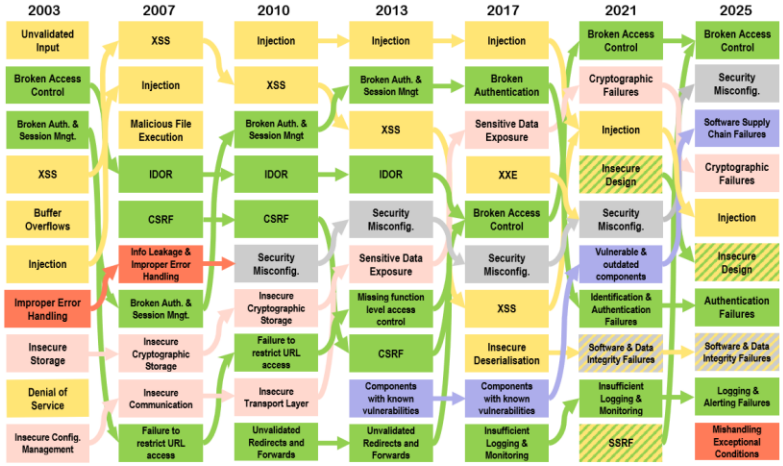
Twenty Years of OWASP Top 10



Open Worldwide Application Security Project
Top 10 of Web Application Risks
2003-2025

Faiz Ilham Muhammad, Erik Poll, Harald Vranken

OWASP Top 10

Open *Worldwide* Application Security Project

founded 2001

name changed from Web to Worldwide in 2024

Best (only?) known for Top 10 of Web Application Risks

The Top 10 is

- great for awareness
- a great first step in improving security

but...

- *only* a first step
- *not* a 'standard' (unlike OWASP ASVS)

Other Top Ns

- OWASP Top 10 for LMM Applications & GenAI
- OWASP Mobile Top 10
- OWASP API Top 10
- OWASP Kubernetes Top 10
- …

Top Ns by other organisations:

- CWE Top 25 Software Weaknesses, annually since 2019
- CWE Top 25 Hardware Weaknesses, since 2021

2025 edition of OWASP Top 10

1. Broken Access Control
2. Security Misconfiguration
3. Software Supply Chain Failures ☆
4. Cryptographic Failures
5. Injection
6. Insecure Design
7. Authentication Failures
8. Software & Data Integrity Failures
9. Logging & Alerting Failures ☆
10. Mishandling Exceptional Conditions

8 categories based on data,

2 based on community survey ☆

Honourable mentions:

- Lack of application resilience
- Memory corruption
- AI-assisted coding

4. Injection Attacks

CWE-89 SQL Injection
CWE-79 Cross-site Scripting (XSS)
CWE-77 Command Injection
CWE-78 OS Command Injection
CWE-90 LDAP Injection
CWE-98 PHP Remote File Inclusion
CWE-91 XML Injection
CWE-88 Argument Injection
CWE-93 CRLF Injection
CWE-643 XPath Injection
CWE-94 Code Injection
CWE-96 Static Code Injection
CWE-95 Eval Injection
CWE-97 Server-Side Includes (SSI)
CWE-99 Resource Injection
CWE-917 Expression Language Injection
CWE-113 HTTP Response Splitting

CWE-20 Improper Input Validation
CWE-116 Improper Encoding or Escaping of Output

CWE-115 Misinterpretation of Output
CWE-112 Missing XML Validation
CWE-129 Improper Validation of Array Index

CWE-470 Unsafe Reflection
CWE-493 Public Variable Without Final Modifier
CWE-500 Public Static Field Not Marked Final
CWE-610 Externally Controlled Reference to a Resource in Another Sphere

…
…
…

Path traversal attacks are included in Broken Access Control

CWE-74 Improper Neutralization of Special Elements Used by a Downstream Component ('Injection')
CWE-76 Improper Neutralization of Equivalent Special Elements
CWE-83 Improper Neutralization of Script in Attributes in a Web Page
CWE-86 Improper Neutralization of Invalid Characters in Identifiers in Web Pages
CWE-644 Improper Neutralization of HTTP Headers for Scripting Syntax
CWE-159 Improper Handling of Invalid Use of Special Elements

6. Insecure Design

Access control

- CWE-362 Race Condition
- CWE-266 Incorrect Privilege Assignment
- CWE-269 Improper Privilege Management
- CWE-286 Incorrect User Management

Misc.

- CWE-602 Client-Side Enforcement of Security
- CWE-501 Trust Boundary Violation
- CWE-653 Insufficient Compartmentalization
- CWE-656 Reliance on Security Through Obscurity
- CWE-657 Violation of Secure Design Principles
- CWE-693 Protection Mechanism Failure
- CWE-799 Improper Control of Interaction Frequency
- CWE-841 Improper Enforcement of Behavioral Workflow
- CWE-1125 Excessive Attack Surface

Information leakage

- CWE-256 Unprotected Storage of Credentials
- CWE-312 Cleartext Storage of Sensitive Info
- CWE-313 Cleartext Storage in a File or on Disk
- CWE-316 Cleartext Storage of Sensitive Info in Memory
- CWE-522 Insufficiently Protected Credentials
- CWE-419 Unprotected Primary Channel
- CWE-525 Use of Web Browser Cache for Sensitive Info
- CWE-311 Missing Encryption of Sensitive Data
- CWE-539 Use of Persistent Cookies for Sensitive Info
- CWE-598 GET Requests With Sensitive Query Strings

UI

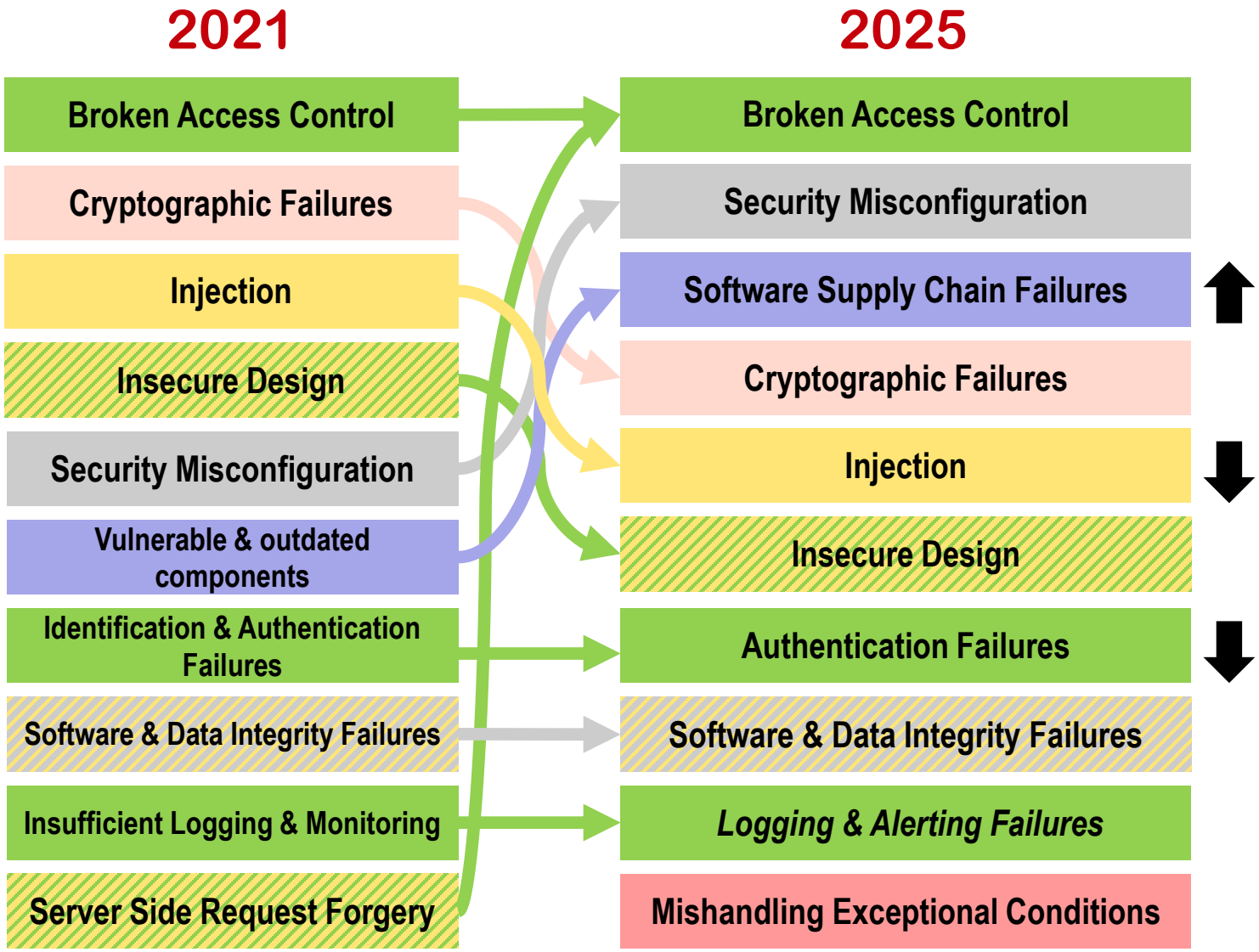
- CWE-451 UI Misrepresentation of Critical Information
- CWE-1021 Improper Restriction of Rendered UI Layers
- CWE-1022 Untrusted Link with window.opener Access

Input handling

- CWE-183 Permissive List of Allowed Inputs
- CWE-434 Upload of File with Dangerous Type
- CWE-436 Interpretation Conflict
- CWE-444 HTTP Request Smuggling

- CWE-73 External Control of File Name or Path
- CWE-642 External Control of Critical State Data
- CWE-646 Reliance on File Name or Extension of External File
- CWE-807 Reliance on Untrusted Inputs in Security Decision
- CWE-454 External Initialization of Trusted Variables or Data Stores
- CWE-472 External Control of Assumed-Immutable Web Parameter

- CWE-676 Use of Potentially Dangerous Function
- CWE-382 J2EE Bad Practices: Use of System.exit()
- CWE-628 Function Call with Incorrectly Specified Arguments


2021
2025
Broken Access Control
Cryptographic Failures
Injection
Insecure Design
Security Misconfiguration
Vulnerable & outdated components
Identification & Authentication Failures
Software & Data Integrity Failures
Insufficient Logging & Monitoring
Server Side Request Forgery
Broken Access Control
Security Misconfiguration
Software Supply Chain Failures
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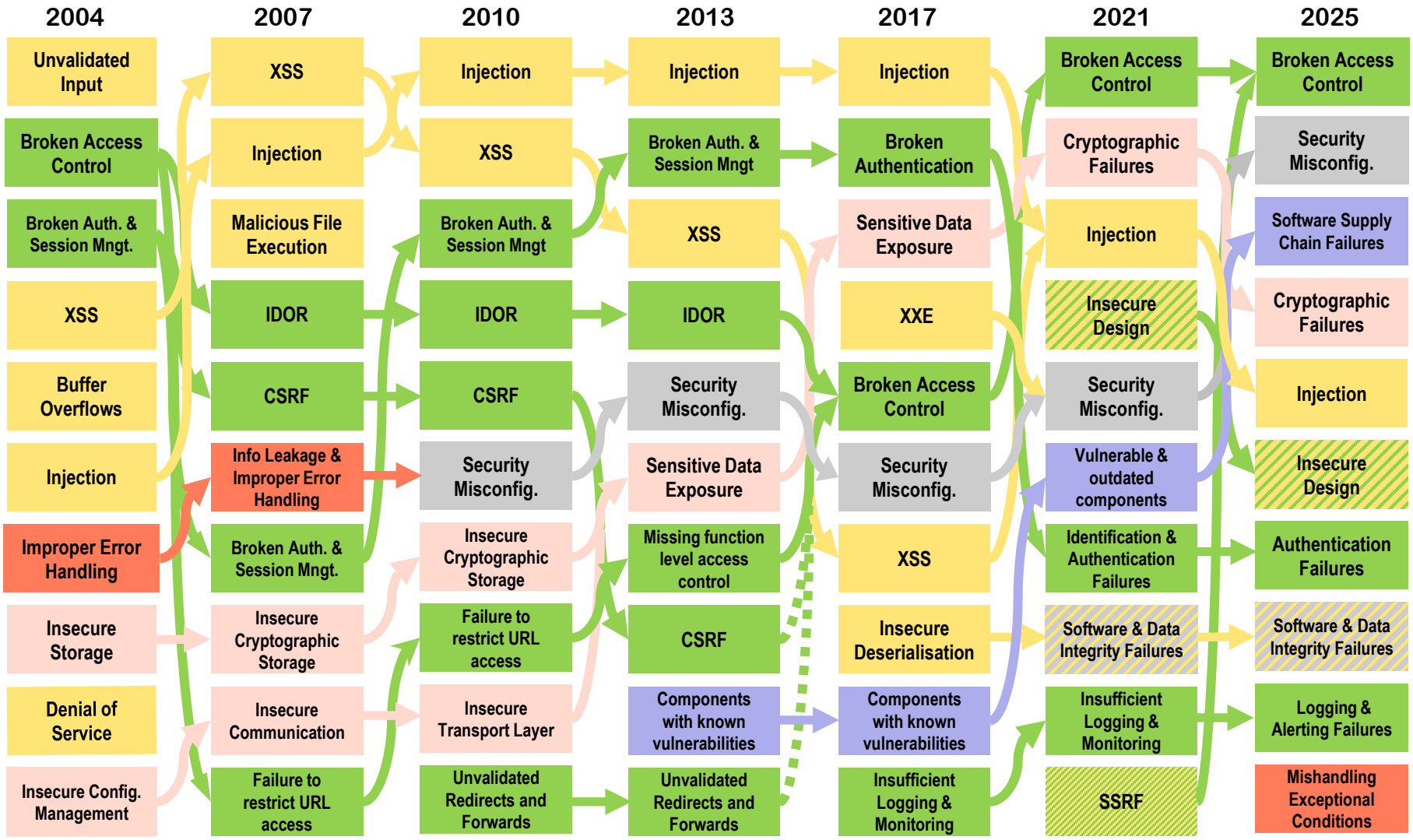
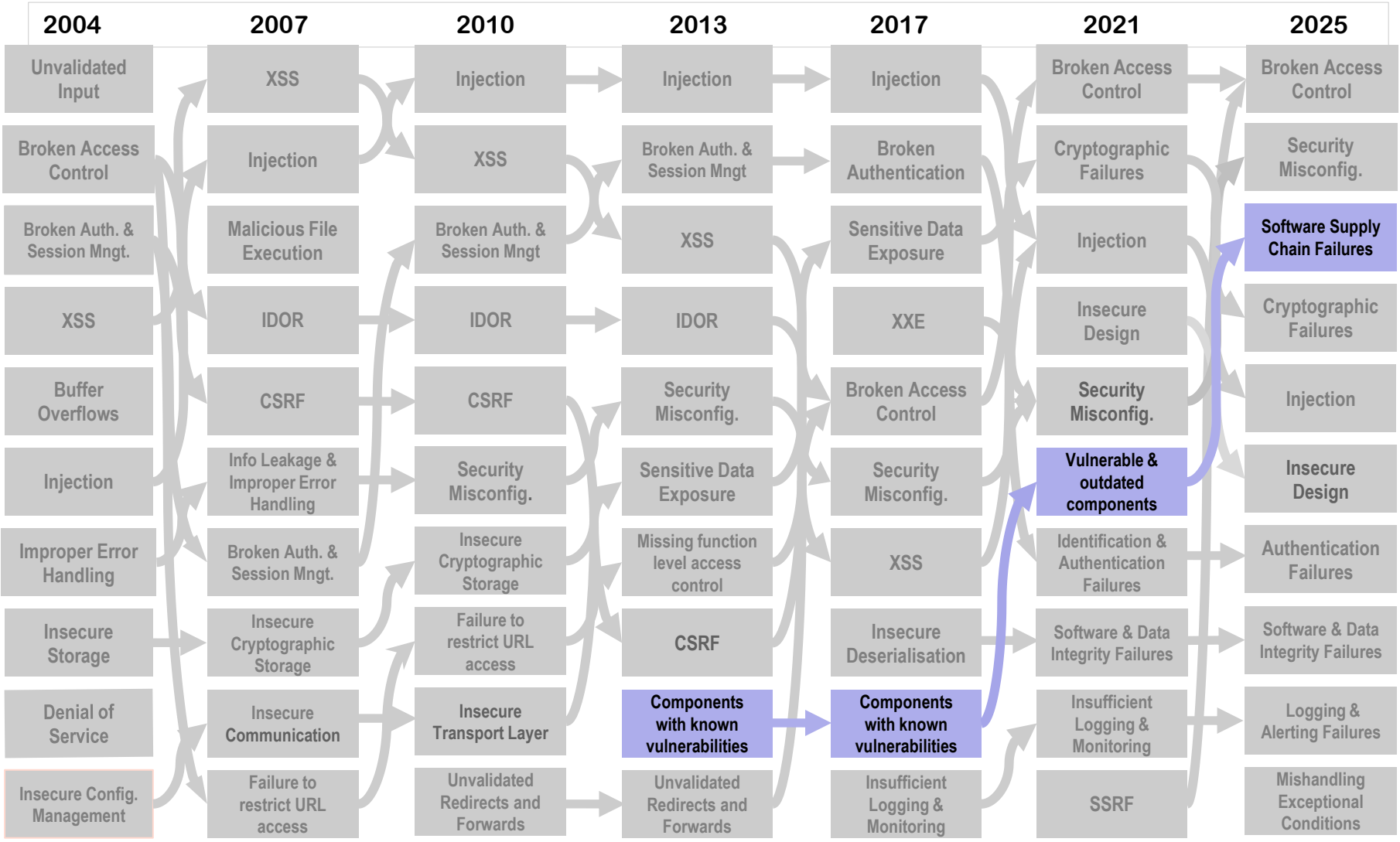
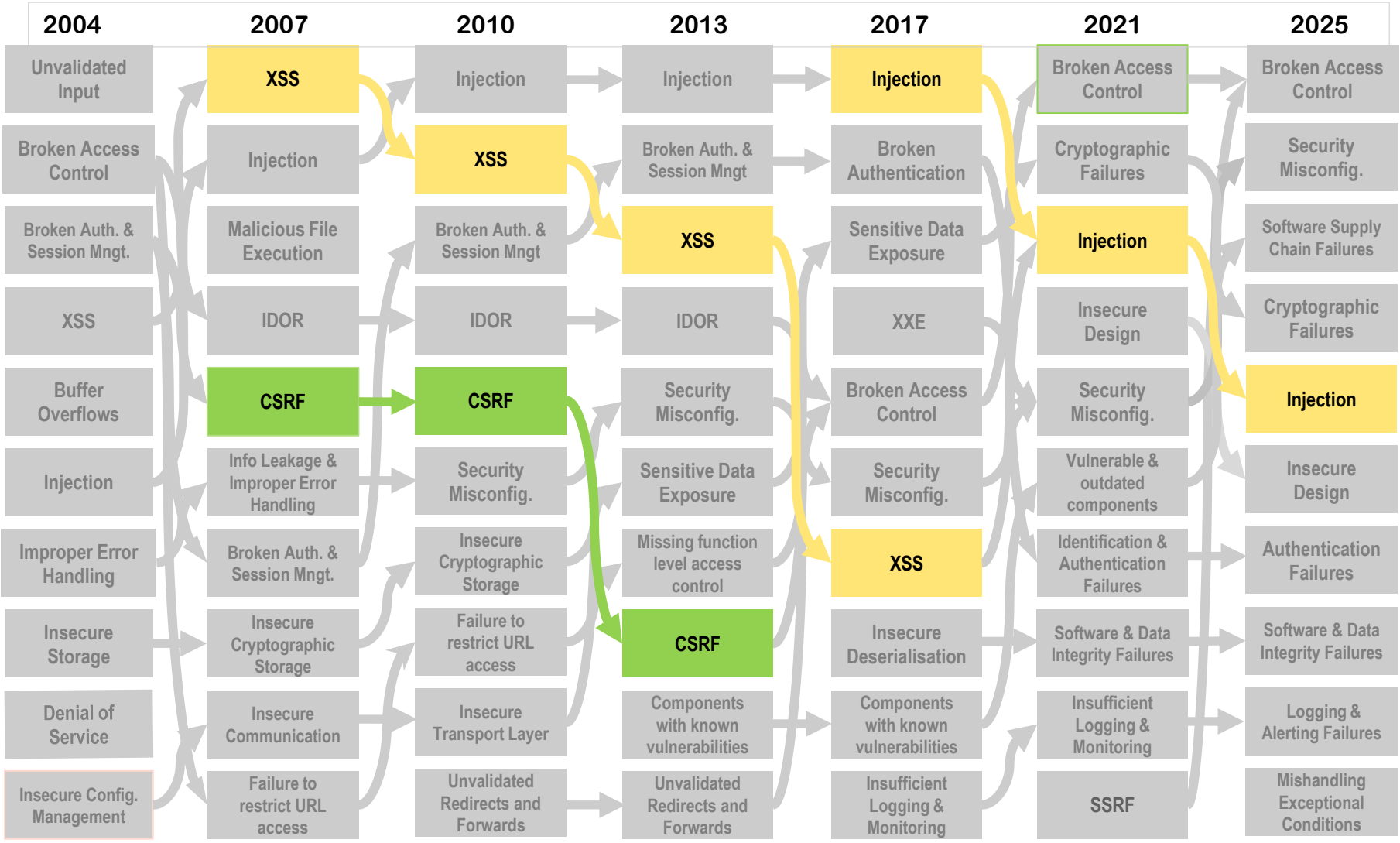
Evolution of the OWASP Top 10



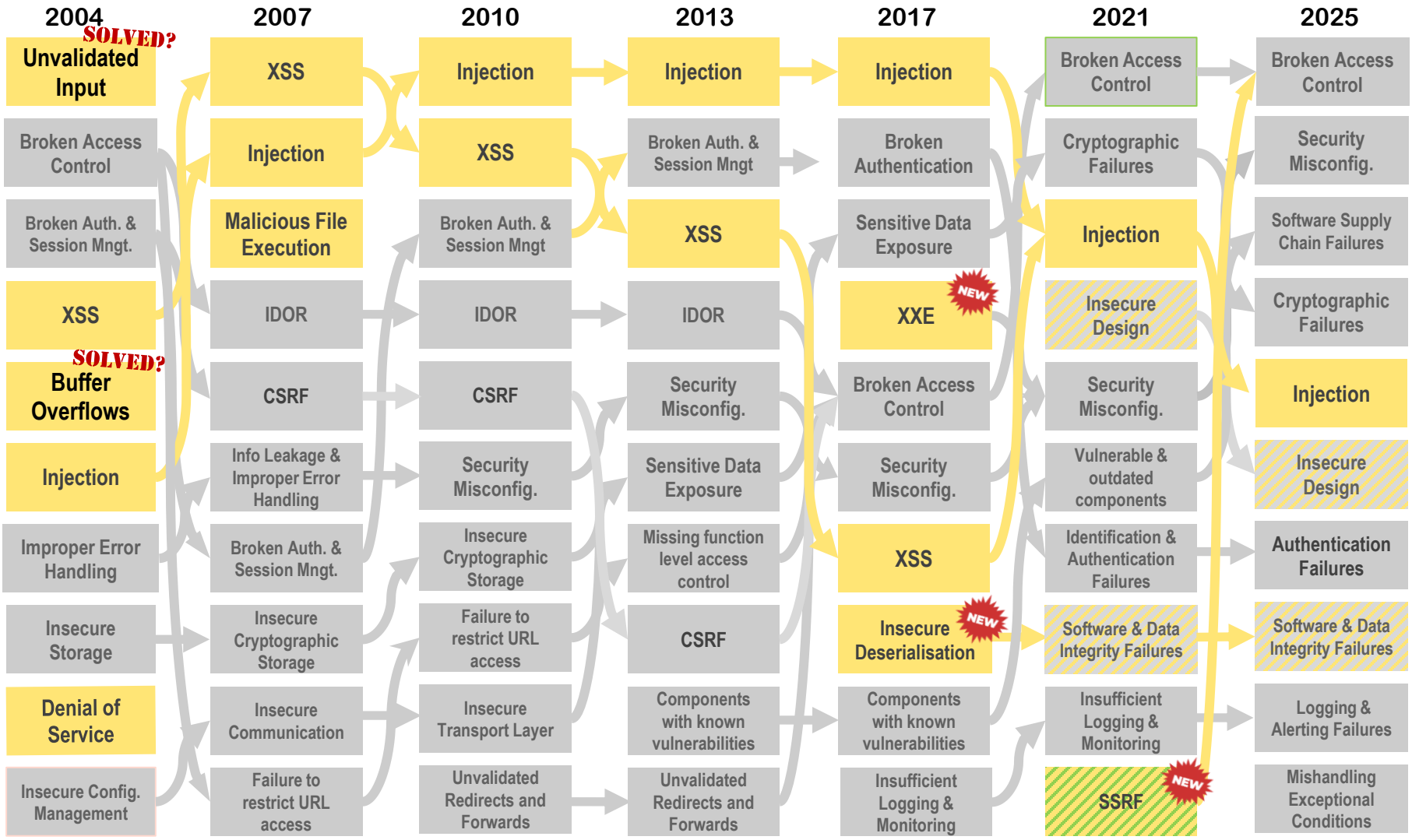
Upwards trends



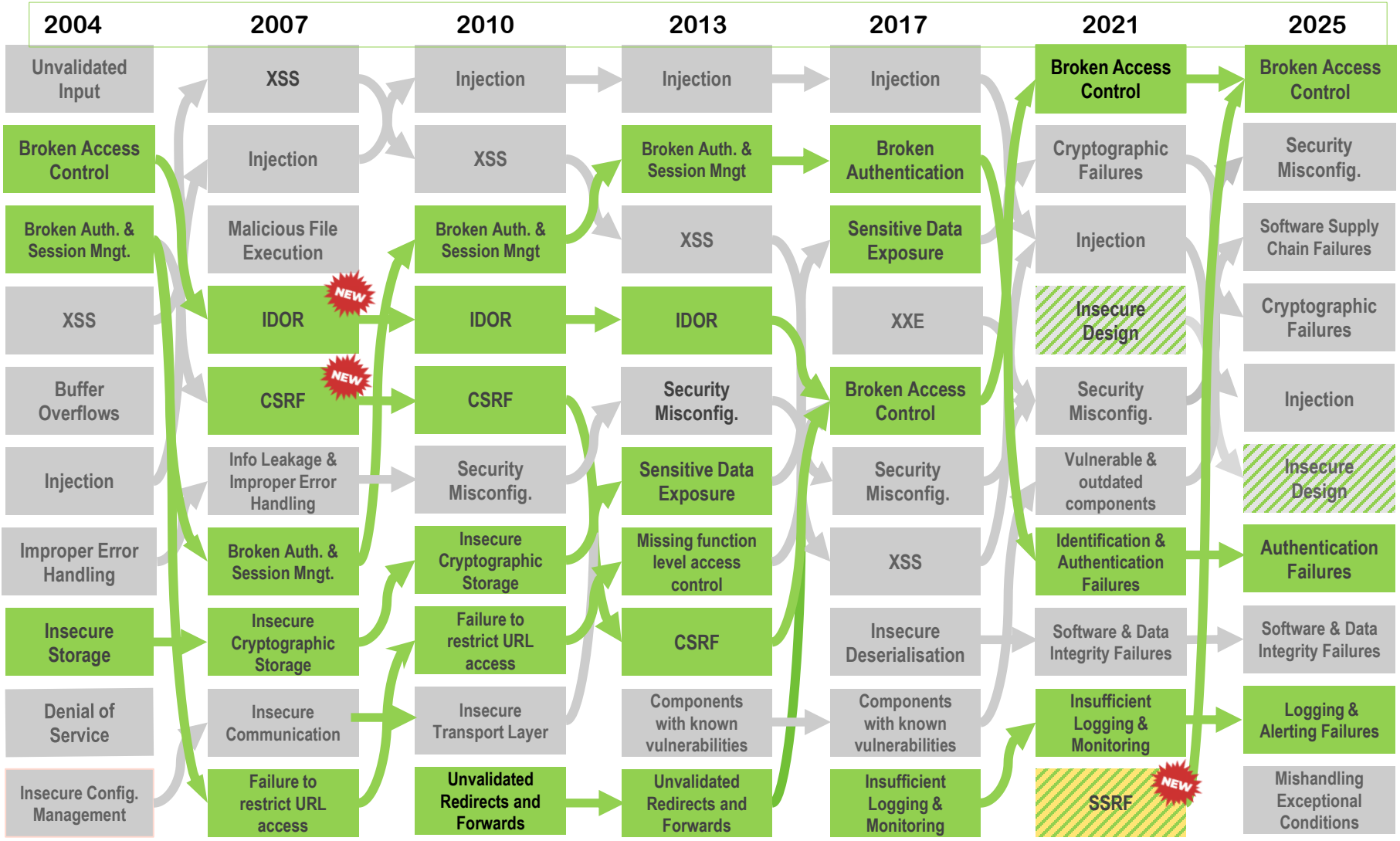
Downward trends



All issues due to input handling



All issues due to access control



2025 CWE Top 25 – based on CVE data

1 Cross-Site Scripting
2 SQL Injection
3 Client-side Request Forgery (CSRF)
4 Missing Authorization
5 Out-of-bounds Write
6 Path Traversal
7 Use After Free
8 Out-of-bounds Read
9 OS Command Injection
10 Code Injection
11 Classic Buffer Overflow
12 Upload of Dangerous File
13 NULL pointer deference
14 Stack-based Buffer overflow
15 Deserialization of Untrusted Data
16 Heap-based Buffer Overflow
17 Incorrect Authorization
18 Improper Input Validation
19 Improper Access Control
20 Exposing Info to Unauthorized User
21 Missing Authentication
22 Server-Side Request Forgery (SSRF)
23 Command Injection
24 Authorization Bypass with User-Controlled Key
25 Allocation of Resources without Throttling

This ranking is based on frequency (# CVEs)
The OWASP Top 10 is based on incidence (# applications) & impact

OWASP Top 10 vs 2025 CWE Top 25

- Broken Access Control
- Security Misconfiguration
- Software Supply Chain Failures
- Cryptographic Failures
- Injection
- Insecure Design
- Authentication Failures
- Software & Data Integrity Failures
- Logging & Alerting Failures
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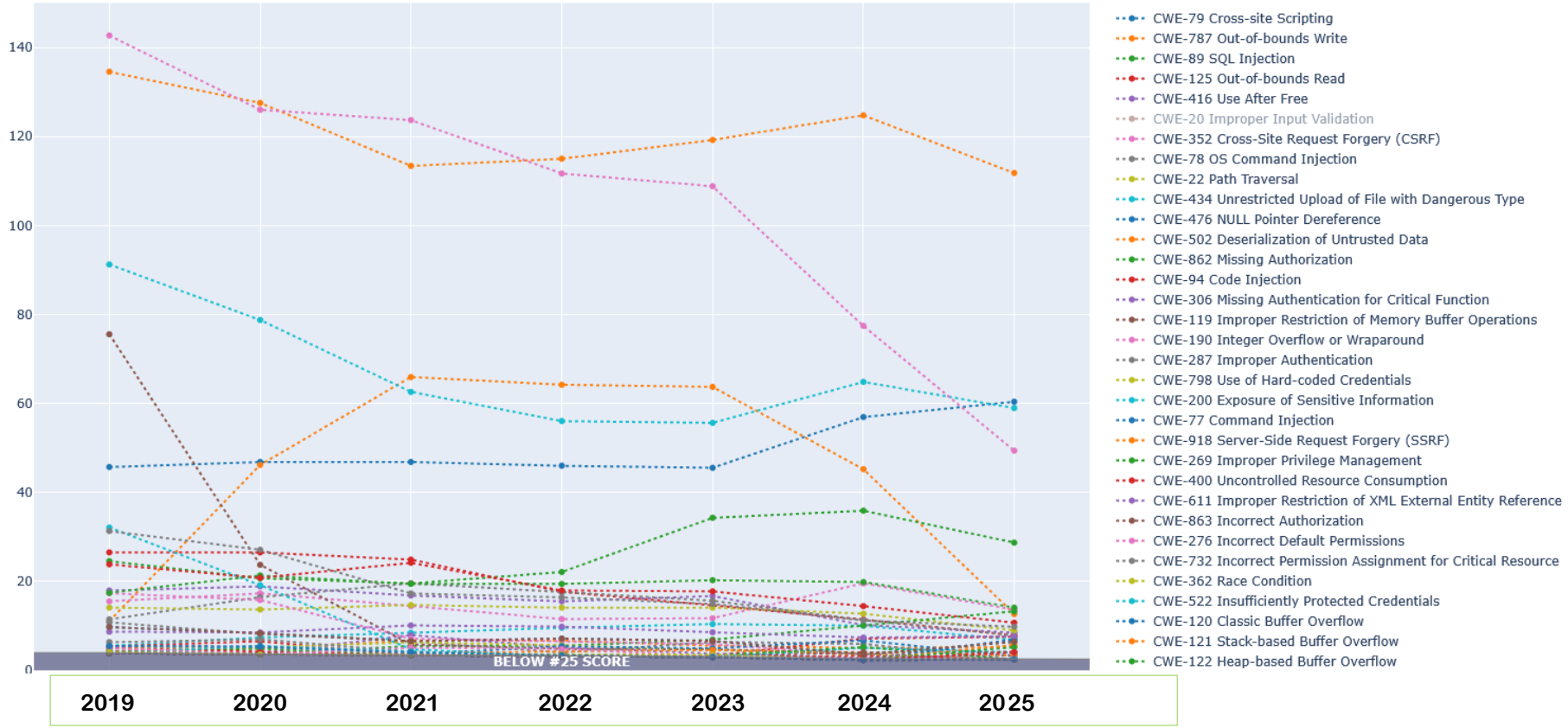
Big difference, due to

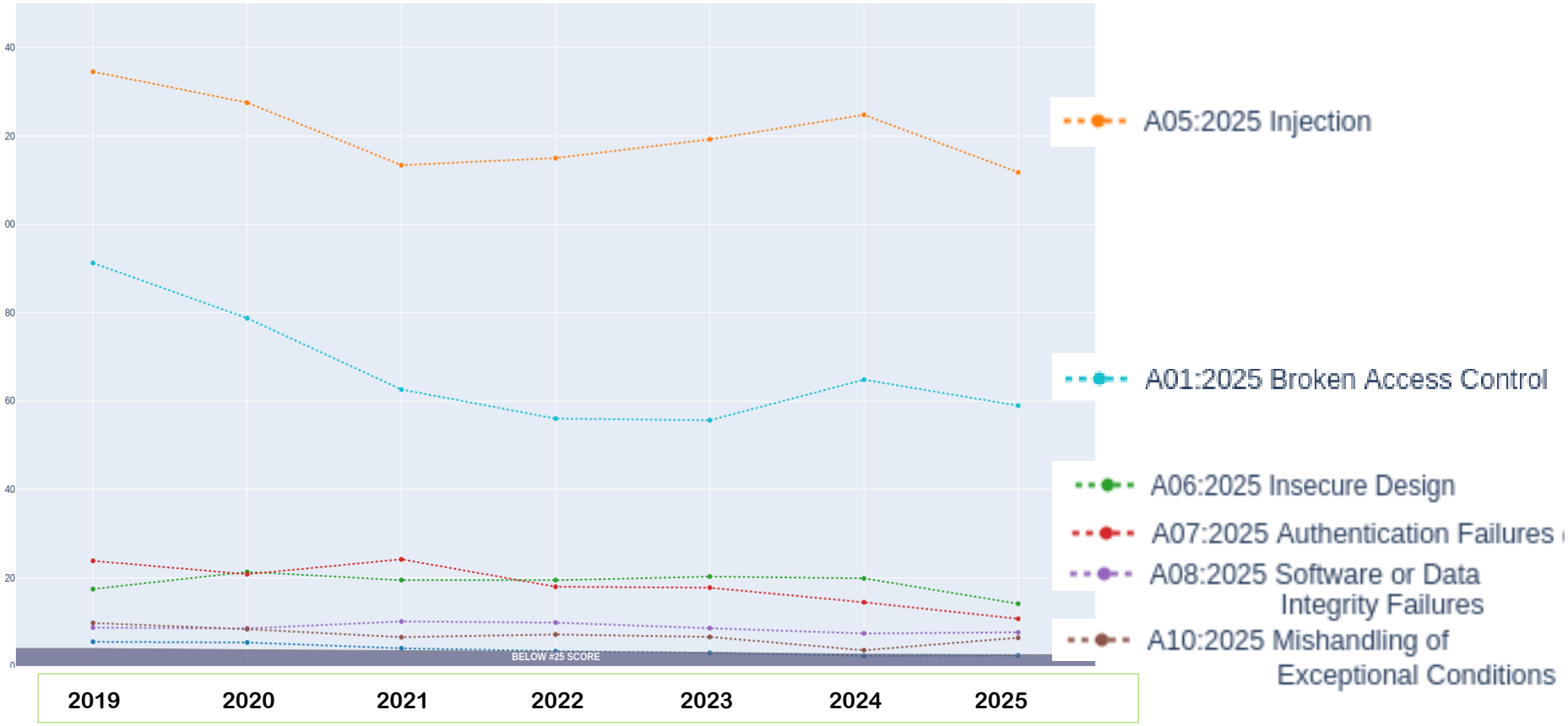
1. looking at incidence vs frequency
2. some flaws not showing up as CVEs

CWE Top 25 trends (i.e. CVE trends)

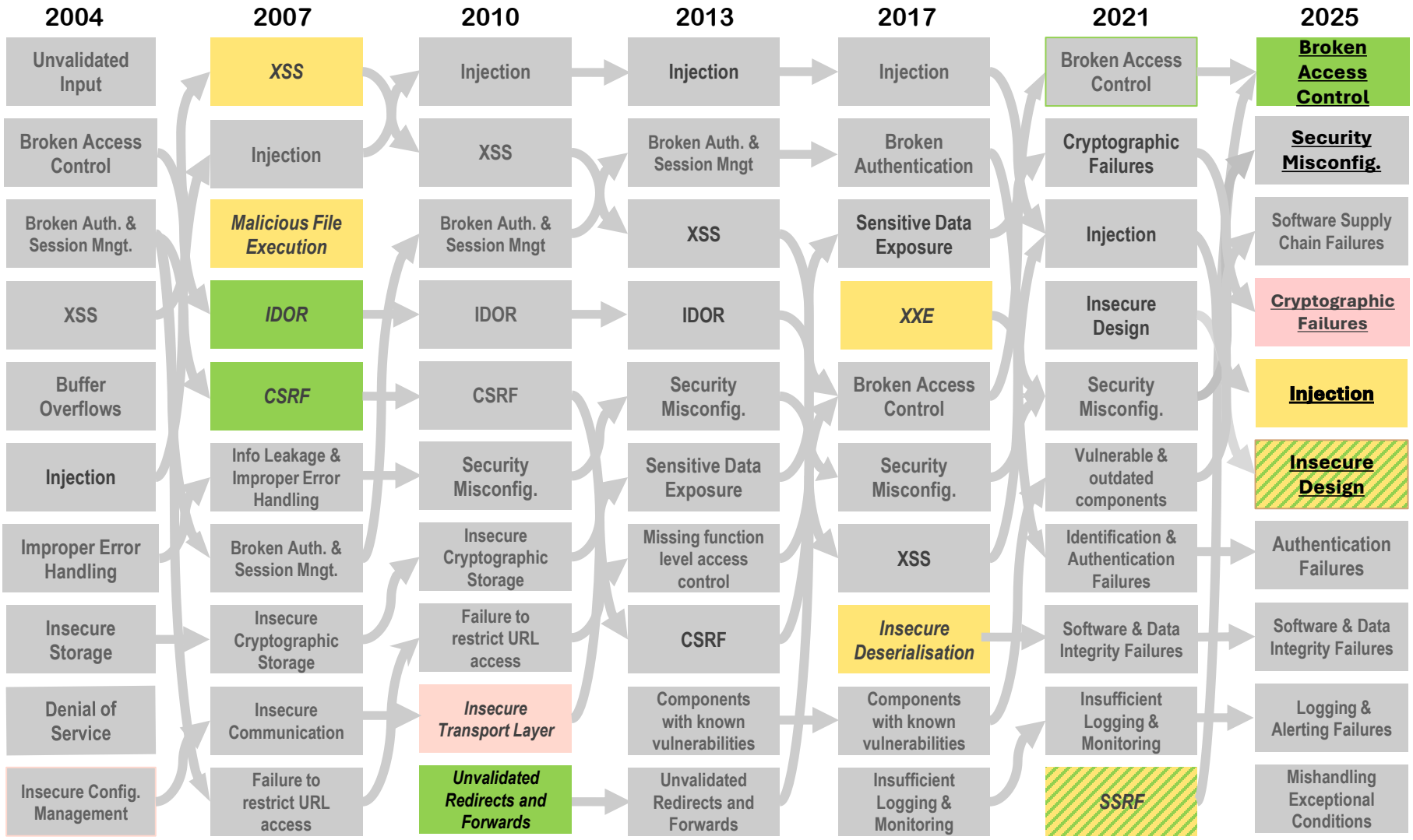


faizilham.com/lab/cwe-owasp/ranks.html

CVE trends – aggregated in the OWASP Top 10 categories



OWASP Trend: *specific* → **generic** Bad for awareness/actionability?



4. Cryptographic Failures

(Password) Hashing

- CWE-261 Weak Encoding for Password
- CWE-328 Reversible One-Way Hash
- CWE-759 One-Way Hash without a Salt
- CWE-760 One-Way Hash with a Predictable Salt
- CWE-916 Password Hash With Insufficient Computational Effort

Key management

- CWE-321 Use of Hard-coded Cryptographic Key
- CWE-320 Key Management Errors (Prohibited)

Not using crypto

- CWE-523 Unprotected Transport of Credentials
- CWE-319 Cleartext Transmission of Sensitive Info

Logic Flaws

- CWE-296 Improper Following of a Certificate Chain
- CWE-324 Use of a Key Past its Expiration Data
- CWE-347 Improper Verification of Crypt. Signature
- CWE-322 Key Exchange without Entity Authentication
- CWE-323 Reusing a Nonce, Key Pair in Encryption
- CWE-325 Missing Required Cryptographic Step
- CWE-757 Algorithm Downgrade

Insecure crypto – i.e. real crypto failures?

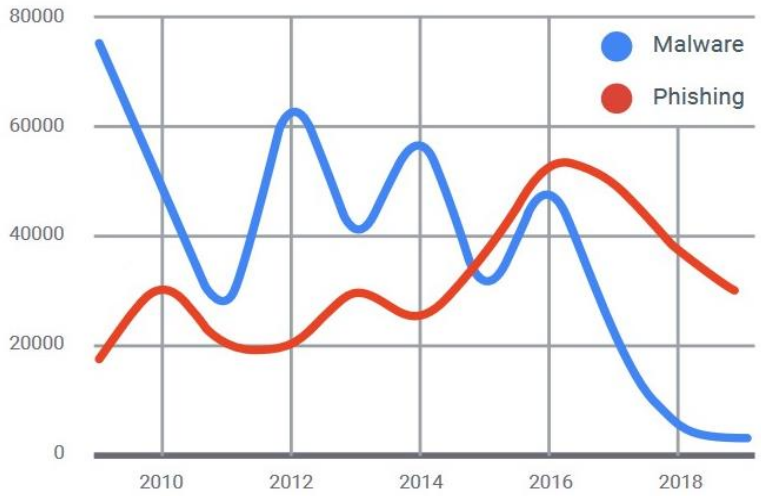
- CWE-326 Inadequate Encryption Strength
- CWE-327 Broken or Risky Cryptographic Algorithm
- CWE-780 RSA Algorithm without OAEP
- CWE-1240 Crypto Primitive with Risky Implementation

Randomness

- CWE-329 Not Using a Random IV with CBC Mode
- CWE-330 Use of Insufficiently Random Values
- CWE-331 Insufficient Entropy
- CWE-332 Insufficient Entropy in PRNG
- CWE-334 Small Space of Random Values
- CWE-335 Incorrect Usage of Seeds in PRNG
- CWE-336 Same Seed in PRNG
- CWE-337 Predictable Seed in PRNG
- CWE-338 Use of Cryptographically Weak PRNG
- CWE-1241 Use of Predictable Algorithm in RNG
- CWE-340 Generation of Predictable Numbers or Identifiers
- CWE-342 Predictable Exact Value from Previous Values

Bigger trend: software vs wetware flaws

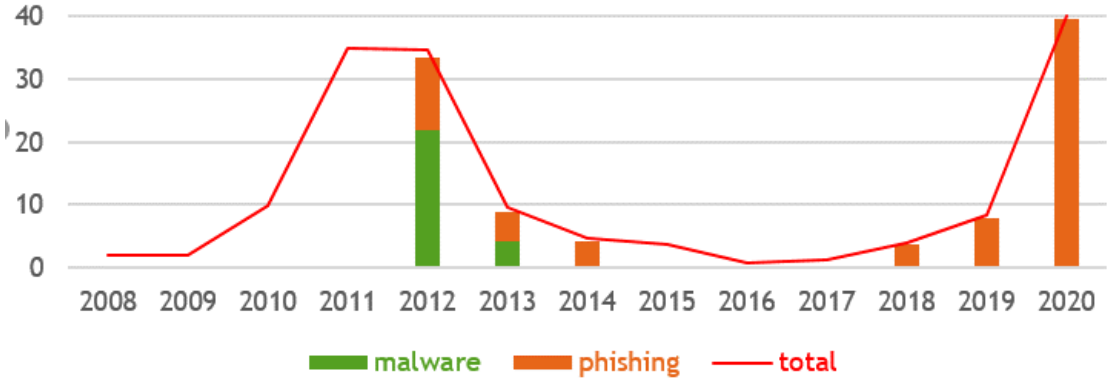
Exploit malware vs phishing detected by Google



[Source: Safe Browsing/

Google Transparency Report]

Internet banking losses in the Netherlands



[Source: Betaalvereniging]

Conclusions

- Classification and ranking security vulnerabilities is a messy business
- Trends are hard to spot, but
  - *Supply chain issues* on the rise
  - *Injection problems* on decline (thanks to better platforms & APIs?) but not if you look at frequency instead of incidence
  - *Misconfiguration* on the rise, due to *more* platforms & APIs?
- How to maximise awareness and actionability?

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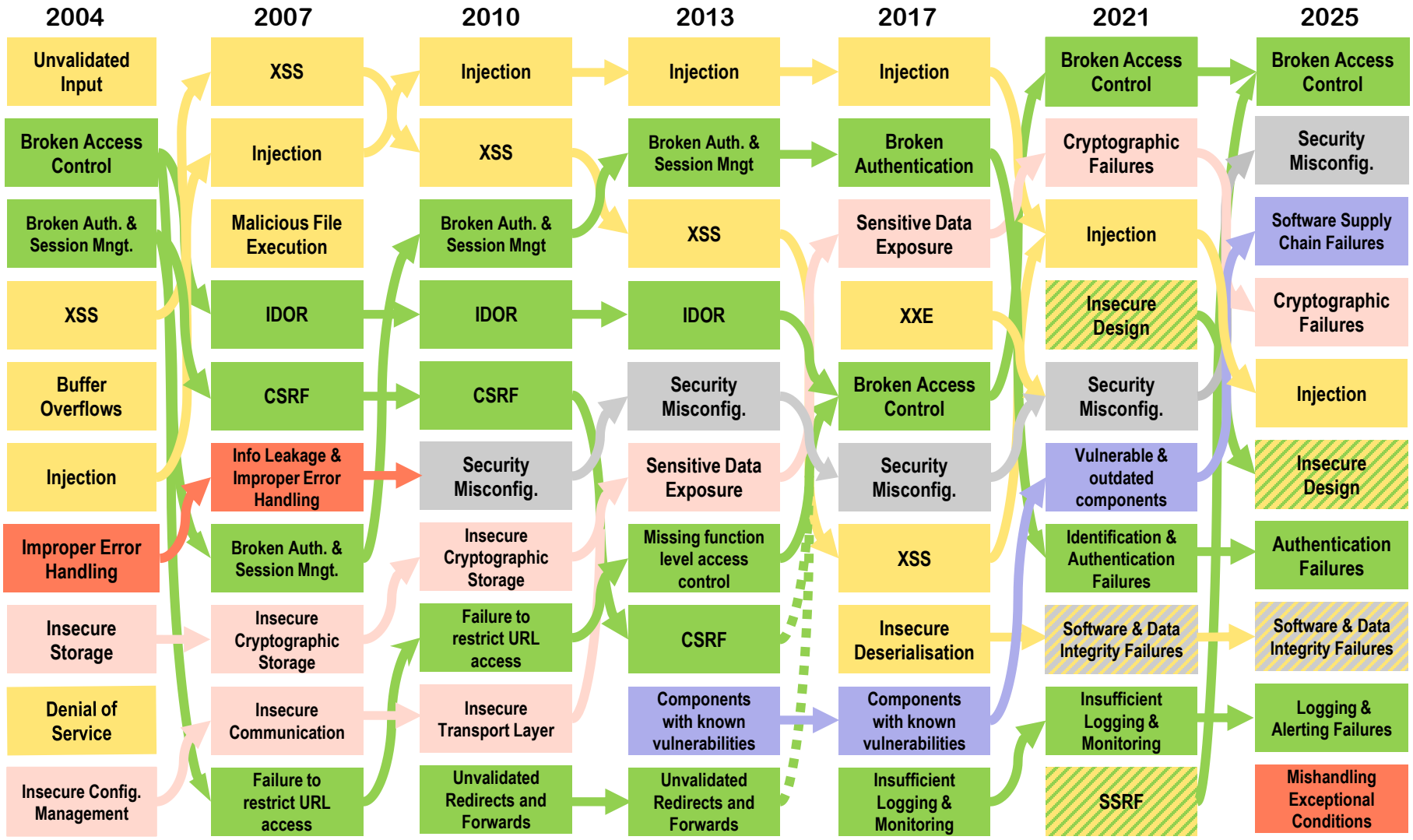
Evolution of the OWASP Top 10



8. Software & Data Integrity Failures

Input handling

- CWE-345 Insufficient Verification of Data Authenticity
- CWE-353 Missing Support for Integrity Check
- CWE-426 Untrusted Search Path
- CWE-427 Uncontrolled Search Path Element
- CWE-502 Deserialization of Untrusted Data
- CWE-565 Reliance on Cookies without Validation and Integrity Checking
- CWE-784 Reliance on Cookies without Validation and Integrity Checking in Security Decision
- CWE-915 Improperly Controlled Modification of Dynamically-Determined Object Attributes

Code handling/software supply chain issues

- CWE-494 Download of Code Without Integrity Check
- CWE-829 Inclusion of Functionality from Untrusted Control Sphere
- CWE-830 Inclusion of Web Functionality from an Untrusted Source
- CWE-926 Improper Export of Android Application Components

- CWE-506 Embedded Malicious Code
- CWE-509 Replicating Malicious Code (Virus or Worm)

2. Security Misconfiguration

- CWE-15 External Control of System or Configuration Setting
- CWE-16 Configuration
- CWE-260 Password in Configuration File
- CWE-547 Use of Hard-coded, Security-relevant Constants
- CWE-489 Active Debug Code
- CWE-5 J2EE Misconfiguration: Data Transmission Without Encryption
- CWE-11 ASP.NET Misconfiguration: Creating Debug Binary
- CWE-13 ASP.NET Misconfiguration: Password in Configuration File
- CWE-1174 ASP.NET Misconfiguration: Improper Model Validation

Cookies & CORS

- CWE-315 Cleartext Storage of Sensitive Information in a Cookie
- CWE-614 Sensitive Cookie in HTTPS Session Without 'Secure' Flag
- CWE-1004 Sensitive Cookie Without 'HttpOnly' Flag
- CWE-526 Exposure of Sensitive Information Through Environment Variables
- CWE-942 Permissive Cross-domain Policy with Untrusted Domains

Injection attacks

- CWE-611 Improper Restriction of XML External Entity Reference
- CWE-776 XML Entity Expansion