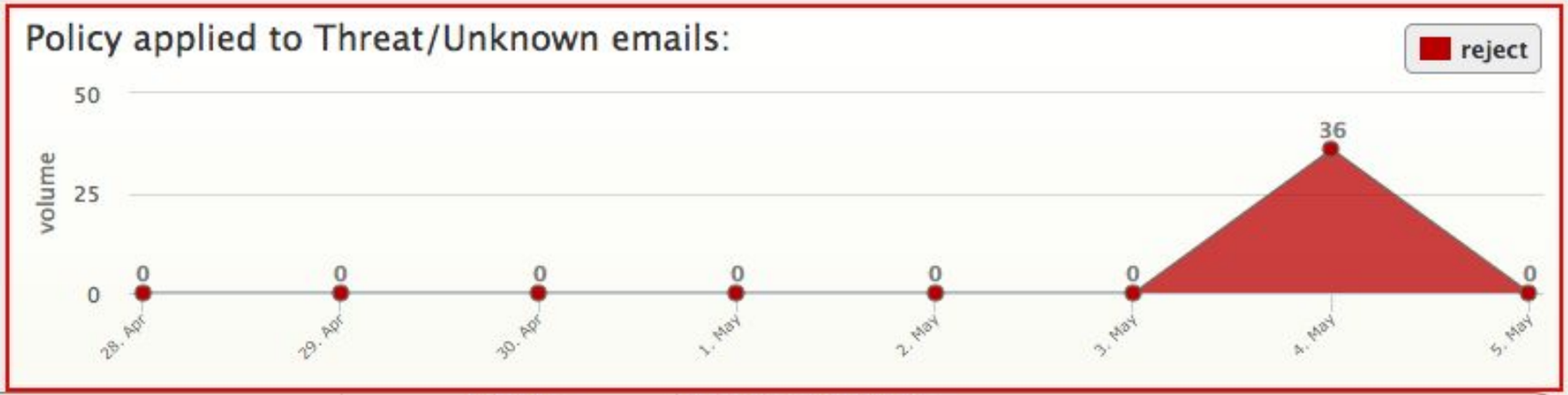
Providers: google.com

Recalculate

DMARC Capable | Non-compliant Sources | Forwarders | Threat/Unknown

Export All as CSV

Threat/Unknown sources are either fraudulent or need to be identified as legitimate. To help dmarcian identify unknown sources, click the icon next to the source to provide more information.



source	volume	DMARC compliance
Other Servers	36	100% Reject

Source	Volume	DMARC compliance
Other Servers	**36**	**100% Reject**

Reject Policy Applying To 36 of 36 messages.

Show 10 entries Search:

	Server Name	From: domain count	Message count	IP count	DMARC Compliance
⊖	*.nxdomain	1	19	19	0% (SPF: 0%, DKIM: 0%)

Show 10 entries Search: Column visibility

From: Domain	IP	PTR	Country	Messages	Policy Applied	Override Reason	DKIM			SPF			As Received By
							DMARC	Raw	d=	DMARC	Raw	Domain	
wendyk.org	91.187.122.28	nxdomain		1	Reject	none	fail	none	none	fail	softfail	wendyk.org	google.com
wendyk.org	39.44.242.212	nxdomain		1	Reject	none	fail	none	none	fail	softfail	wendyk.org	google.com
wendyk.org	91.187.109.16	nxdomain		1	Reject	none	fail	none	none	fail	softfail	wendyk.org	google.com
wendyk.org	109.166.169.113	nxdomain		1	Reject	none	fail	none	none	fail	softfail	wendyk.org	google.com
wendyk.org	123.23.93.11	nxdomain		1	Reject	none	fail	none	none	fail	softfail	wendyk.org	google.com
wendyk.org	203.189.159.169	nxdomain		1	Reject	none	fail	none	none	fail	softfail	wendyk.org	google.com
wendyk.org	89.44.11.66	nxdomain		1	Reject	none	fail	none	none	fail	softfail	wendyk.org	google.com
wendyk.org	191.240.191.72	nxdomain		1	Reject	none	fail	none	none	fail	softfail	wendyk.org	google.com
wendyk.org	203.189.131.209	nxdomain		1	Reject	none	fail	none	none	fail	softfail	wendyk.org	google.com
wendyk.org	94.248.93.232	nxdomain		1	Reject	none	fail	none	none	fail	softfail	wendyk.org	google.com

Showing 1 to 10 of 19 entries First Previous 1 2 Next Last

⊕	*.airtelbroadband.in	1	3	3	0% (SPF: 0%, DKIM: 0%)
⊕	*.servfail	1	3	3	0% (SPF: 0%, DKIM: 0%)
⊕	*.vnpt.vn	1	2	2	0% (SPF: 0%, DKIM: 0%)
⊕	*.airtel.in	1	1	1	0% (SPF: 0%, DKIM: 0%)
⊕	*.rafinsatellite.net	1	1	1	0% (SPF: 0%, DKIM: 0%)

Detail Viewer

Domains

wendyk.org

Providers

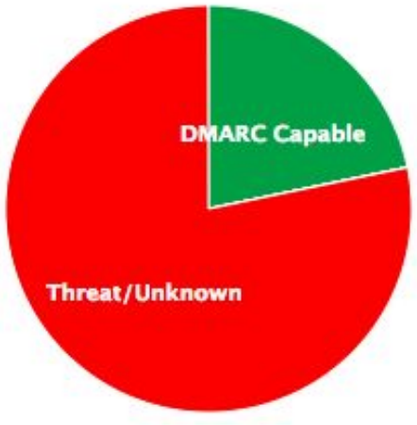
google.com

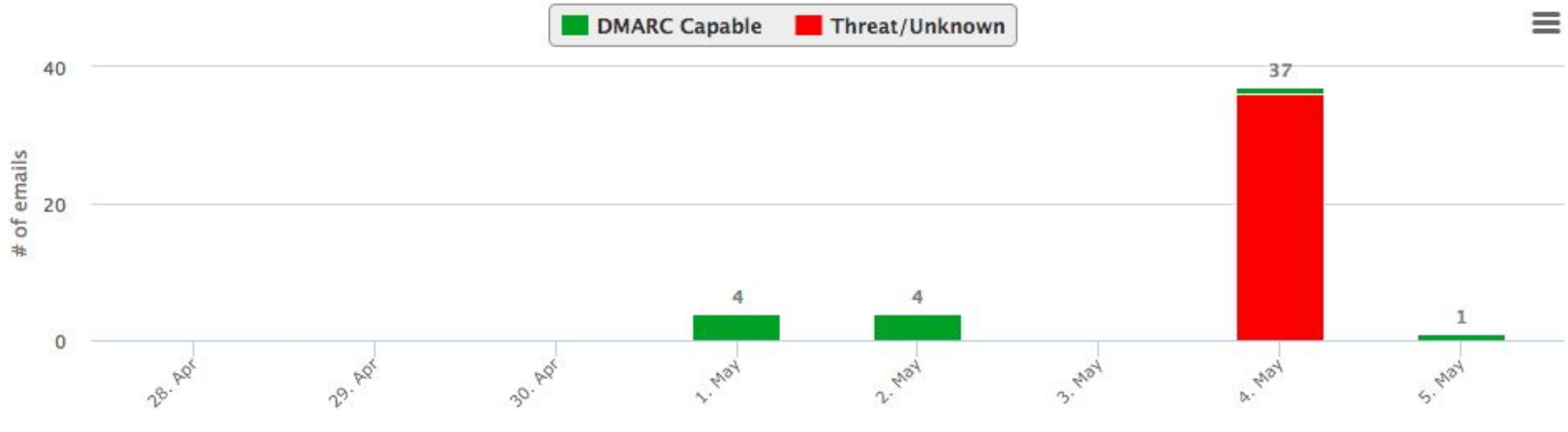
From
2018-04-28
To
2018-05-05

Filter:
None

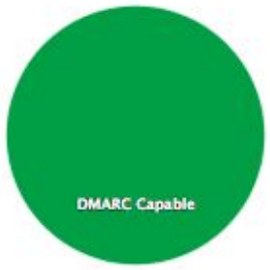
Scale:
Logarithmic

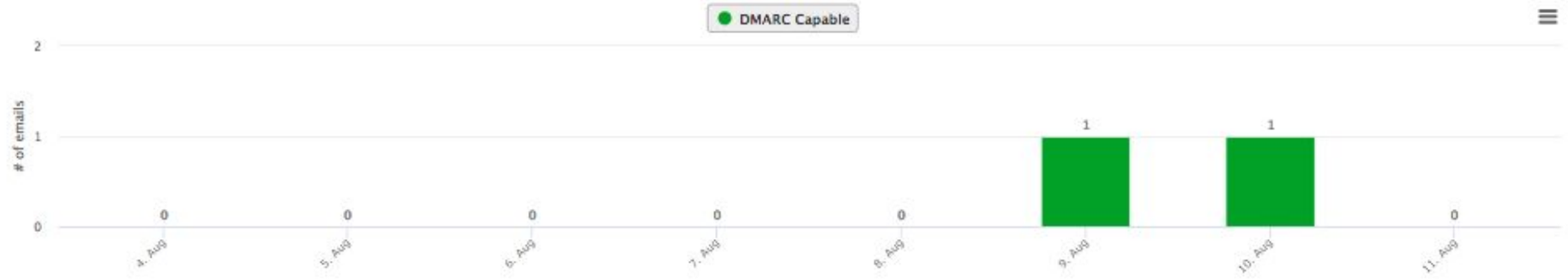
Email Volume by Category





Email Volume by Category





DMARC Capable | Non-compliant sources | Forwarders | Threat/Unknown

Export All as CSV

DMARC Capable can send DMARC compliant email. Technical staff can attend to your organization's servers. External emailers listed here can send DMARC compliant email.

DMARC Capable by Email Volume

	Source	Volume	DMARC Compliance		
+	Google, Inc.	2	100%	SPF 100%	DKIM 100%

TROUBLESHOOTING

- DMarcian's Issues tab under "Monitor" is very helpful (and don't forget about dig and nslookup)

IF YOU RUN YOUR OWN MAIL SERVER

MTA STRICT TRANSPORT SECURITY (MTA-STS)

- Allows domains to require authentication and TLS encryption for SMTP

START-TLS

- Allows your mail server to protect against downgrades
- https://starttls-everywhere.org/
  - Creating a list of email servers that use TLS

MORE RESOURCES

- https://www.ftc.gov/news-events/blogs/business-blog/2017/03/want-stop-phishers-use-email-authentication

- https://blog.returnpath.com/how-to-explain-spf-in-plain-english/

- https://blog.returnpath.com/how-to-explain-dkim-in-plain-english-2/

- https://blog.returnpath.com/how-to-explain-dmarc-in-plain-english/

- https://zakird.com/papers/mail.pdf

- https://www.usenix.org/system/files/conference/usenixsecurity18/sec18-hu.pdf

Suggested Questions

What happens with DMARC if you don’t have SPF and DKIM set up?

What does SPF do again? What’s DKIM once more?

What kind of encryption is going on with DKIM?

I use <other technology> how can I <secure my website/email>?