# SeifPass: a Secure Password Manager

**MIT PRIMES**
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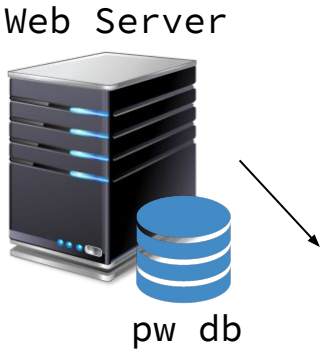
# Problem

- Passwords: common, but vulnerable to offline attacks


| User | Password |
|---|---|
| Alice | password123 |
| Bob | MyPetsName |
| ... | ... |

# Hash

Web Server

pw db

| User | Password |
|---|---|
| Alice | hash(password123) |
| Bob | hash(MyPetsName) |
| ... | ... |

Linked in

Attacker

pw db

| Common passwords | Computed hash |
|---|---|
| password123 | hash(password123) |
| MyPetsName | hash(MyPetsName) |
| ... | ... |

# Salted Hash

Web Server

pw db

| User | Hashed Password, Salt |
|---|---|
| Alice | hash(password123 + 4abcd@!#), 4abcd@!# |
| Bob | hash(MyPetsName + abcd%), abcd% |
| ... | ... |

Attacker

pw db

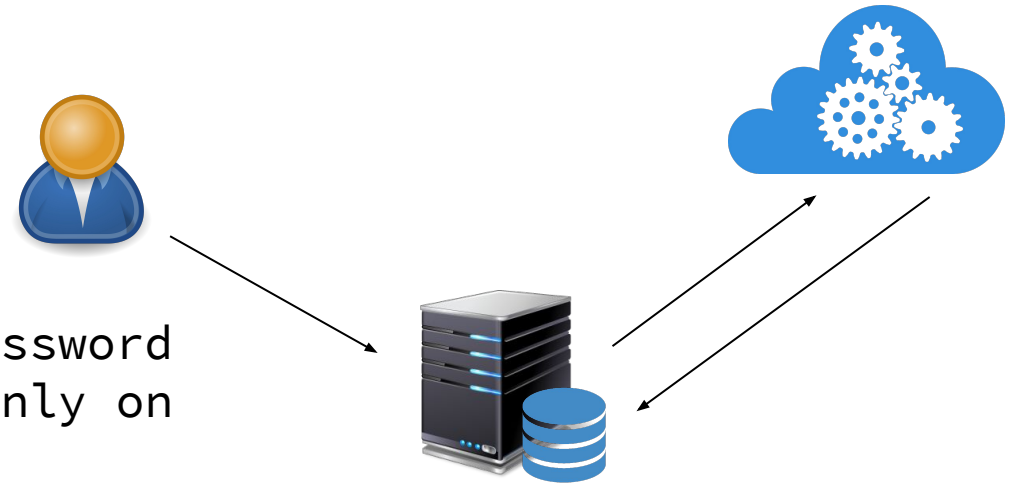
| Common passwords | Computed hash |
|---|---|
| password123 | hash(password123 + 4abcd@!#) |
| MyPetsName | hash(MyPetsName + abcd%) |
| ... | ... |

# Solution

- Architecture for password hardening using a remote cryptographic service

Benefits:

- No offline attacks



Hardening: encrypting password with secret key stored only on crypto service

# Distributed Trust


Hard to detect online attacks

harden($pw_0$)

harden($pw_1$)

User

hash(pw)

Web Server

pw db

hash(pw)

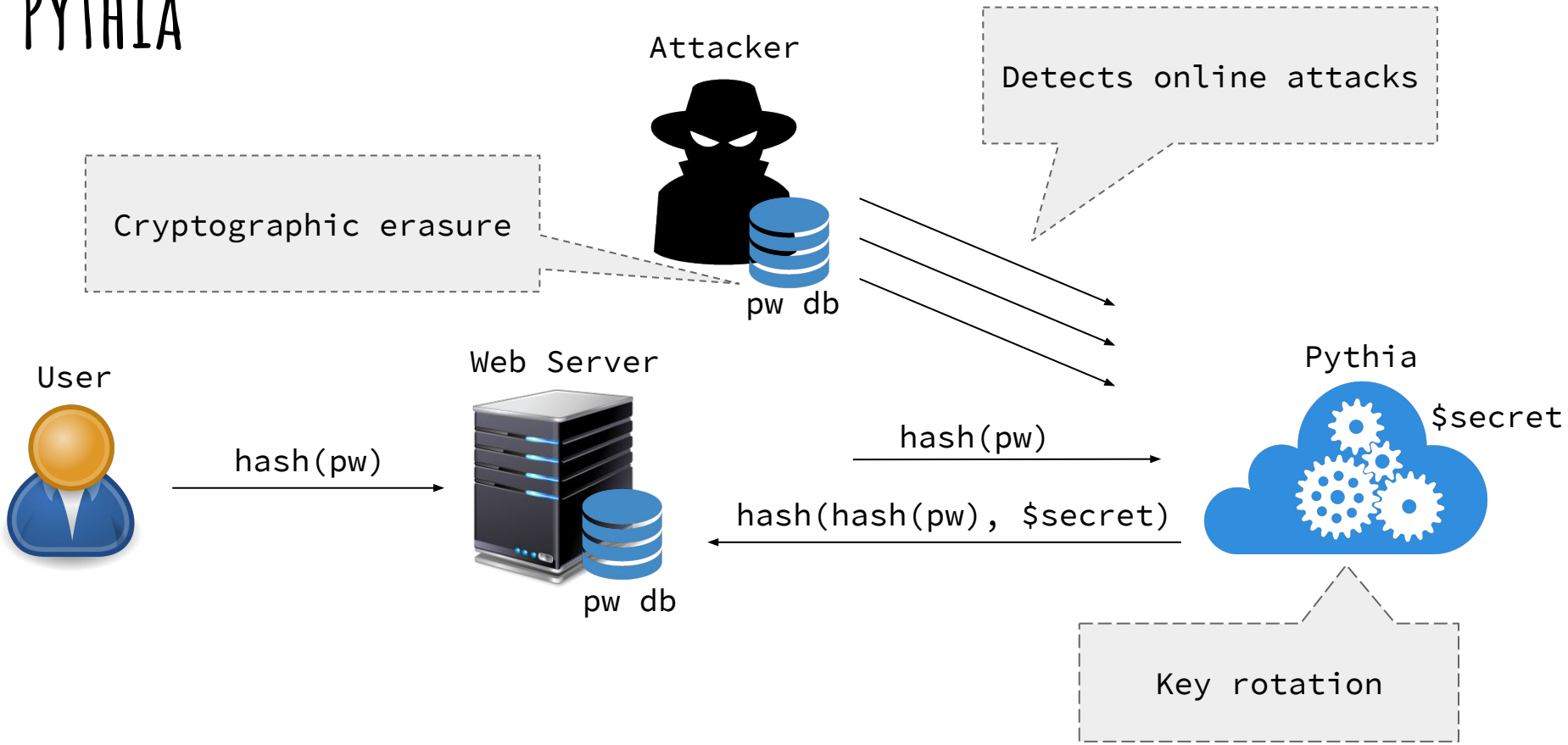
hash(hash(pw), $secret)

Crypto Service

$secret

How do we rotate $secret?

# Pythia

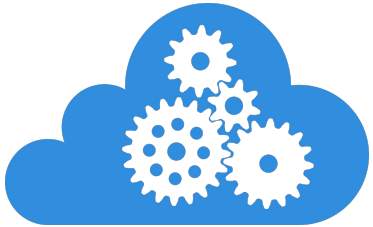

Attacker
Detects online attacks
Cryptographic erasure
pw db
User
Web Server
Pythia
$secret
hash(pw)
hash(pw)
hash(hash(pw), $secret)
pw db
Key rotation

# Pythia - New User

User

Web Server

pw db



Pythia

user,pw

t = random()
x = randomize(pw)

query(w, t, x)

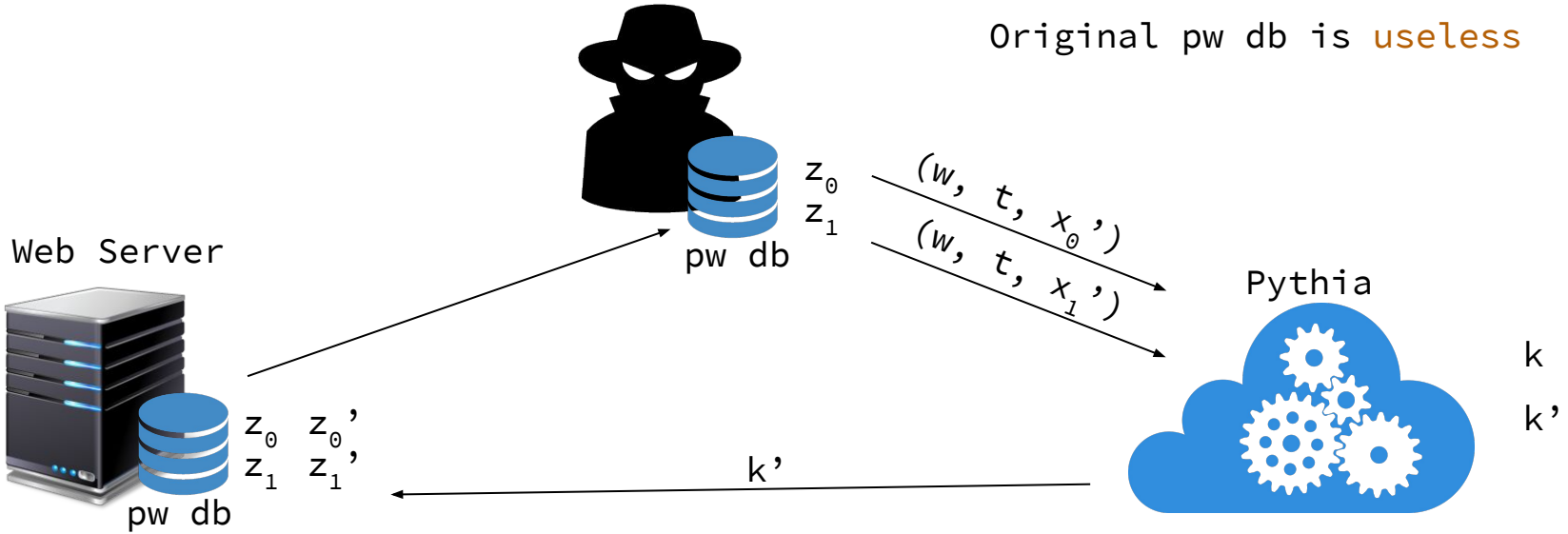
w: web server id
t: user id
x: randomized password

k = keytable[w]
y = F(k, t, x)

y

z = unrandomize(y)
store: (user, t, z)

# Compromise Recovery



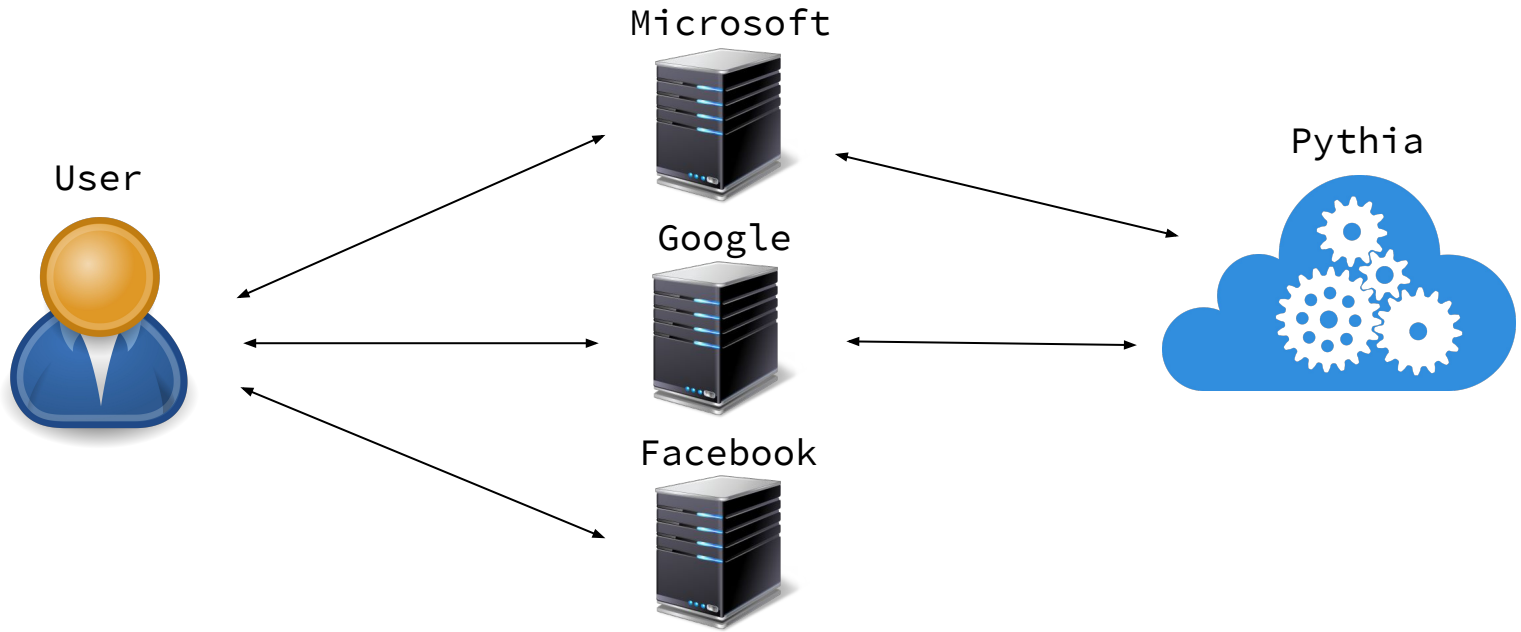

No need for original password

User password does not change

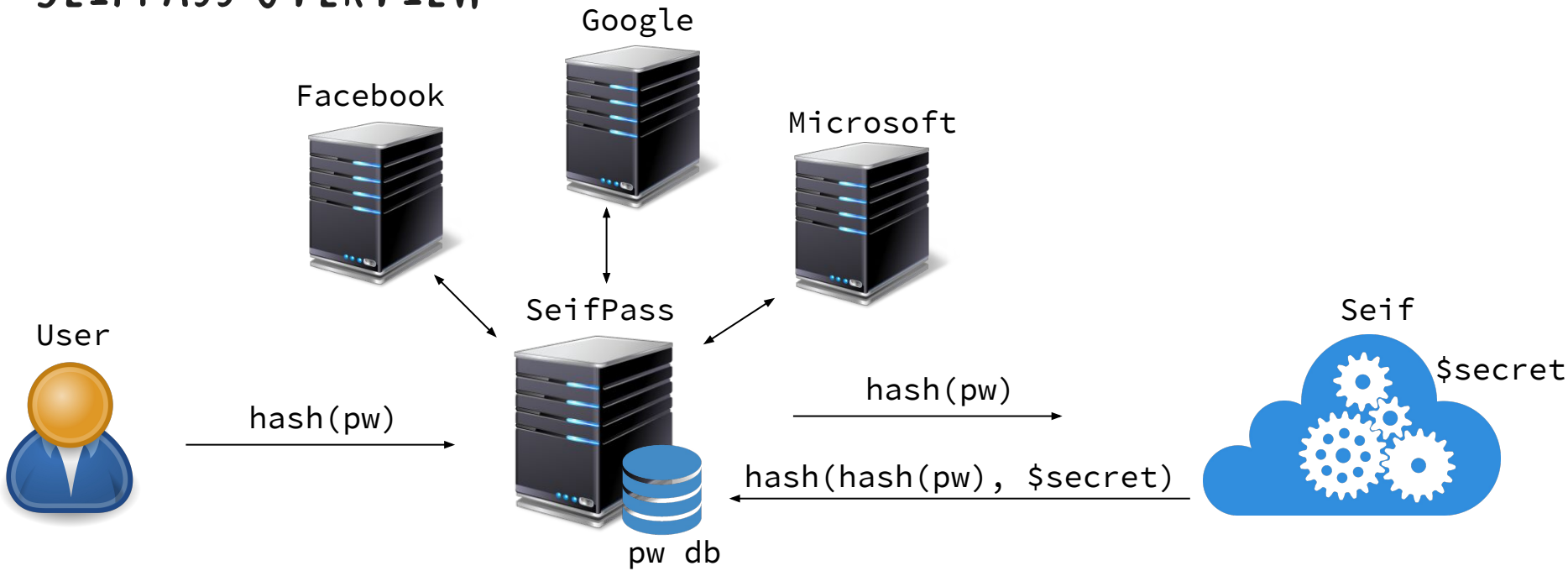
**Key:**
z_i : passwords
w: web server id
t: user id
x: randomized password
k: pythia instance for this web server

# Limitations of Pythia

- May be hard to merge in large code base
- No guarantee applications will implement it



# SeifPass Overview




User does not have to depend on application to secure password

# Seif - Node.js Pythia Wrapper

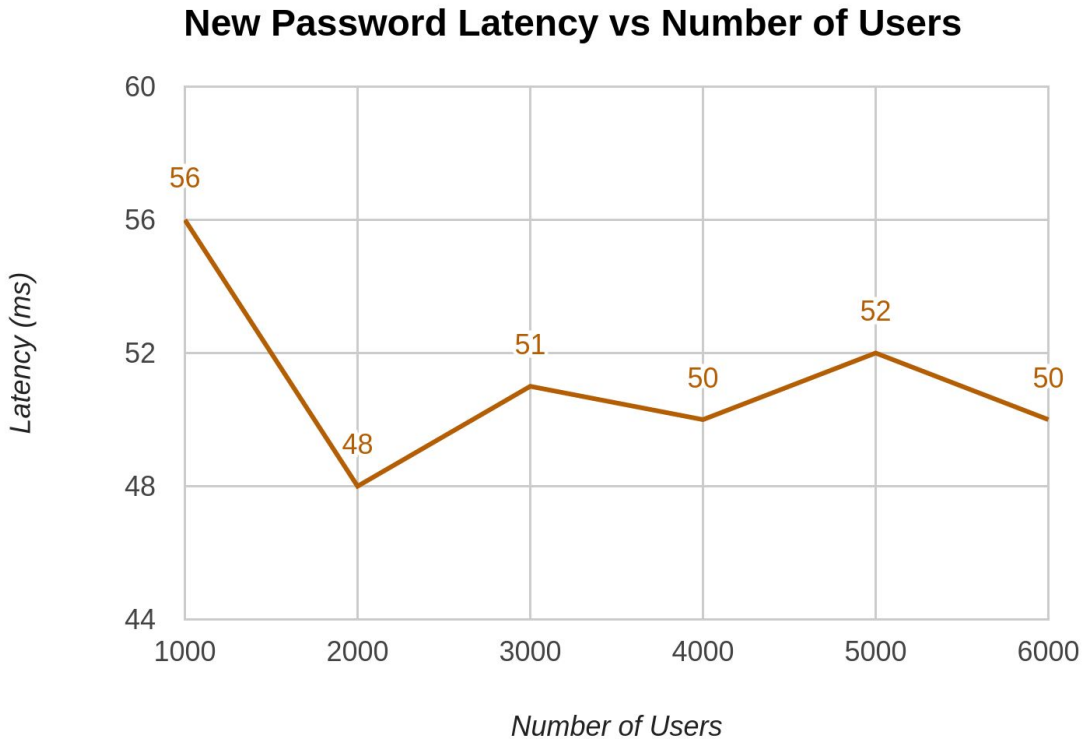
- Pythia Service in Node.js
- Easy to use
- https://github.com/naitsirc/seif

express

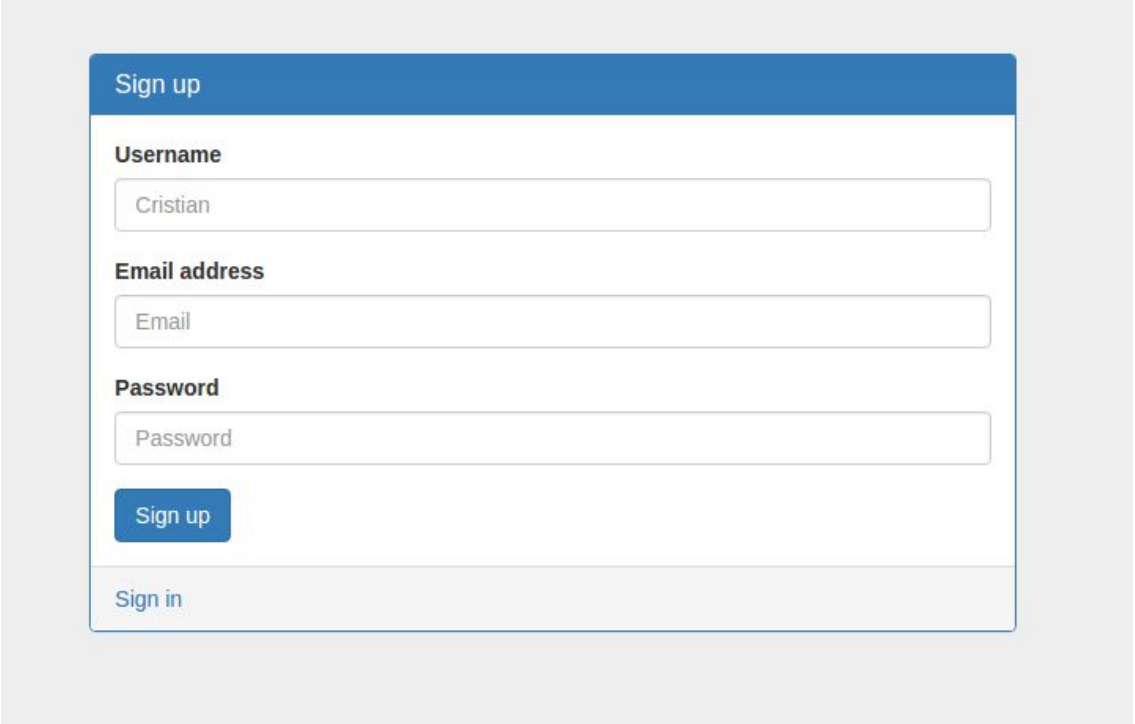
Dependencies:

- Relic Crypto Library
- pyrelic (python wrapper for Relic)
- Node.js
- Express.js (web application framework)
- mongoDB

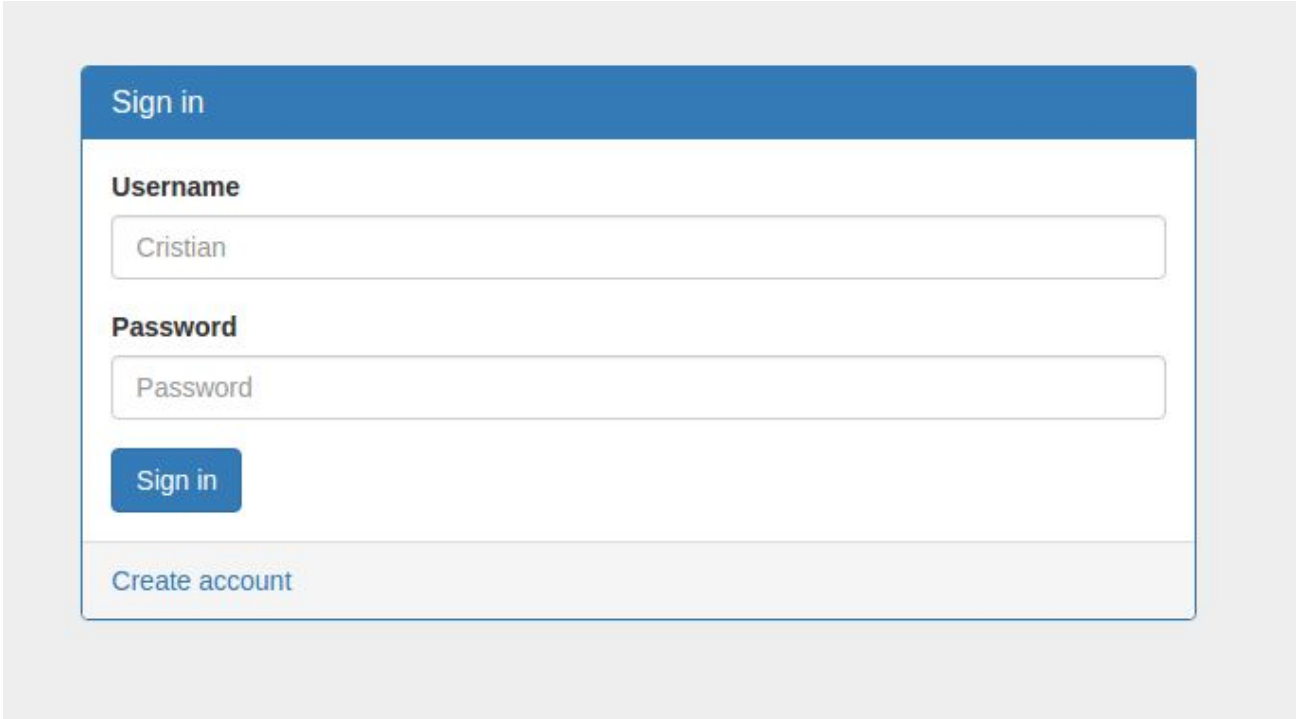
# Scalability Study



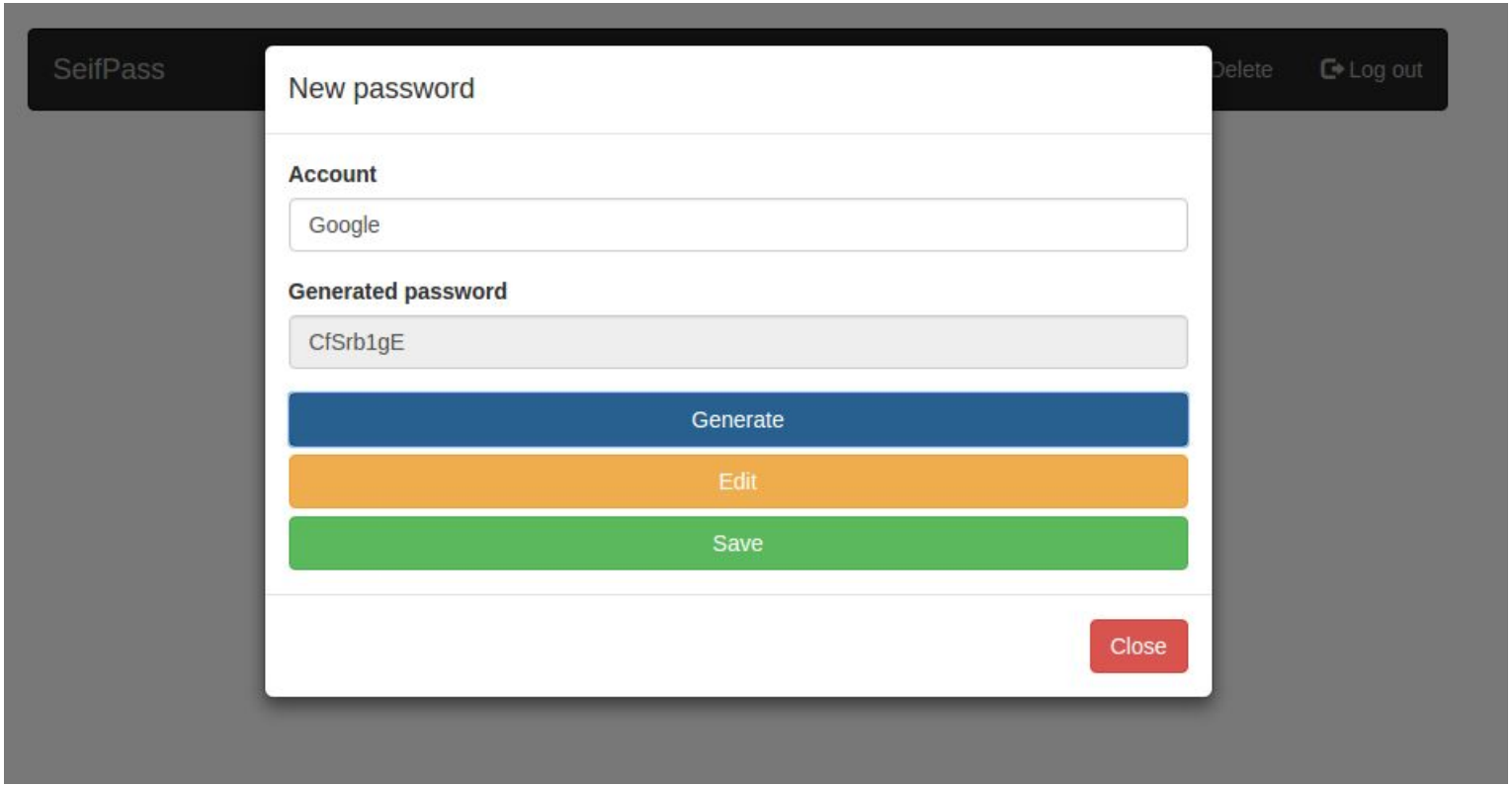
# SeifPass - Sign up



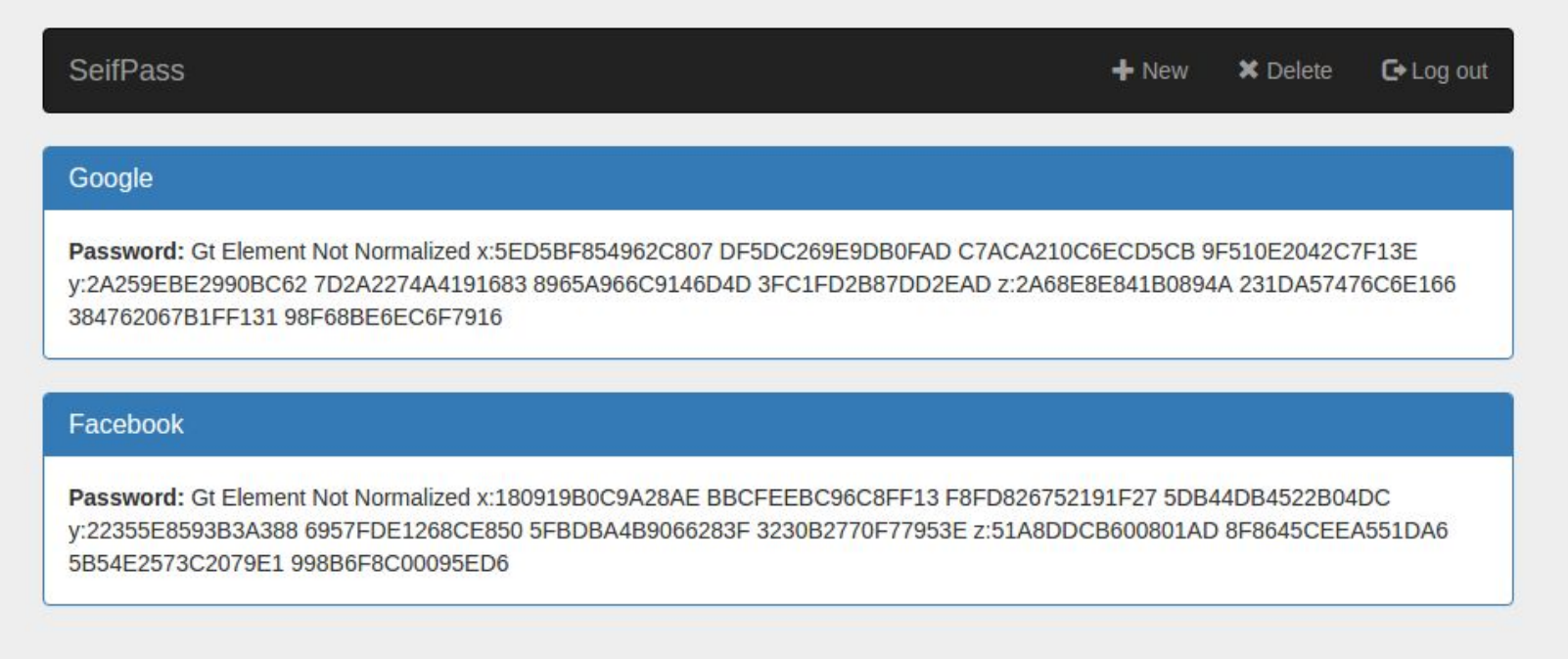
# SeifPass - Sign in



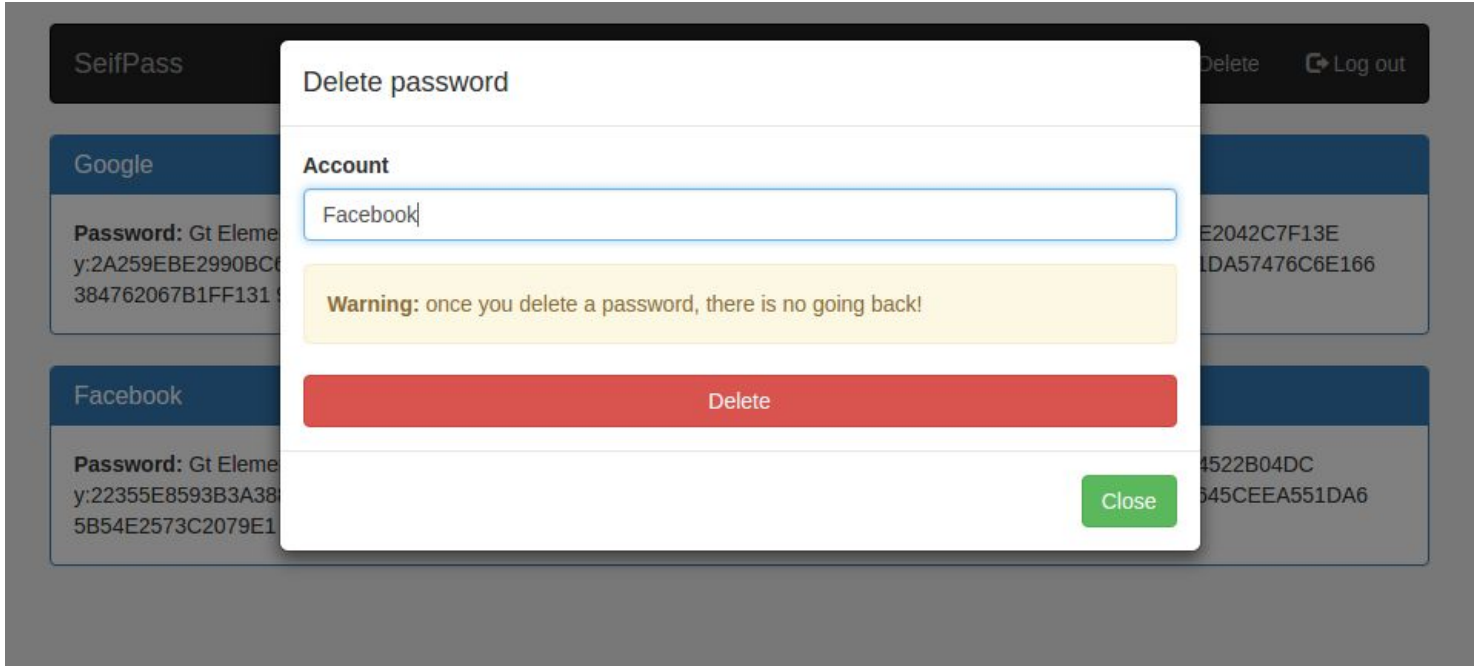
# SeifPass - New Password



# SeifPass - Password Manager



# SeifPass - Delete Password



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Thank you to my parents for the support!