Aus den Fehlern anderer lernen

Web Security verstehen durch Gegenbeispiele

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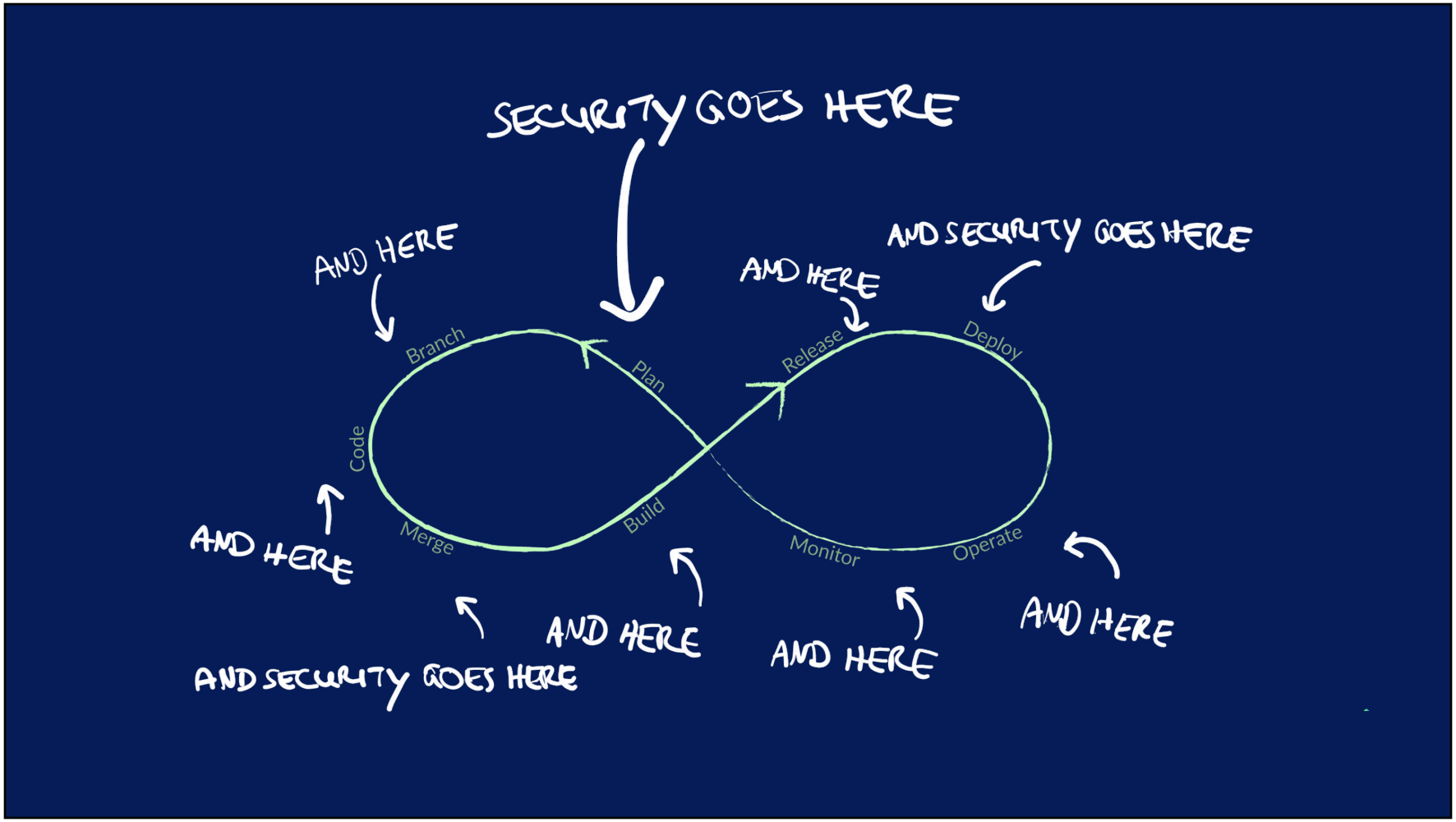
SECURITY GOES HERE
AND HERE
AND HERE
AND SECURITY GOES HERE
Code
Branch
Plan
Release
Deploy
Merge
Build
Monitor
Operate
AND HERE
AND SECURITY GOES HERE
AND HERE
AND HERE
AND HERE

Preliminary

learning from
the mistakes of others

≠

fingerpointing & blaming

OWASP Top Ten

1. Broken Access Control
2. Cryptographic Failures
3. Injection
4. Insecure Design
5. Security Misconfiguration
6. Vulnerable and Outdated Components
7. Identification and Authentication Failures
8. Software and Data Integrity Failures
9. Security Logging and Monitoring Failures
10. Server-Side Request Forgery (SSRF)

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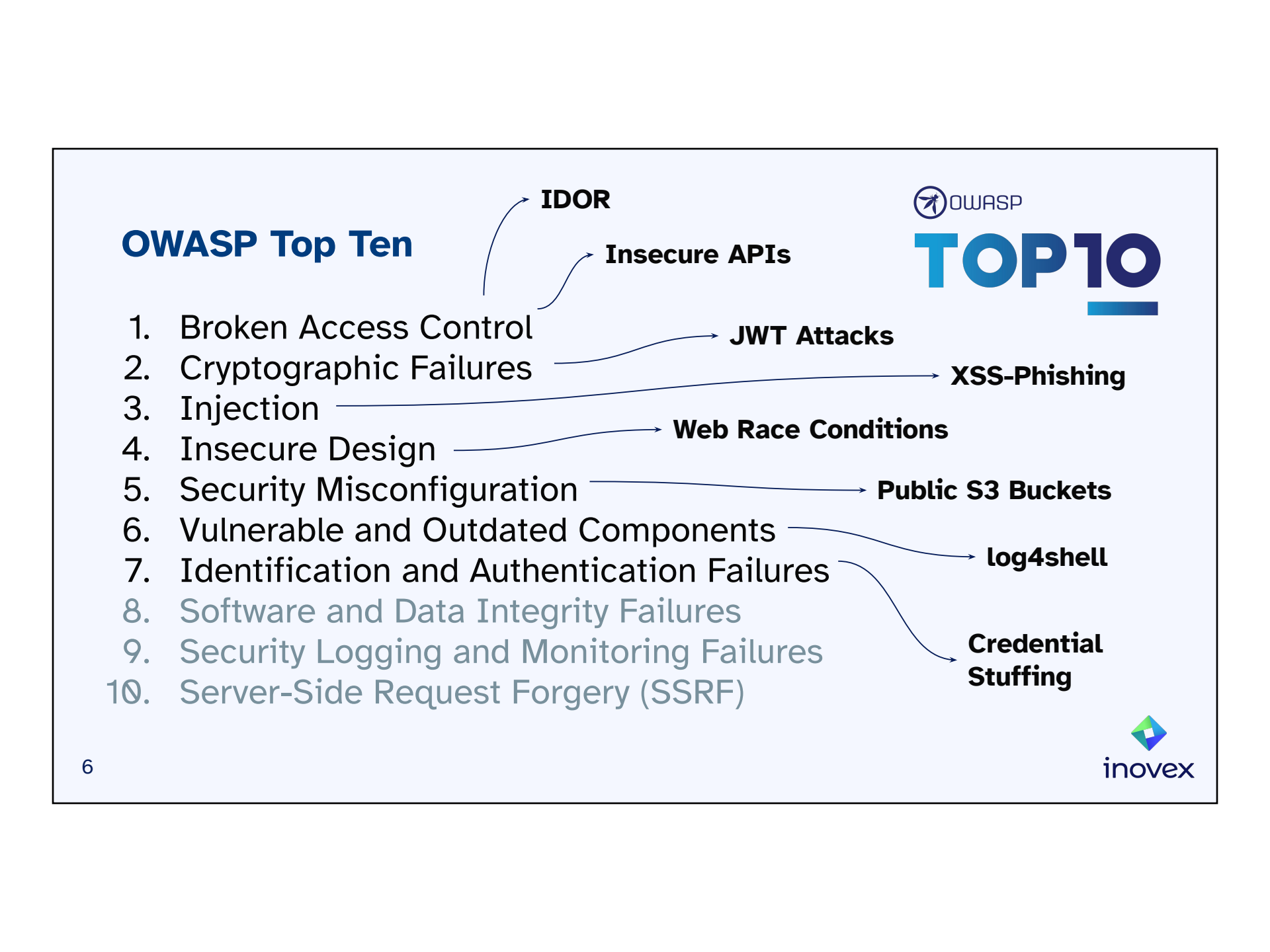
OWASP Top Ten



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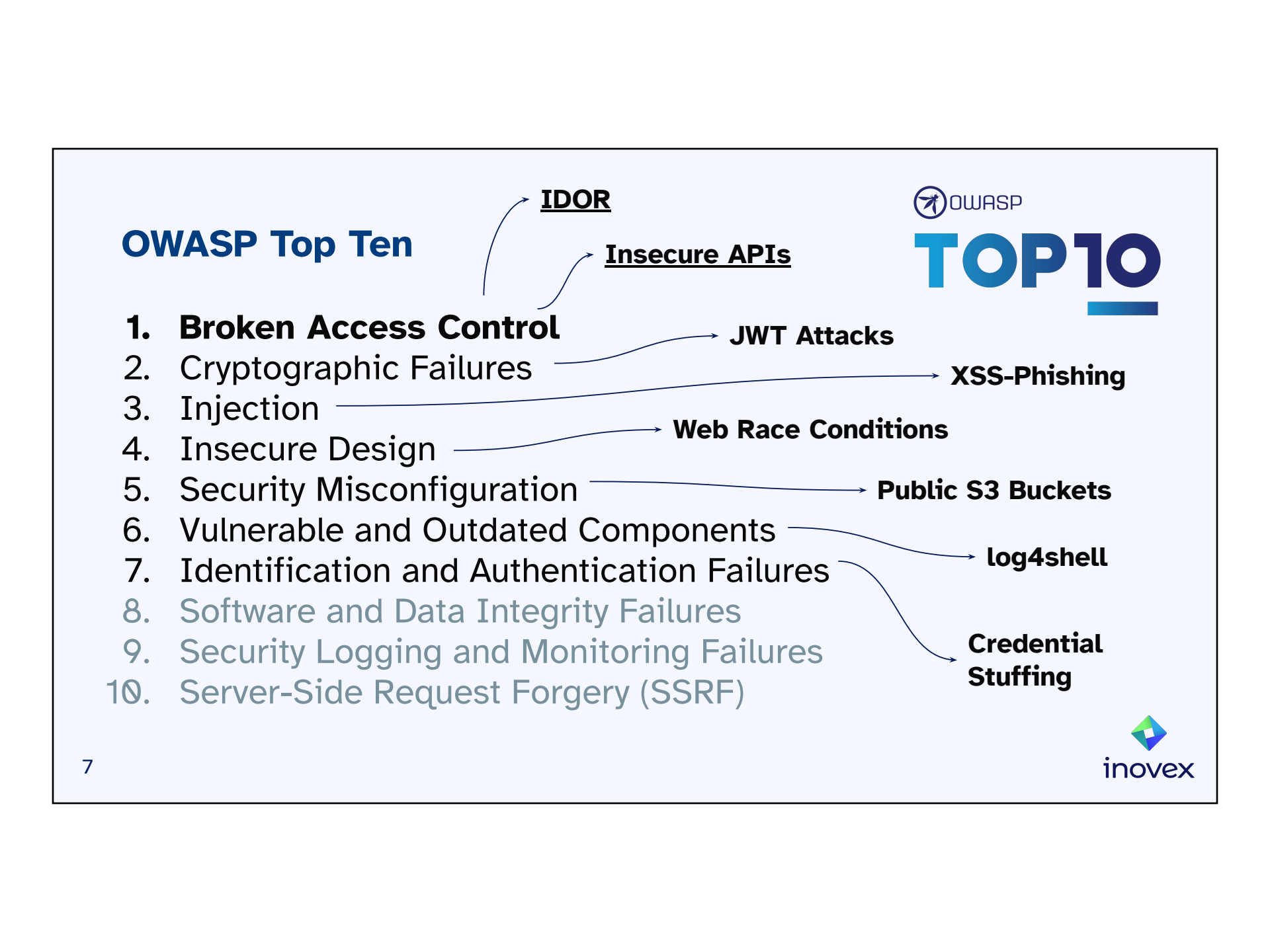
OWASP Top Ten



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Insecure Direct Object Reference (IDOR)

- DiGA Novega: Treatment of depression via web application through video/audio and interactive exercises
- Data download (required by GDPR)
  - `GET https://www.novego.com/myaccount/participant/data-export/21378`
  - 21378 = User ID

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Insecure Direct Object Reference (IDOR)

GET https://www.novego.com/myaccount/participant/export/21377

- Email address
- Gender
- therapy program registered
- self-assessment results

GAD-7 Anxiety

Over the last two weeks, how often have you been bothered by the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid, as if something awful might happen	0	1	2	3

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Insecure GraphQL API

- Grocery delivery start-ups Flink und Gorillas both use GraphQL-APIs
- GraphQL
  - Introspection: self-documented API
  - client defines return object
- Similar flaws found at Flink (03/2021) and Gorillas (05/2021)

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Insecure GraphQL API: Flink

- self-documented GraphQL API

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Insecure GraphQL API: Flink

- self-documented GraphQL API

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Insecure GraphQL API: Flink

- self-documented GraphQL API

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Insecure GraphQL API: Gorillas

Fields

```
activeOrders(
    filter: GraphFilterScalar
    feed: GraphFeedInput
): [MarketOrderData]
```

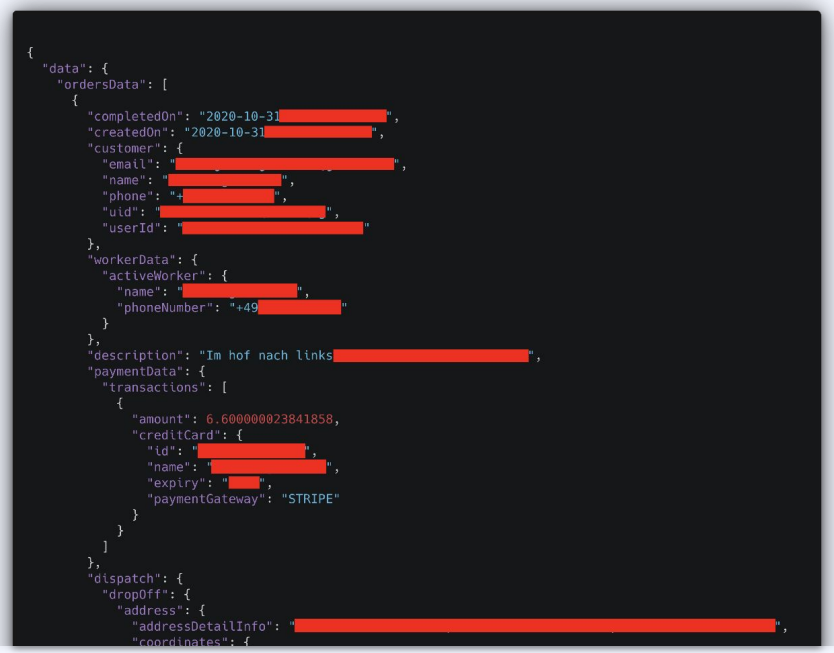
Get Order Data

```
ordersData(
    filter: GraphFilterScalar
    feed: GraphFeedInput
): [OrderData]
```

Get Order Data

```
tenantConfig(
    filter: GraphFilterScalar
    feed: GraphFeedInput
): [TenantConfig]
```

Get Tenant Configuration Data



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Takeaways

- IDOR:
  - Don’t use incrementing IDs, but e.g. UUIDs
  - Don’t rely on secrecy of IDs
- Insecure API:
  - GraphQL needs other Authz measures
- In general:
  - Design Authz early
  - Follow principle of least privilege
  - Deny by default
  - Test for misuse cases

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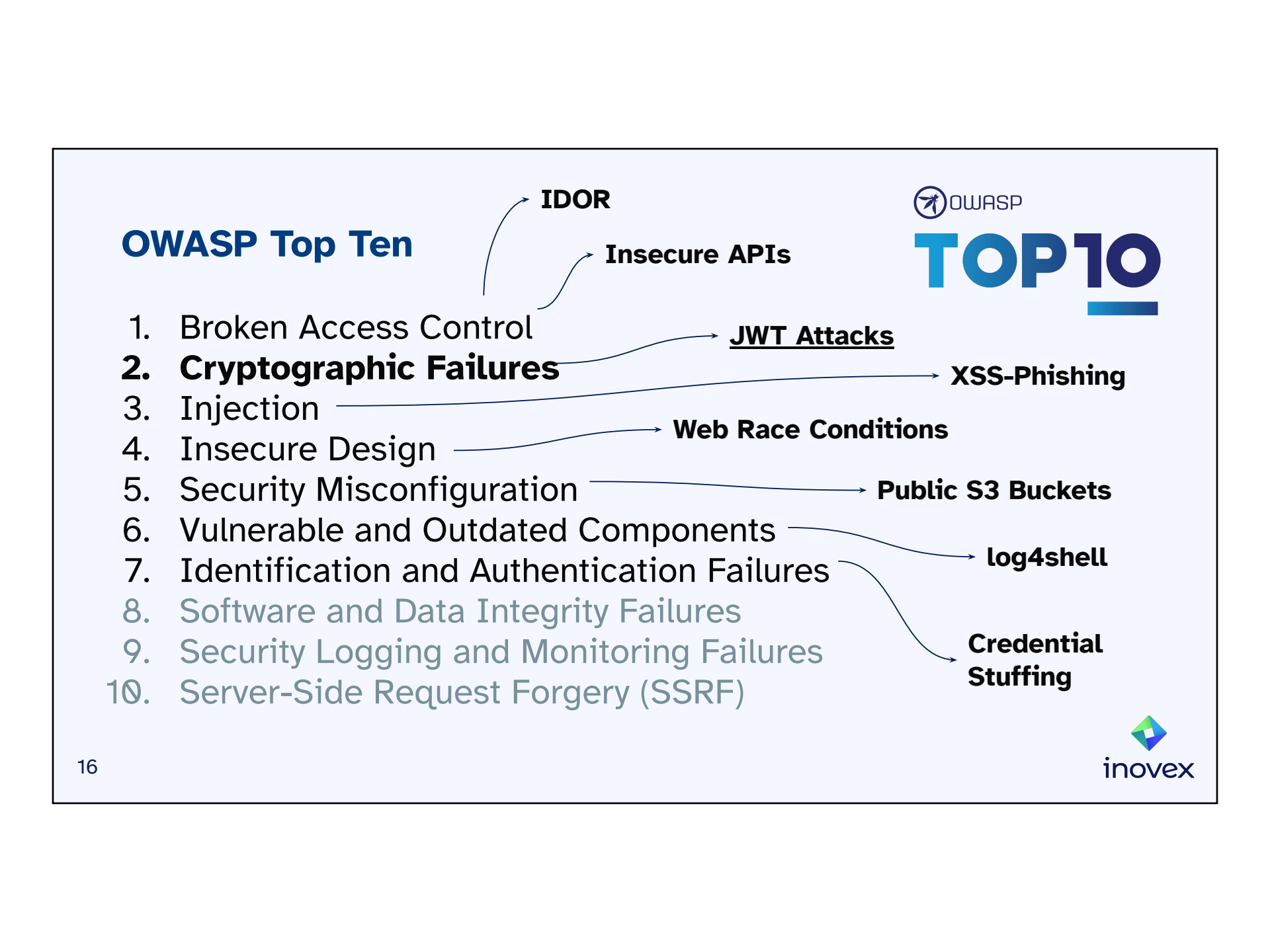
OWASP Top Ten



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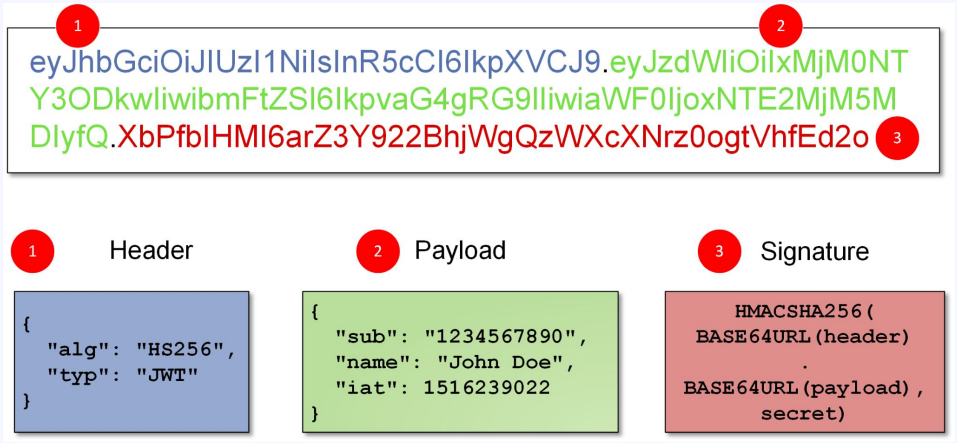
JWT Failures

- JWT = JSON Web Token
- standard for JSON-Payload that is signed and/or encrypted
- often used for Authn/Authz tokens



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Design flaws of JWT as Authn token

- Logout is impossible
  - self-contained token are valid as long they are not expired
  - logout = revocation is not possible without losing JWT's advantages
- Change of permissions/roles is hard
  - needs re-issue of token

- Good reasons JWT might be no good idea at all
  → Stop using JWT for sessions

Implementation flaws of JWTs

- complex cryptography without secure defaults
  - RSA PKCS#1 v1.5 problematic since 1998
- over-engineered standard
  - too many use cases leading to unreasonable variants

```
4.1.3.  "jwk" (JSON Web Key) Header Parameter

The "jwk" (JSON Web Key) Header Parameter is the public key that
corresponds to the key used to digitally sign the JWS.  This key is
represented as a JSON Web Key [JWK].  Use of this Header Parameter is
OPTIONAL.
```

- flexible specification, leading to error-prone implementations
  - None-Attack
  - polyglot JWTs

"alg" Param Value
HS256
HS384
HS512
RS256
RS384
RS512
ES256
ES384
ES512
PS256
PS384
PS512
none

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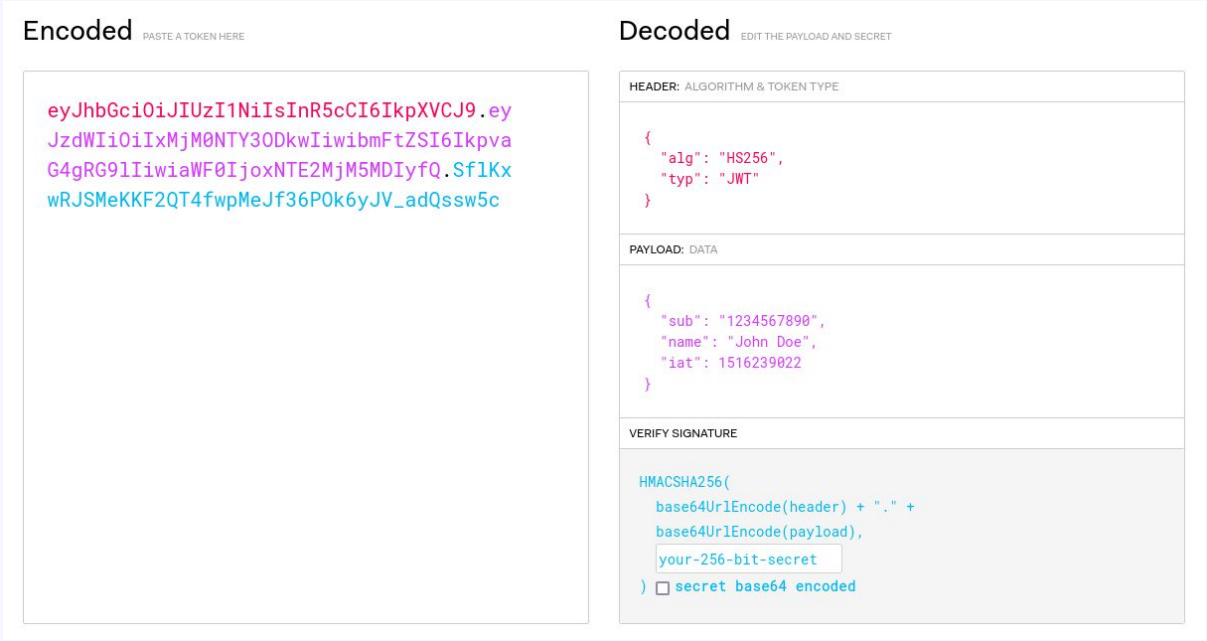
Implementation flaws of JWTs: None-Attack

- `alg` allows specification of different algorithms



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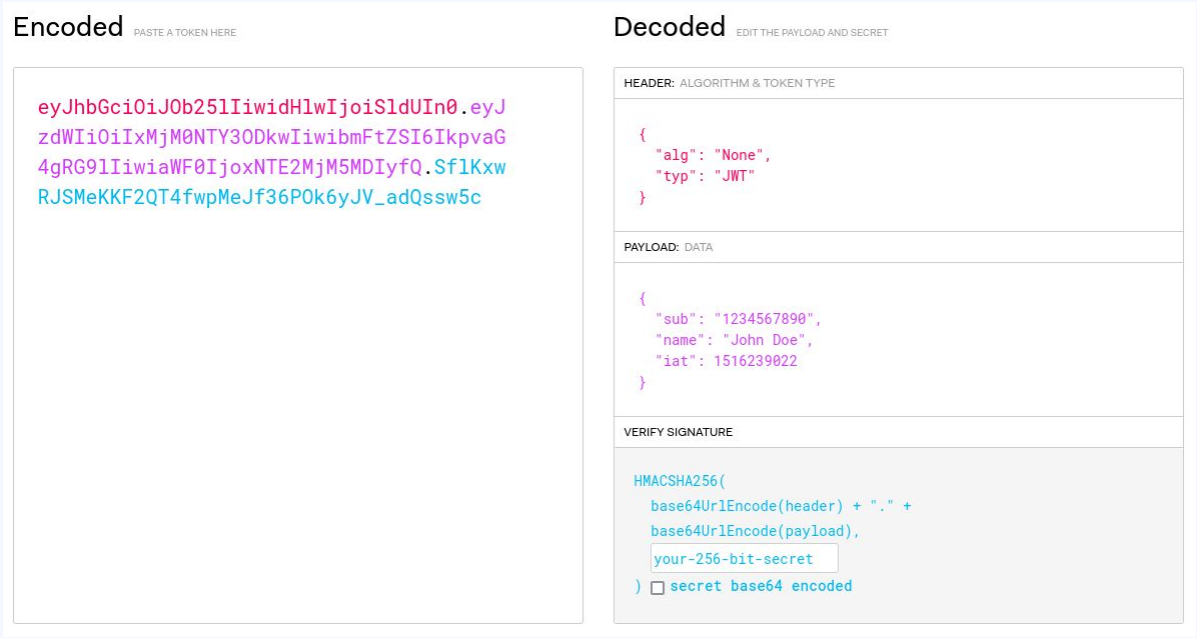
Implementation flaws of JWTs: None-Attack

- None is also a valid algorithm, meaning the signature is not checked



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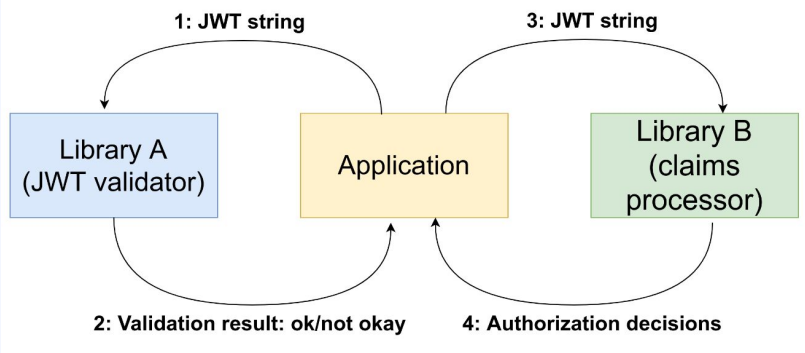
presented by Tom Tervoort at

Implementation flaws of JWTs: Polyglot JWTs



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Implementation flaws of JWTs: Polyglot JWTs

```
{
   "AAAA":".XXXX.",
   "protected": "AAAA",
   "payload": "BBBB",
   "signature": "CCCC"
}
```


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Implementation flaws of JWTs: Polyglot JWTs

```
{
   "AAAA":".XXXX.",
   "protected": "AAAA",
   "payload": "BBBB",
   "signature": "CCCC"
}
```

jwcrypto ignored unknown JSON fields:

```
{      header      payload
   "AAAA":".XXXX.",
   "protected": "AAAA",
   "payload": "BBBB",
   "signature": "CCCC"
}
```

python-jwt split on periods, and ignored non-base64 characters:

```
{
   "AAAA":".XXXX.",
   "protected": "AAAA",
   "payload": "BBBB",
   "signature": "CCCC"
}
```

Takeaways

- Consider alternatives to JWT
  - use Session Token
  - use PASETO / Macaroon / Biscuits
- Use modern, patched JWT library
- Set algorithm explicitly

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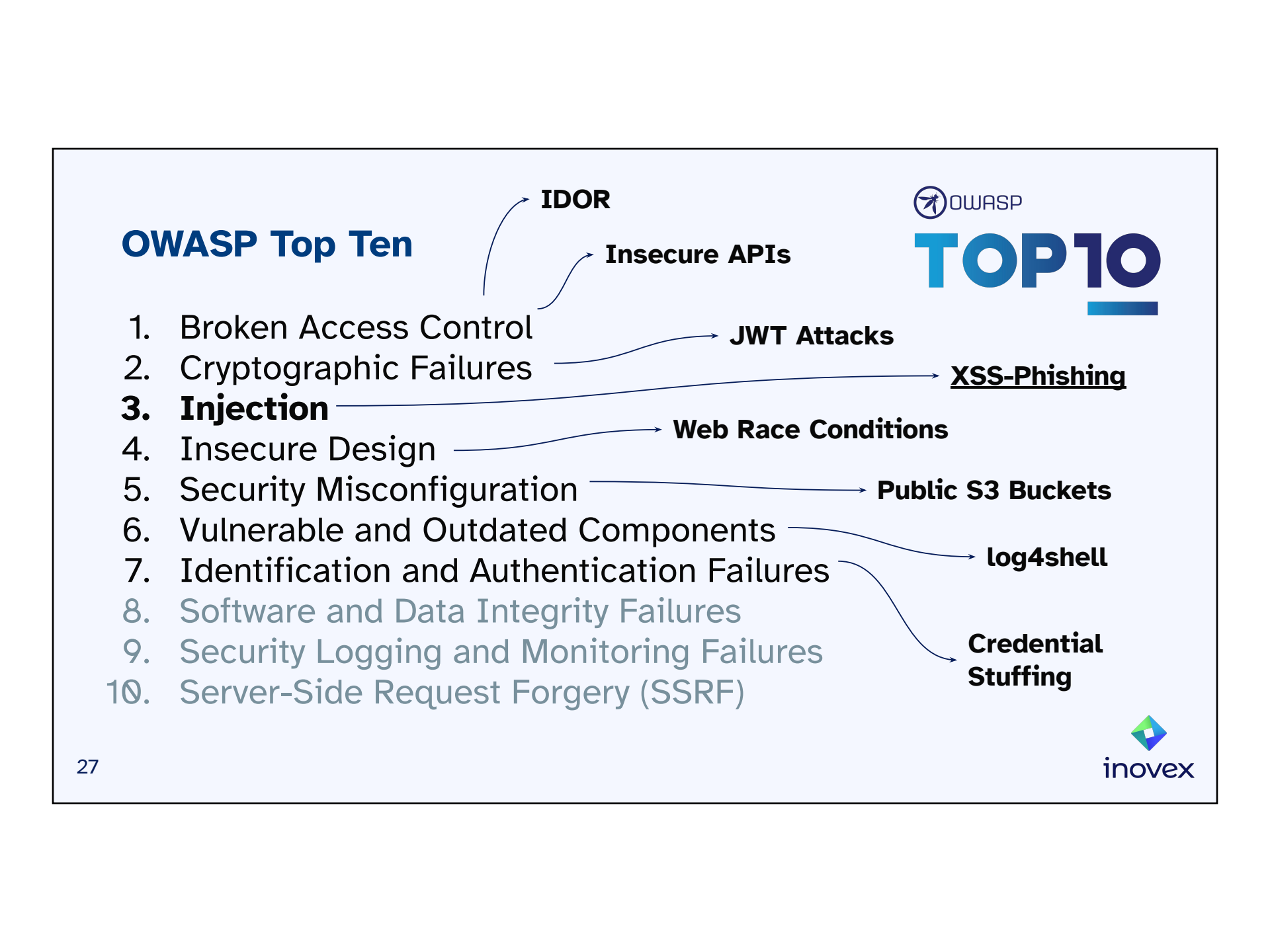
OWASP Top Ten



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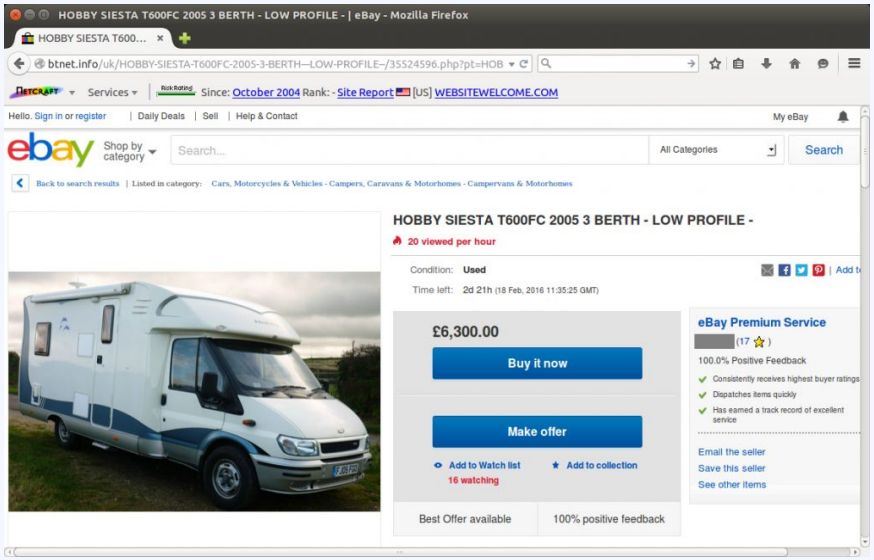
Cross-Site-Scripting (XSS)

- User input is contained in the application in a way allowing an attacker to execute arbitrary scripts in the victim's browser

```
<script>alert(42);</script>
```

- Affects all user controlled data, including URL parameter, request body, header and cookies

Stored XSS: Ebay (2015)



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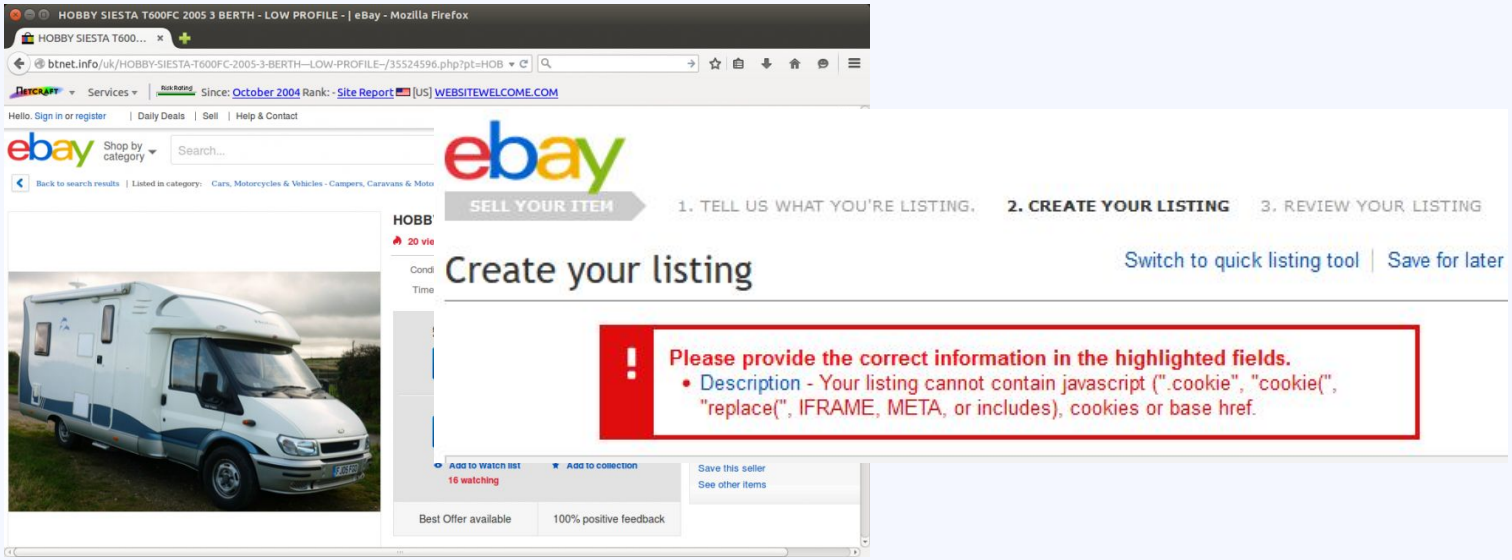

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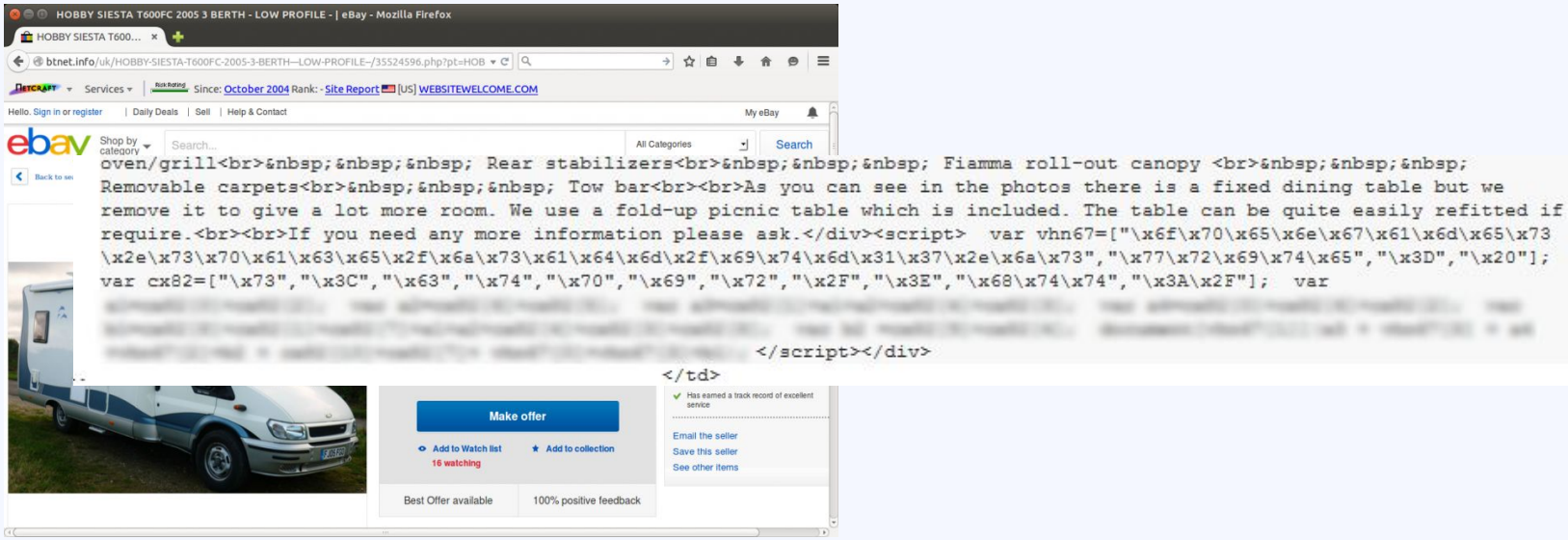
Stored XSS: Ebay (2015)



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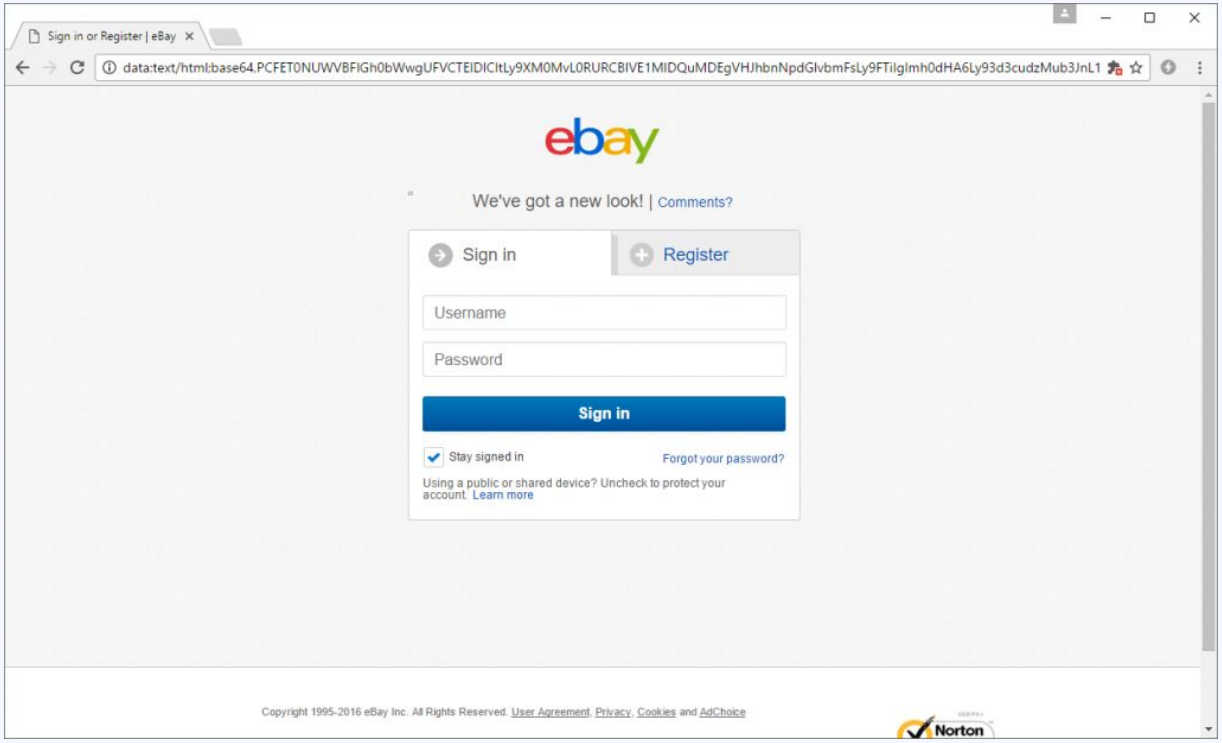

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Photo by cottonbro studio

XSS - Yesterday's snow?

- Modern SPA frameworks prevent XSS quite successful
- No longer a mass phenomenon
- XSS tends to be forgotten
- But: still relevant, when no framework is used

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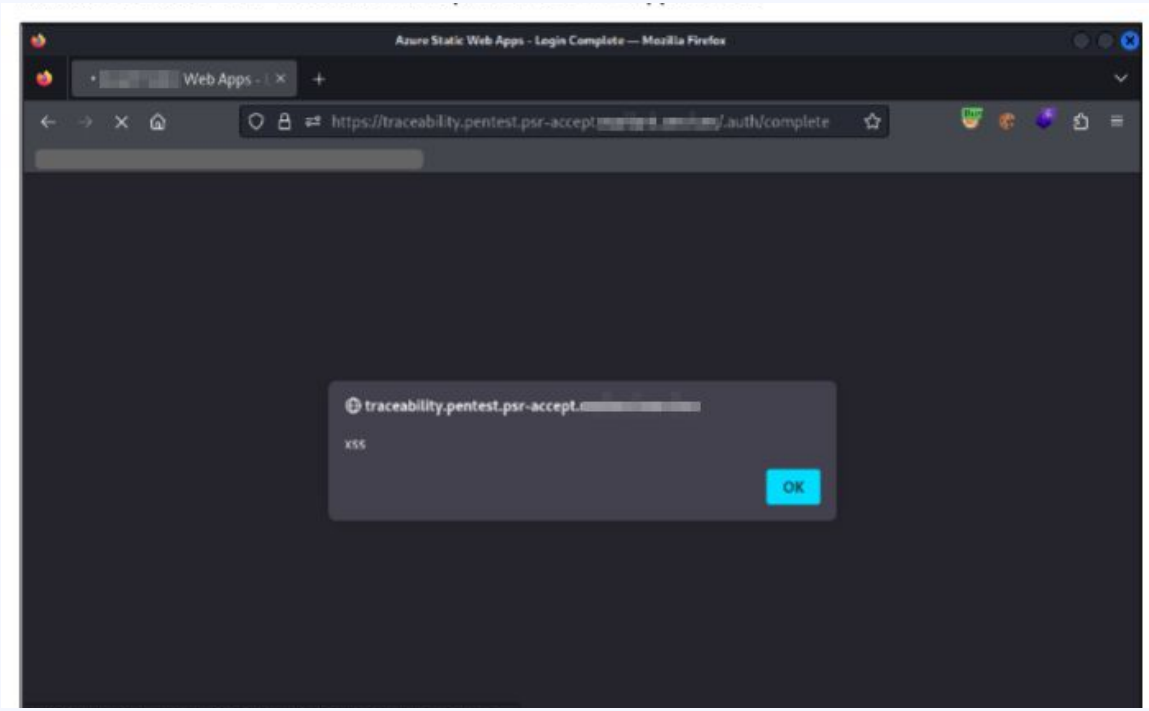
OAuth Solution in Hyperscaler Cloud Product...



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OAuth Solution in Hyperscaler Cloud Product...

https://traceability.XXXXXXX.com/.auth/login/aad?post_login_redirect_uri=http%253A%252F%252Fredirect.example.org

```
<head>
        <title> Login Complete</title>
        <script type=text/javascript>
                window.onload = function () {
                        try { document.getElementById('redirectLink').click()
                }catch(a){}};
        </script>
</head>
<body>
        <a id=redirectLink href=/.auth/complete/#/http%3A%2F%2Fredirect.example.org
                Click here if it doesn't automatically redirect.
        </a>
</body>
```


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OAuth Solution in Hyperscaler Cloud Product...

https://traceability.XXXXXXX.com/.auth/login/aad?post_login_redirect_uri=%23/%3E%3Cscript%3Ealert(%27xss%27)%3C/script%3E

```
<head>
        <title> Login Complete</title>
        <script type=text/javascript>
                window.onload = function () {
                        try { document.getElementById('redirectLink').click()
                }catch(a){}};
        </script>
</head>
<body>
        <a id=redirectLink href=/.auth/complete/#/><script>alert('xss')</script>>
                Click here if it doesn't automatically redirect.
        </a>
</body>
```


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Takeaways

- How are you handling XSS?
  - Modern web frameworks do it quite well
  - Don’t forget it everywhere else!
- Do defense in depth
  - HttpOnly Cookies
  - Content Security Policy (CSP)
  - (WAF)

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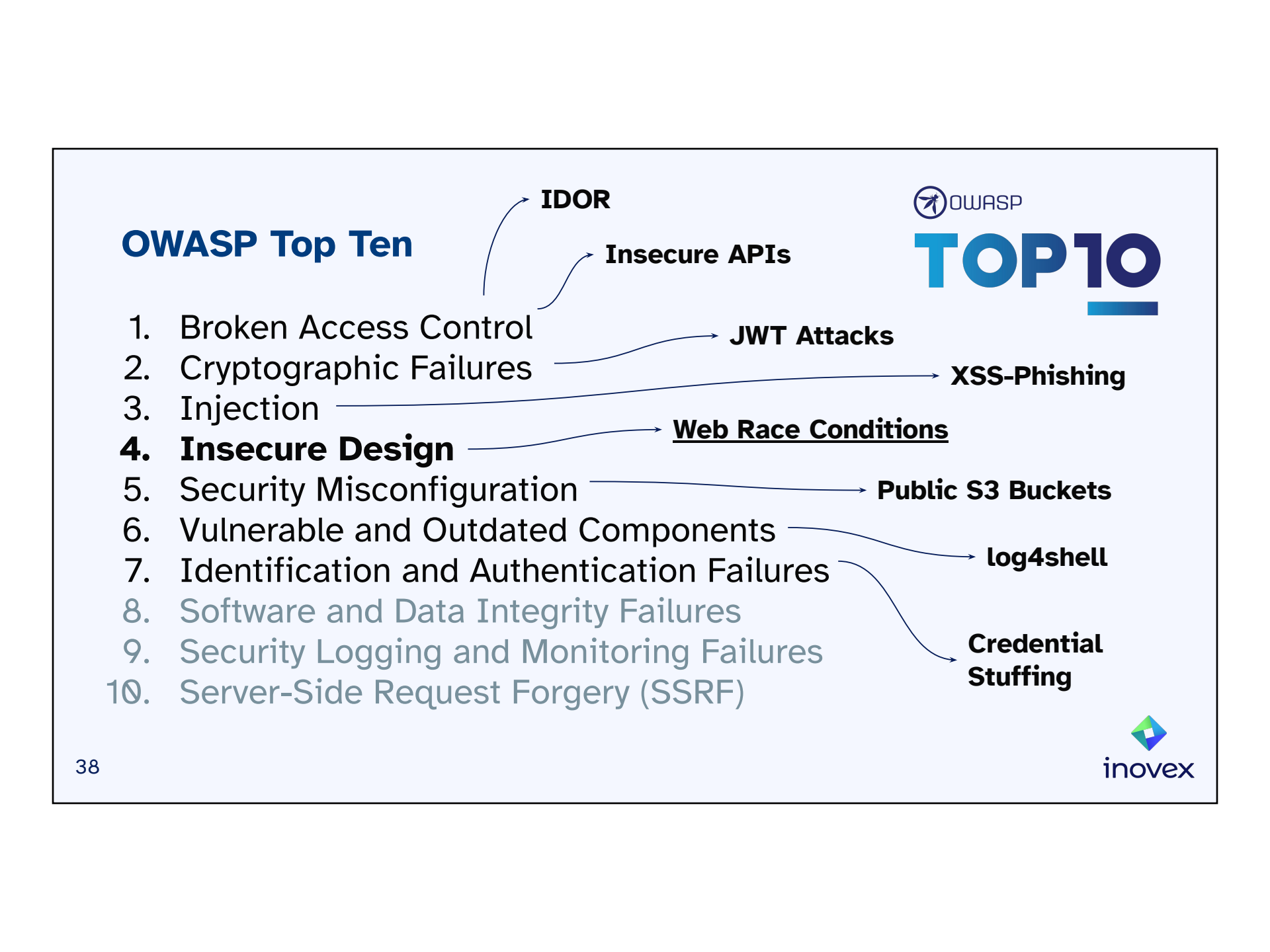
OWASP Top Ten



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Insecure Design: Web Race Conditions

- exploit race conditions between security relevant process steps
  - redeeming a voucher
  - usage of one-time-token (e.g. OTP)
  - withdrawing/transferring of money
  - identification/registration
- network latency, jitter and internal latency cause exploitable delays

Web Race Conditions: Bonify (2023)

Bonify: FinTech-Startup for to assess creditworthiness of applicants

Authentication and identification via bank account

bonify — das Schufa-Startup, das jedem sagt, ob Du kreditwürdig bist | by Lilith Wittmann

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Web Race Conditions: Bonify (2023)

Microservice architecture with service-to-service communication

Registration process:

1. Creation of user in user-service
2. Login in online banking, under supervision of banking-service
3. Request of name information held in banking-service by the user-service
4. Flagging of user as “validated”

Web Race Conditions: Bonify (2023)

Microservice architecture with service-to-service communication

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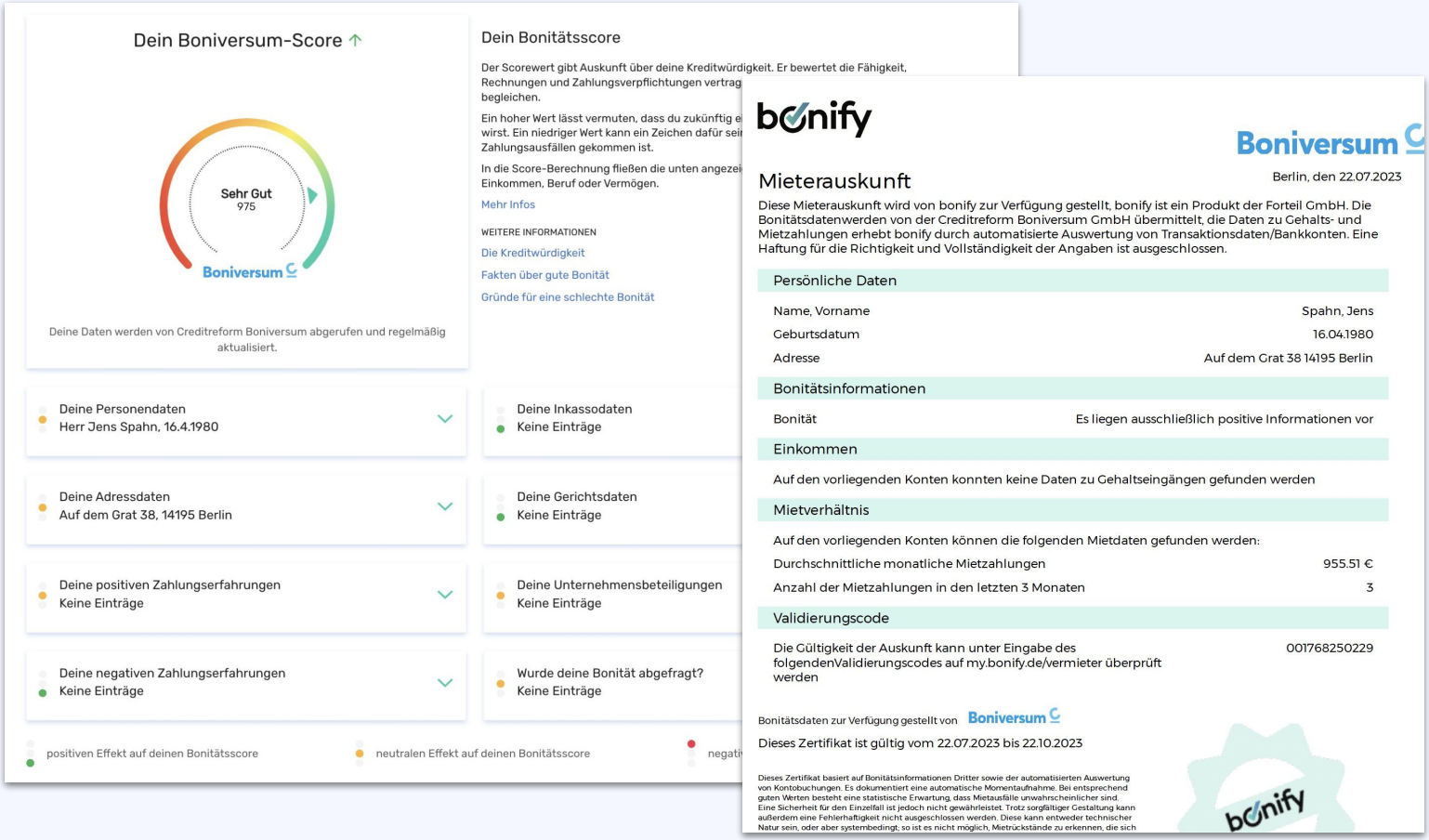
Dein Boniversum-Score
Sehr Gut
975
Boniversum
Deine Daten werden von Creditreform Boniversum abgerufen und regelmäßig aktualisiert.
Dein Bonitätsscore
Der Scorewert gibt Auskunft über deine Kreditwürdigkeit. Er bewertet die Fähigkeit, Rechnungen und Zahlungsverpflichtungen vertrag
begleichen.
Ein hoher Wert lässt vermuten, dass du zukünftig e
wirst. Ein niedriger Wert kann ein Zeichen dafür sei
Zahlungsausfällen gekommen ist.
In die Score-Berechnung fließen die unten angezei
Einkommen, Beruf oder Vermögen.
Mehr Infos
WEITERE INFORMATIONEN
Die Kreditwürdigkeit
Fakten über gute Bonität
Gründe für eine schlechte Bonität
Deine Personendaten
Herr Jens Spahn, 16.4.1980
Deine Adressdaten
Auf dem Grat 38, 14195 Berlin
Deine positiven Zahlungserfahrungen
Keine Einträge
Deine negativen Zahlungserfahrungen
Keine Einträge
Deine Inkassodaten
Keine Einträge
Deine Gerichtsdaten
Keine Einträge
Deine Unternehmensbeteiligungen
Keine Einträge
Wurde deine Bonität abgefragt?
Keine Einträge
positiven Effekt auf deinen Bonitätsscore
neutralen Effekt auf deinen Bonitätsscore
bonify
Boniversum
Mieterauskunft
Berlin, den 22.07.2023
Diese Mieterauskunft wird von bonify zur Verfügung gestellt, bonify ist ein Produkt der Forteil GmbH. Die Bonitätsdatenwerden von der Creditreform Boniversum GmbH übermittelt, die Daten zu Gehalts- und Mietzahlungen erhebt bonify durch automatisierte Auswertung von Transaktionsdaten/Bankkonten. Eine Haftung für die Richtigkeit und Vollständigkeit der Angaben ist ausgeschlossen.
Persönliche Daten
Name, Vorname Spahn, Jens
Geburtsdatum 16.04.1980
Adresse Auf dem Grat 38 14195 Berlin
Bonitätsinformationen
Bonität Es liegen ausschließlich positive Informationen vor
Einkommen
Auf den vorliegenden Konten konnten keine Daten zu Gehaltseingängen gefunden werden
Mietverhältnis
Auf den vorliegenden Konten können die folgenden Mietdaten gefunden werden:
Durchschnittliche monatliche Mietzahlungen 955.51 €
Anzahl der Mietzahlungen in den letzten 3 Monaten 3
Validierungscode
Die Gültigkeit der Auskunft kann unter Eingabe des folgendenValidierungscodes auf my.bonify.de/vermieter überprüft werden 001768250229
Bonitätsdaten zur Verfügung gestellt von Boniversum
Dieses Zertifikat ist gültig vom 22.07.2023 bis 22.10.2023
Dieses Zertifikat basiert auf Bonitätsinformationen Dritter sowie der automatisierten Auswertung von Kontobuchungen. Es dokumentiert eine automatische Momentaufnahme. Bei entsprechend guten Werten besteht eine statistische Erwartung, dass Mietausfälle unwahrscheinlicher sind. Eine Sicherheit für den Einzelfall ist jedoch nicht gewährleistet. Trotz sorgfältiger Gestaltung kann außerdem eine Fehlerhaftigkeit nicht ausgeschlossen werden. Diese kann entweder technischer Natur sein, oder aber systembedingt, so ist es nicht möglich, Mietrückstände zu erkennen, die sich
bonify

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Takeaways

- Thoroughly design processes
- Take timing into account - don’t rely on an implicit order
  - When is state changed?
  - Can two requests change the same record?
- Consider abuse cases
- Perform threat modelling for *attacker’s view*

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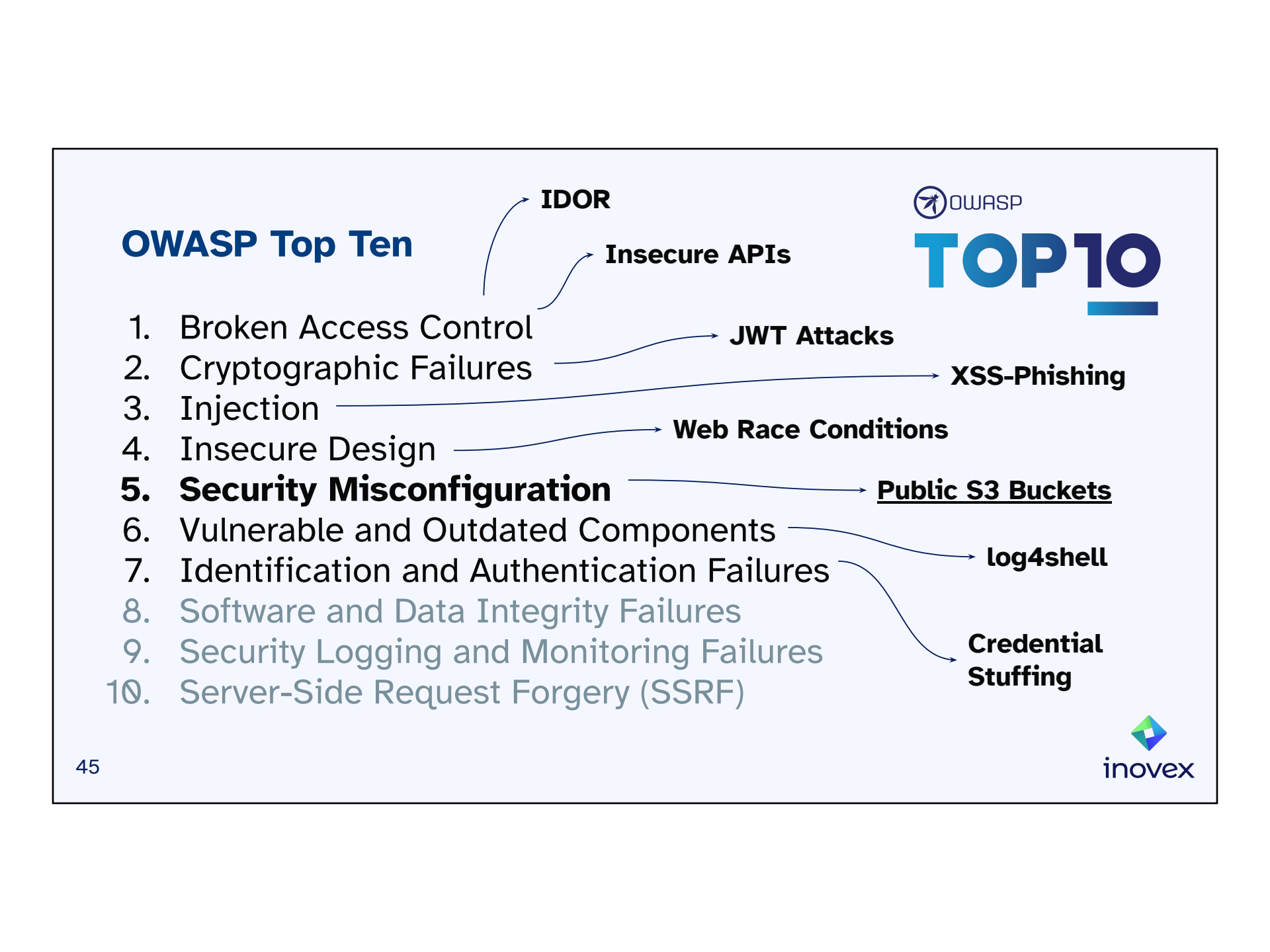
OWASP Top Ten



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Security Misconfiguration: Public S3 Buckets

Another S3 Bucket Leads to Breach of 50k Patient Records

by Dennis Sebayan on March 15, 2021

McGraw Hill's S3 buckets exposed 100,000 students' grades and personal info

ACCENTURE – EMBARRASSING DATA LEAK BUSINESS DATA IN A PUBLIC AMAZON S3 BUCKET

SECURITY THROUGH...WHAT EXACTLY? —

Defense contractor stored intelligence data in Amazon cloud unprotected

Alibaba Victim of Huge Data Leak as China Tightens Security

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Takeaways

- Use automated, repeatable processes to deploy environments
- Identical setups for all stages (but different secrets)
- careful configuration of all layers using best practices
- Use automated test tools / external testers

- For developers: provide secure defaults

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OWASP Top Ten

1. Broken Access Control
2. Cryptographic Failures
3. Injection
4. Insecure Design
5. Security Misconfiguration
6. **Vulnerable and Outdated Components**
7. Identification and Authentication Failures
8. Software and Data Integrity Failures
9. Security Logging and Monitoring Failures
10. Server-Side Request Forgery (SSRF)

IDOR

Insecure APIs

JWT Attacks

XSS-Phishing

Web Race Conditions

Public S3 Buckets

log4shell

Credential Stuffing

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Vulnerable and Outdated Components: Log4Shell

- a zero-day vulnerability in Log4j, a Java logging framework
- allowing arbitrary code execution
- existed unnoticed since 2013, published and patched in 2021

- basic and popular framework, big impact through many transitive dependencies
- common problems: Where do we use it? Are we affected?

Takeaways

- Have a detailed software inventory (e.g. SBOM)
- Reduce unnecessary dependencies

- Tool recommendations:
  - Renovate
  - OWASP Dependency Track

- Plan maintenance of your software
- Ensure fast ability of patch

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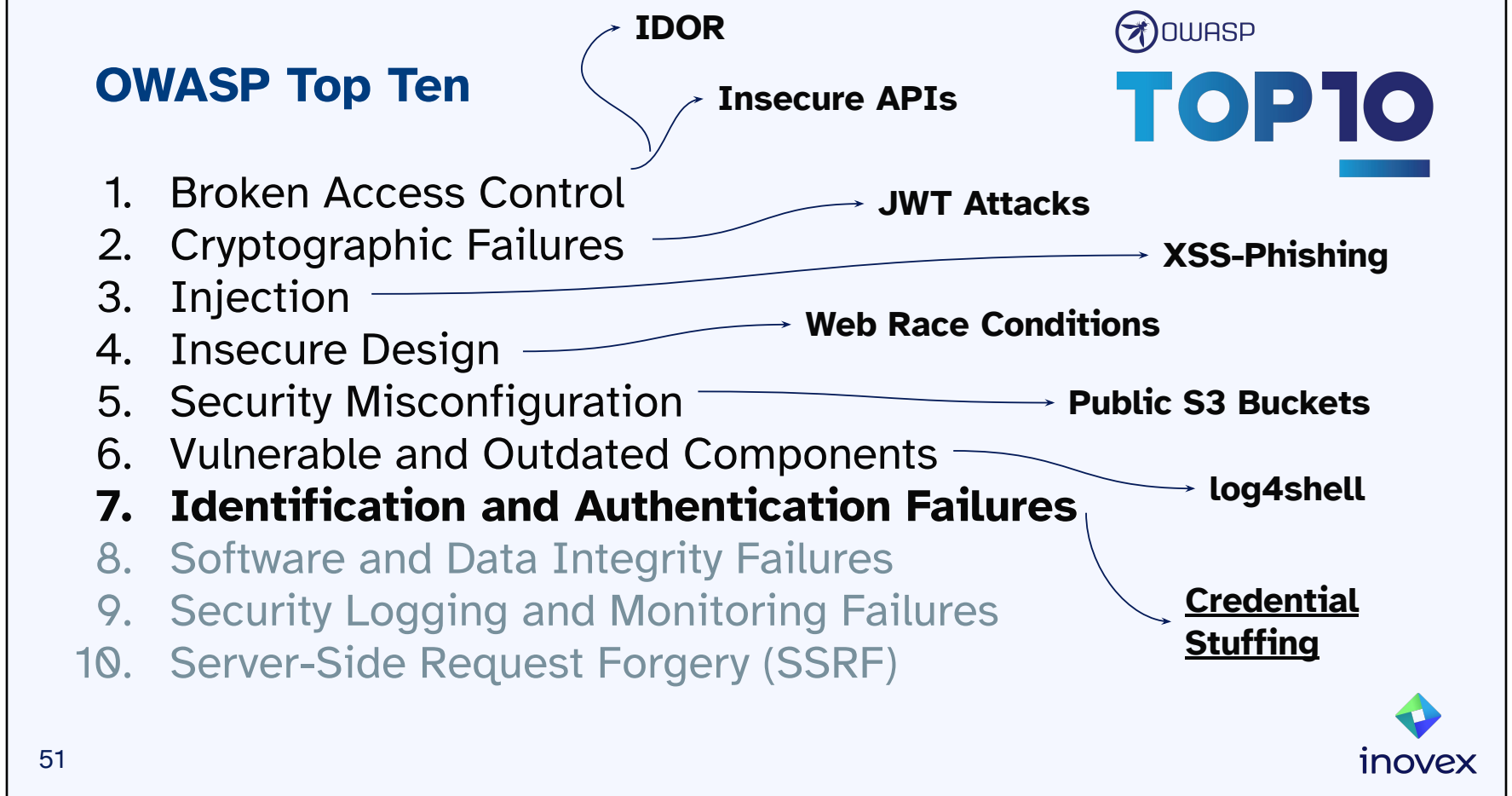
OWASP Top Ten



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Identification and Authentication Failures

User’s mistakes with passwords:

- Weak passwords
- Very weak passwords
- Wrong handling of passwords
- Reuse of passwords

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Identification and Authentication Failures

User's mistakes with passwords:

- Weak passwords → Brute Force Attacks
  try a lot of passwords for a user
- Very weak passwords → Password Spraying
  try weak password for multiple users
- Wrong handling of passwords → Phishing Attacks
  trick the user to tell you the password
- Reuse of passwords → Credential Stuffing
  try a lot of known pairs of username/password

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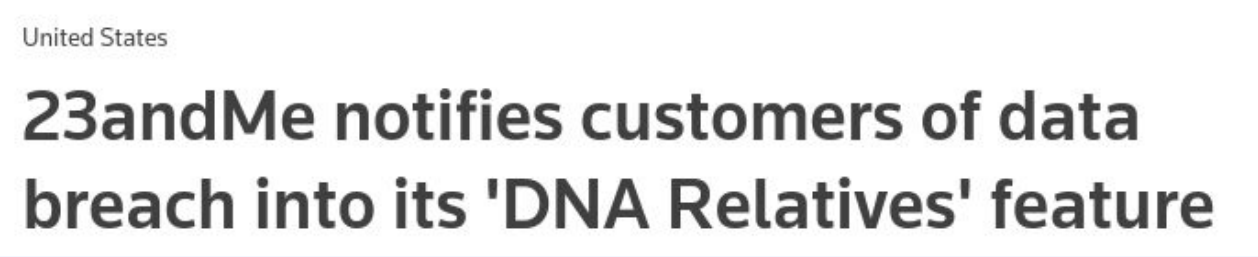
Credential Stuffing: 23andMe (2023)

23andMe: company to explore your own genetic material



Breached using Credential Stuffing

Attackers gained access to millions of user profiles, containing name, sex, age and details about genetic ancestry

Data sets were grouped by ancestry, e.g. 1 million-user data set of Ashkenazi Jews

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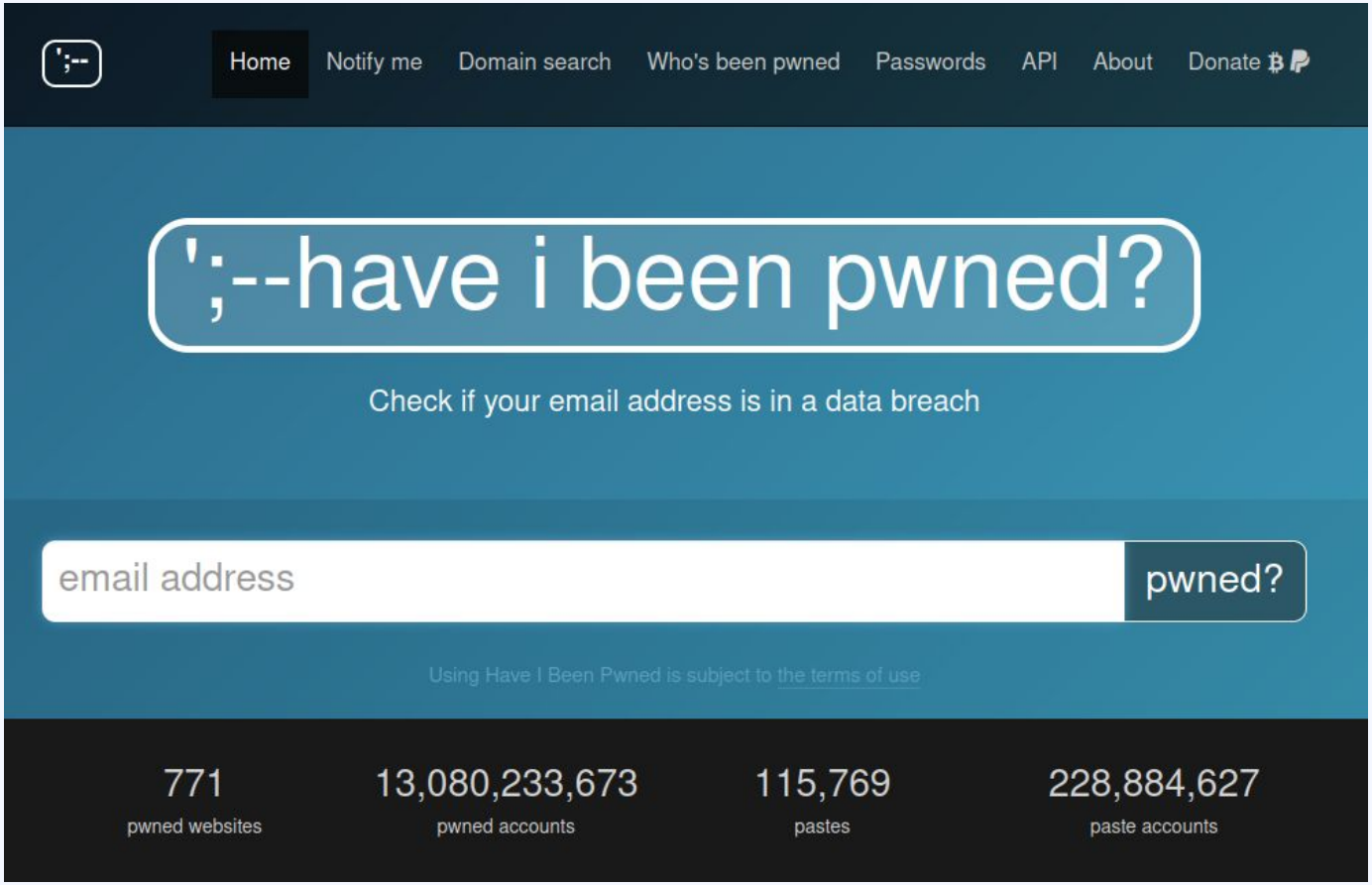
';--
Home
Notify me
Domain search
Who's been pwned
Passwords
API
About
Donate
';--have i been pwned?
Check if your email address is in a data breach
email address
pwned?
Using Have I Been Pwned is subject to the terms of use
771
pwned websites
13,080,233,673
pwned accounts
115,769
pastes
228,884,627
paste accounts

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Takeaways

Users:

- Use secure passwords
- Check for breached passwords
- Use multi-factor (or passwordless) authentication

Devs:

- Allow multi-factor (or passwordless) authentication
- Defense in depth
  - Brute Force protection
    - CAPTCHAs
    - IP Mitigation
  - Identify leaked passwords
  - Keep usernames secret
  - Notify users about security events

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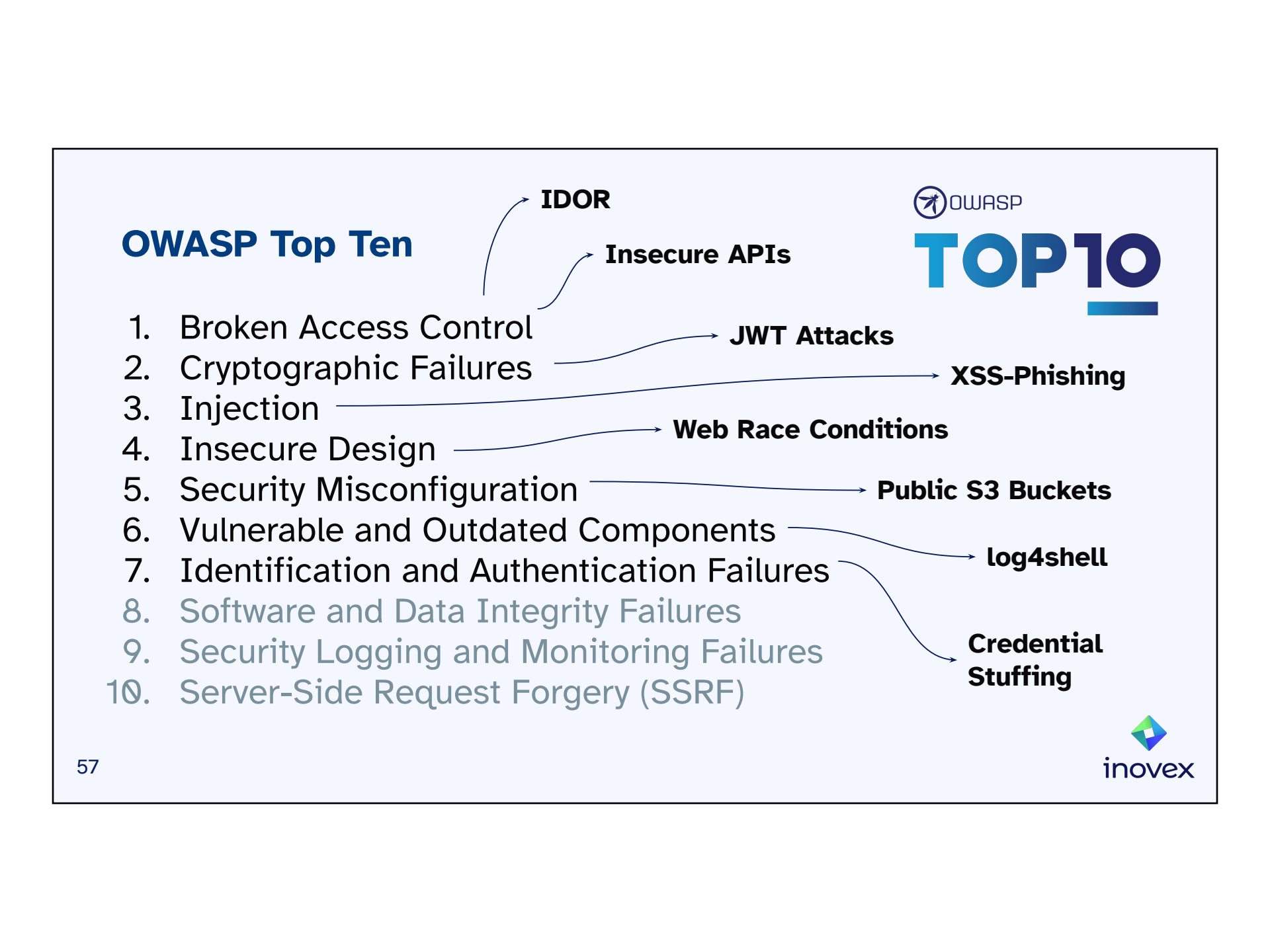
OWASP Top Ten



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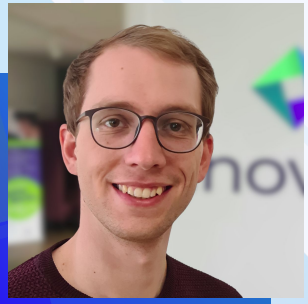
Learn from the mistakes of others

Consider security from the beginning and continuously

Keep up-to-date with threats and check with your attack surface

Thank you!



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