The Dark Ages of App Configuration

presented by **Scott Motte – Mot**

www.dotenvx.com

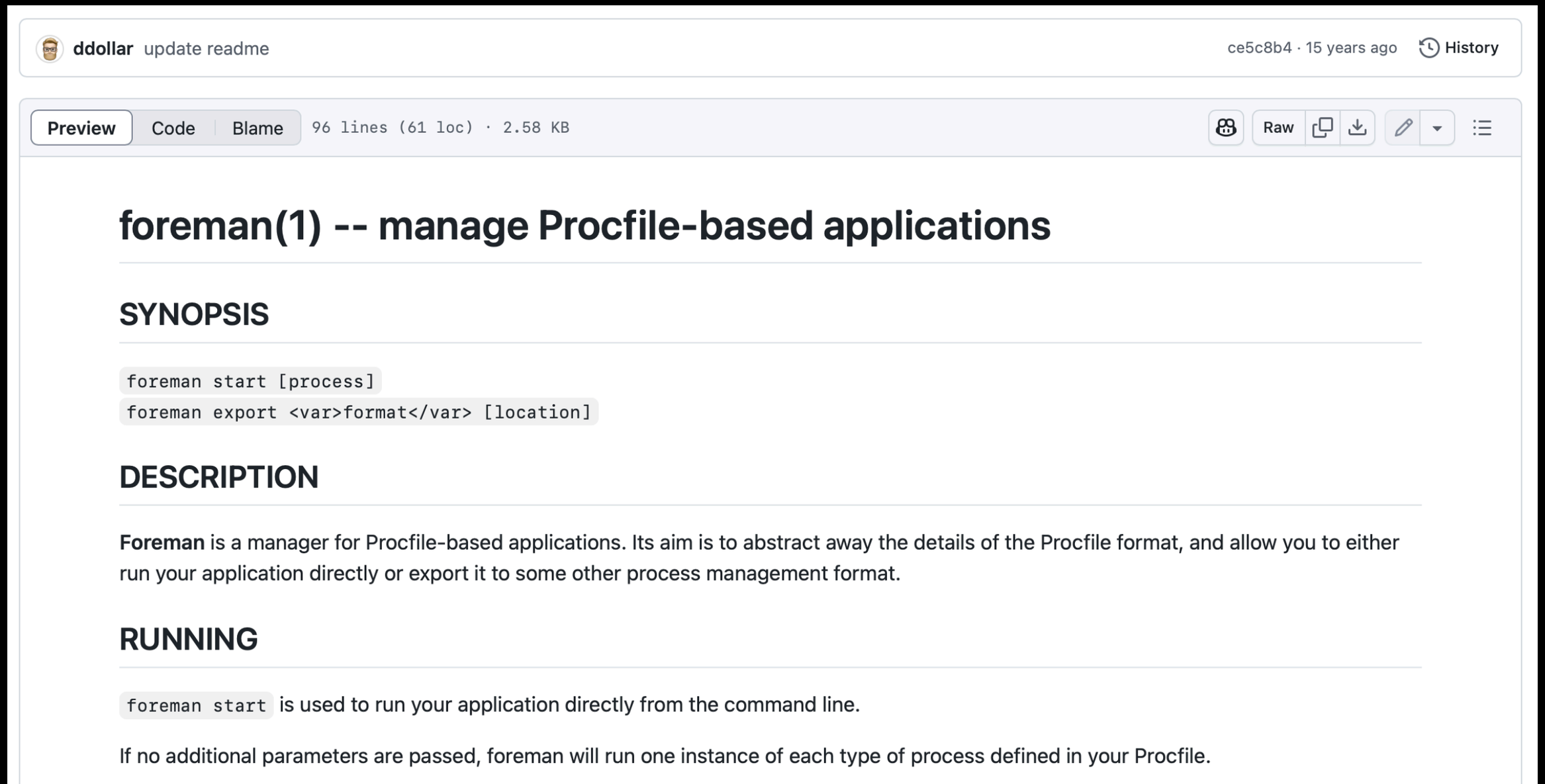
Secrets lived in code (2008)

Then came Heroku (2009)

Procfile (2009)

```
web: RAILS_ENV=production rails server
worker: RAILS_ENV=production script/delayed_job start
```

Foreman (2010)



The .env Renaissance

Twelve-Factor App (2011)

Dotenv is Born (2012)

13 files changed +188 -0 lines changed ↑ Top Search within code

lib/dotenv/environment.rb +22

```
@@ -0,0 +1,22 @@
+ module Dotenv
+   class Environment < Hash
+     def initialize(filename)
+       @filename = filename
+       load
+     end
+
+     def load
+       read.each do |line|
+         self[$1] = $2 if line =~ /\A([\w_]+)=(.*)\z/
+       end
+     end
+
+     def read
```

Ruby to Node (2013)

2013: phpdotenv
2013: python-dotenv
2013: dotenv (nodejs)
2013: godotenv
2013: dotenv_elixir
2014: dotenv-rs
2014: docker-compose
2017: dotenv.net
2017: dotenv-kotlin
2020: dotenv-java
2021: swift-dotenv

Small Code, Big Reach

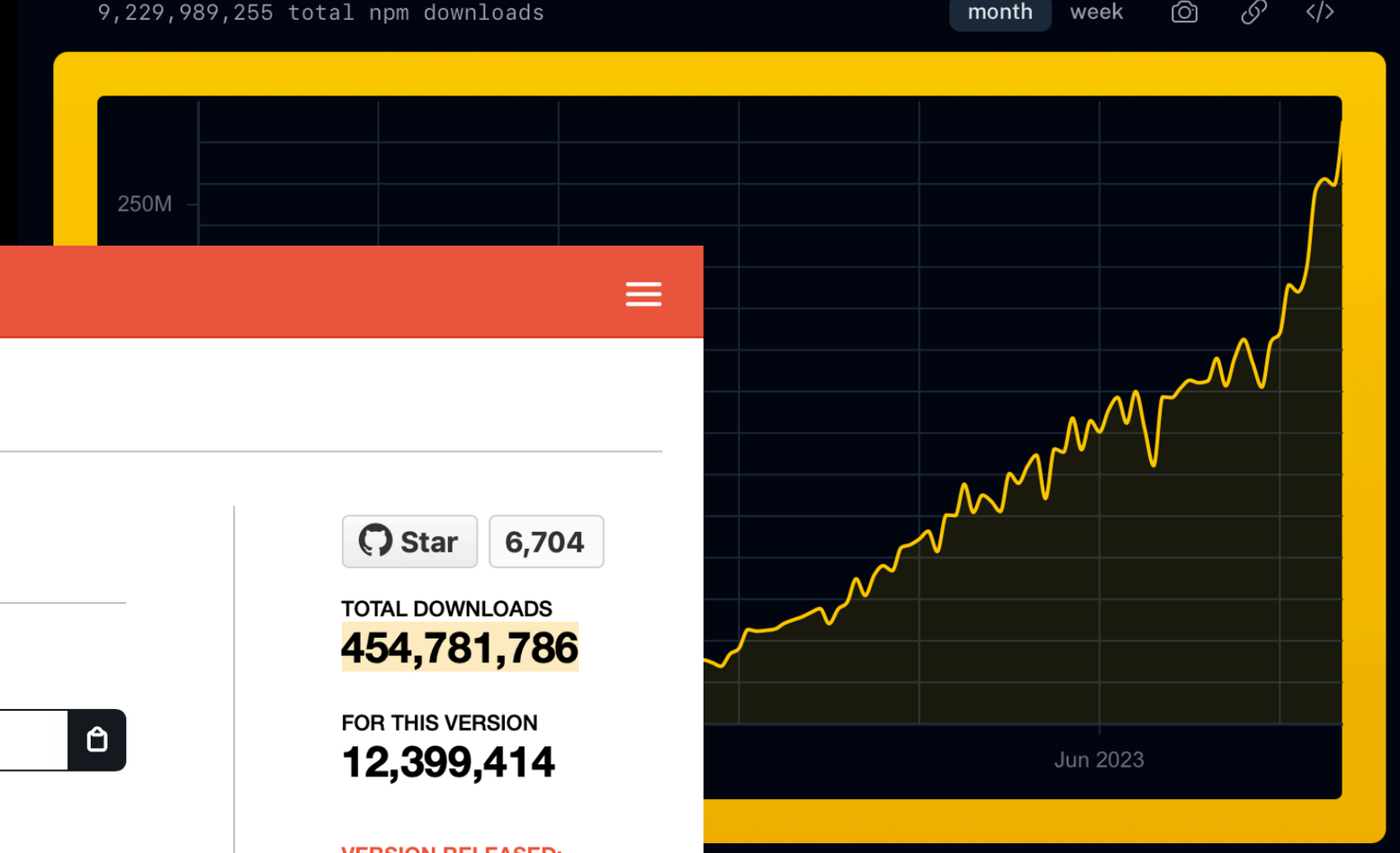
dotenv v17.2.2

Loads environment variables from .env file

github.com/motdotla/dotenv#readme

9,229,989,255 total npm downloads

month week



dotenv *3.1.8*

Loads environment variables from `.env`.

GEMFILE:

```
gem 'dotenv', '~> 3.1', '>= 3.1.8'
```

INSTALL:

```
gem install dotenv
```

Star 6,704

TOTAL DOWNLOADS

454,781,786

FOR THIS VERSION

12,399,414

VERSION RELEASED:

ON APR 10

🏛️ Before .env files

- Configuration scattered across code, hardcoded credentials, no order.
- Every app reinvented the wheel. Chaos.

🌅 The .env Renaissance

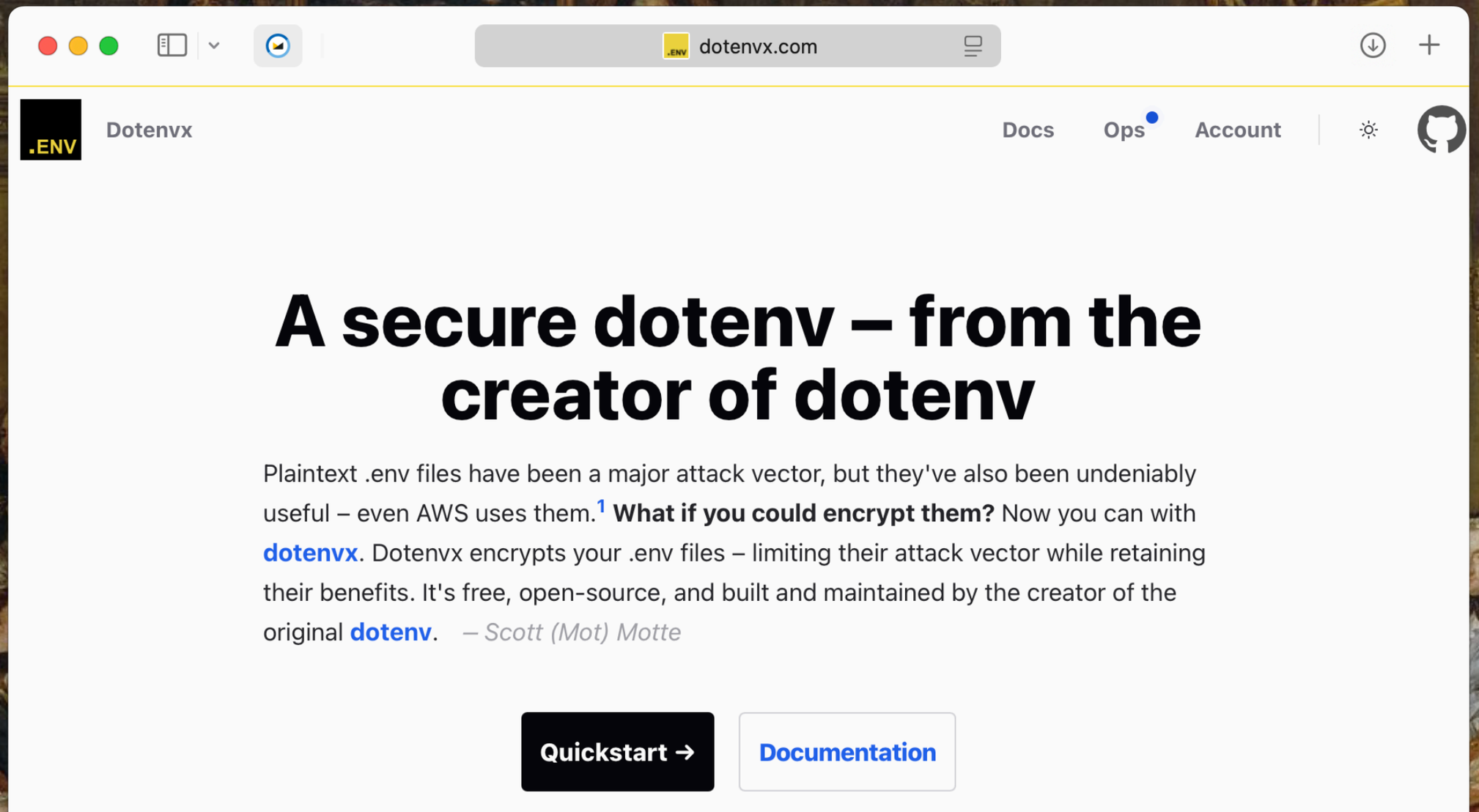
- Simplicity, clarity, and portability return.
- Developers rediscover “human-scale” configuration.
- Tools like dotenv spread literacy and discipline — configuration becomes readable again.

🦾 Present day

- What comes next?

What if you could encrypt .env files?

Introducing dotenvx



live demo: dotenvx encrypt

How ECIES works

Elliptical Curve Integrated Encryption Scheme

Let's start with the inputs

[DOTENV_PRIVATE_KEY]

330e791f55fd59ae377eb4328e2296629244b9e37372dd5a41322a5133ed0a19

[CIPHERTEXT]

BPWRbDxAUjjLpVJ+w1ytS1FjMPUvnT6Jv9w+I8c+eA3V9rkl1JwADfIM9hbmd3ewtP
fYpJdOIBxmuHkFY8+AjffMSoNNKkNmAIZm8qjnFmex9xwbo39987fDOAjwQ3cNkQYF
tqPP

```
 4
 5 # ----------------------------
 6 # How ECIES works
 7 # ----------------------------
-8 DOTENV_PRIVATE_KEY =
   "330e791f55fd59ae377eb4328e2296629244b9e37372dd5a41322a5133ed0a19"
-9 CIPHERTEXT         = "BPWRbDxAUjjLpVJ+w1ytS1FjMPUvnT6Jv9w+I8c+
   eA3V9rkl1JwADfIM9hbmd3ewtPfYpJdOIBxmuHkFY8+
   AjffMSoNNKkNmAIZm8qjnFmex9xwbo39987fDOAjwQ3cNkQYFtqPP"
10
```

Grab their binary form

```
[ pk_bin ]
{ [DOTENV_PRIVATE_KEY].pack("H*") }


[ ciphertext_bin ]
{ Base64.strict_decode64(CIPHERTEXT) }
```

```
10
11 pk_bin = [DOTENV_PRIVATE_KEY].pack("H*")
12 ciphertext_bin = Base64.strict_decode64(CIPHERTEXT)
13
```

Expand ciphertext_bin

```
[ ciphertext_bin ]

| ephemeral_pk (65) | encrypted_blob |
```

```
13
14 puts "[ciphertext_bin]"
15 ephemeral_pk = ciphertext_bin[0, 65]
16 encrypted_blob = ciphertext_bin[65..]
17 puts "[ ephemeral_pk (65) | encrypted_blob ]"
18
```

Expand encrypted_blob

```
[ ciphertext_bin ]

| ephemeral_pk (65) | encrypted_blob                                  |

| ephemeral_pk (65) | nonce (16) | auth_tag (16) | decryptable (rest) |
```

```ruby
nonce = encrypted_blob[0, 16]
tag = encrypted_blob[16, 16]
decryptable = encrypted_blob[16 + 16..]
puts "[ ephemeral_pk (65) | nonce (16) | auth_tag (16) | decryptable (rest) ]"
puts [ephemeral_pk.unpack1("H*"), nonce.unpack1("H*"), tag.unpack1("H*"),
decryptable.unpack1("H*")].join(" | ")

```

Derive shared point (ECDH on secp256k1)

```
[ ciphertext_bin ]

| ephemeral_pk (65) | encrypted_blob                                  |

| ephemeral_pk (65) | nonce (16) | auth_tag (16) | decryptable (rest) |

[ ephemeral_pk ]

{ ephemeral_pk + pk_bin }(secp256k1) = shared_point
```

```
24
25 # Derive shared point (ECDH on secp256k1)
26 curve = Secp256k1::PublicKey.new(pubkey: ephemeral_pk, raw: true)
27 shared_point = curve.tweak_mul(pk_bin)
28
```

Using ECDH on secp256k1, we combine the ephemeral public key (from the ciphertext) with our private key. That produces a shared point unique to this pair of keys.

Derive AES key from shared point

```
[ ciphertext_bin ]

| ephemeral_pk (65) | encrypted_blob                                  |

| ephemeral_pk (65) | nonce (16) | auth_tag (16) | decryptable (rest) |

[ ephemeral_pk ]

{ ephemeral_pk + pk_bin }(secp256k1) = shared_point

{ shared_point }(hkdf) = aes_key
```

```ruby
# Derive AES key from shared point
combined = curve.serialize(compressed: false) + shared_point.serialize(compressed: false)
aes_key = OpenSSL::KDF.hkdf(combined, salt: "", info: "", length: 32, hash: "SHA256")
puts "[aes_key] #{aes_key.unpack1("H*")}"
```

We pass the combined values through HKDF, a key derivation function, to get our AES-256 key. This is the same key the sender used to encrypt the data.

Decrypt with AES key

```
[ ciphertext_bin ]

| ephemeral_pk (65) | encrypted_blob                                  |

| ephemeral_pk (65) | nonce (16) | auth_tag (16) | decryptable (rest) |

[ ephemeral_pk ]

{ ephemeral_pk + pk_bin }(secp256k1) = shared_point

{ shared_point }(hkdf) = aes_key

{ aes_key, decryptable }(aes-256-gcm.decrypt) = plaintext
```

Decrypt [decryptable] using AES-GCM.

```
34 # Decrypt
35 decipher = OpenSSL::Cipher.new("aes-256-gcm").decrypt
36 decipher.key = aes_key
37 decipher.iv_len = 16
38 decipher.iv = nonce
39 decipher.auth_tag = tag
40 decipher.auth_data = ""
41 plaintext = decipher.update(decryptable) + decipher.final
42 puts "[plaintext] #{plaintext}"
```

phew...but

There's now a gem!

gem "eciesrb", require: "ecies"

Quick Start

```ruby
# examples/quickstart.rb
require "ecies"

# Generate a secret key
sk = Ecies.generate_key
raw_sk = Ecies.decode_hex(sk.send(:serialize))
raw_pk = sk.pubkey.serialize(compressed: false)

# Encrypt data with the receiver's public key
plaintext = "Hello, World!"
encrypted = Ecies.encrypt(raw_pk, plaintext)

# Decrypt data with the receiver's secret key
decrypted = Ecies.decrypt(raw_sk, encrypted)
puts decrypted  # => "Hello, World!"
```

rubygems.org/gems/eciesrb

Search Gems..

RELEASES BLOG GEMS GUIDES SIGN IN

eciesrb *0.0.1*

Elliptic Curve Integrated Encryption Scheme for secp256k1 in Ruby, based on libsecp256k1 and OpenSSL.

GEMFILE:

```
gem 'eciesrb', '~> 0.0.1'
```

INSTALL:

```
gem install eciesrb
```

VERSIONS:

0.0.1 October 22, 2025 (8.5 KB)

RUNTIME DEPENDENCIES (2):

libsecp256k1 ~> 0.6.1
openssl ~> 3.3

Star 1

TOTAL DOWNLOADS
141

FOR THIS VERSION
141

VERSION RELEASED:
ON OCT 21

LICENSE:
MIT

REQUIRED RUBY VERS
>= *3.2*

That's it. Thank you.

dotenvx.com

Go Deeper

dotenvx.com

Read the Whitepaper

Dotenvx: Reducing Secrets Risk with Cryptographic Separation

Abstract. An ideal secrets solution would not only centralize secrets but also contain the fallout of a breach. While secrets managers offer centralized storage and distribution, their design creates a large blast radius, risking exposure of thousands or even millions of secrets. We propose a solution that reduces the blast radius by splitting secrets management into two distinct components: an encrypted secrets file and a separate decryption key.

[Read the Whitepaper]

Dotenvx: Reducing Secrets Risk with Cryptographic Separation

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Abstract. An ideal secrets solution would not only centralize secrets but also contain the fallout of a breach. While secrets managers offer centralized storage and distribution, their design creates a large blast radius, risking exposure of thousands or even millions of secrets. We propose a solution that reduces the blast radius by splitting secrets management into two distinct components: an encrypted secrets file and a separate decryption key.

1. Introduction

Modern software relies on secrets to operate—API keys, tokens, and credentials are essential for applications to interact with services like Stripe, Twilio, and AWS. The majority of these secrets are stored in platform-native secrets managers such as AWS Secrets Manager, Vercel Environment Variables, and Heroku Config Vars. These systems offer convenience by centralizing secrets and seamlessly injecting them into runtime environments. However, this centralization introduces significant risks. If breached, they expose all secrets stored within, resulting in a blast radius where thousands or even millions of secrets may be leaked. At the same time, alternatives such as .env files minimize blast radius but lack the safeguards necessary to prevent unauthorized access. Developers are left choosing between simplicity with higher risk or complexity with a larger blast radius.

What is needed is a secrets system based on hybrid cryptography instead of trust, allowing a developer to encrypt secrets without relying on any third party to remain secure. In this paper, we propose a solution to these risks using a library that decrypts an encrypted secrets file at runtime with a private key stored separately in the platform's secrets manager. This approach contains the blast radius of a breach while maintaining the simplicity of .env files. Even if one component—either the encrypted file or the secrets manager—is compromised, secrets remain secure. Only simultaneous access to both can expose them.

2. Secrets

We define a secret as a token or string value, typically issued by a third-party

1

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