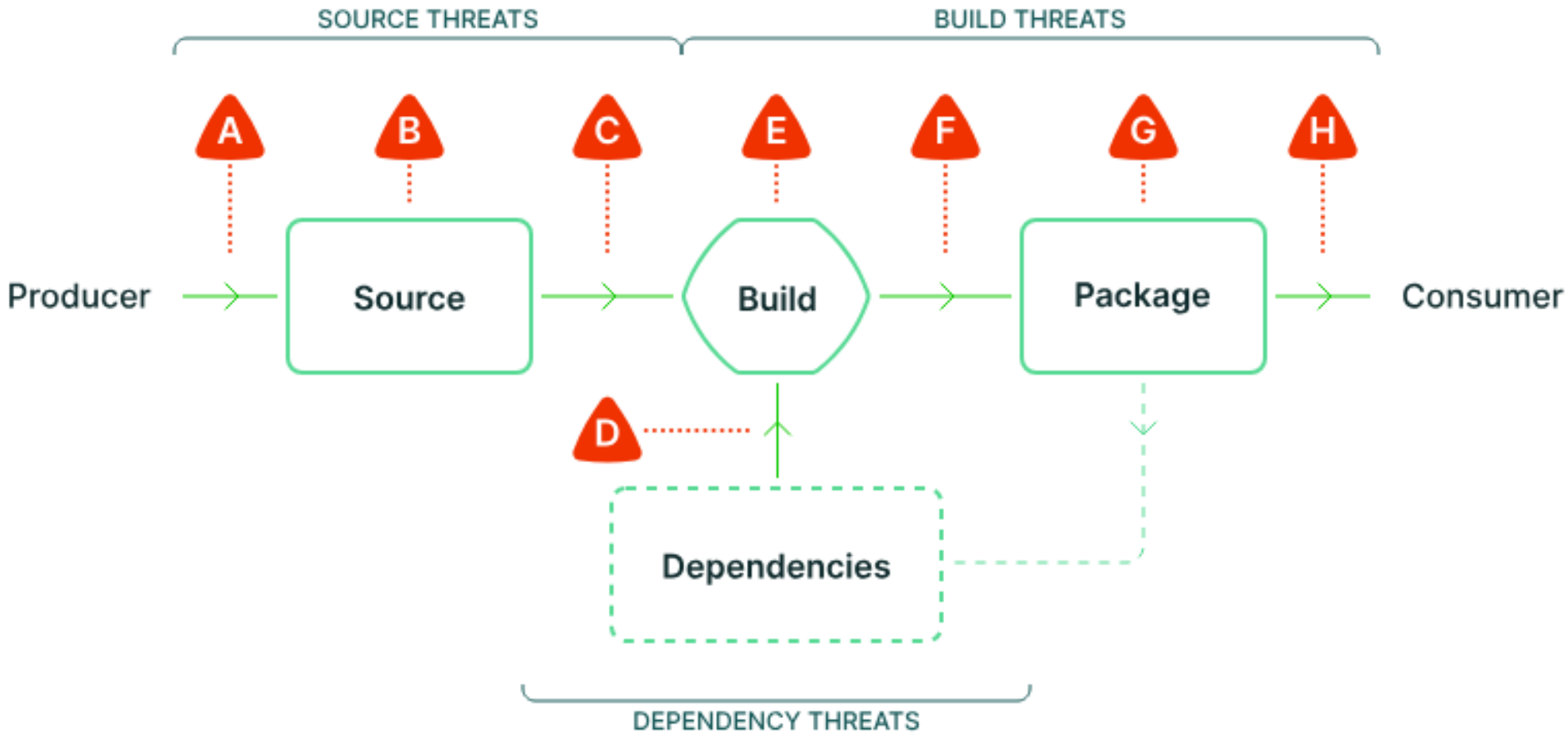
Secure Coding Practices

CYBER SECURITY
neosec

Who is Sven?


Supply Chain
Security

Secure Coding



SOURCE THREATS

A Submit unauthorized change

B Compromise source repo

C Build from modified source

DEPENDENCY THREATS

D Use compromised dependency

BUILD THREATS

E Compromise build process

F Upload modified package

G Compromise package registry

H Use compromised package

Project SLSA - https://slsa.dev/

- Security
- Integrity
- Transparency
- Traceability
- Trust

- Software Supply Chain Security
- Trusted Artifacts
- End-to-End Integrity
- Maturity Model (Level 1–4)
- Prevents Supply Chain Attacks

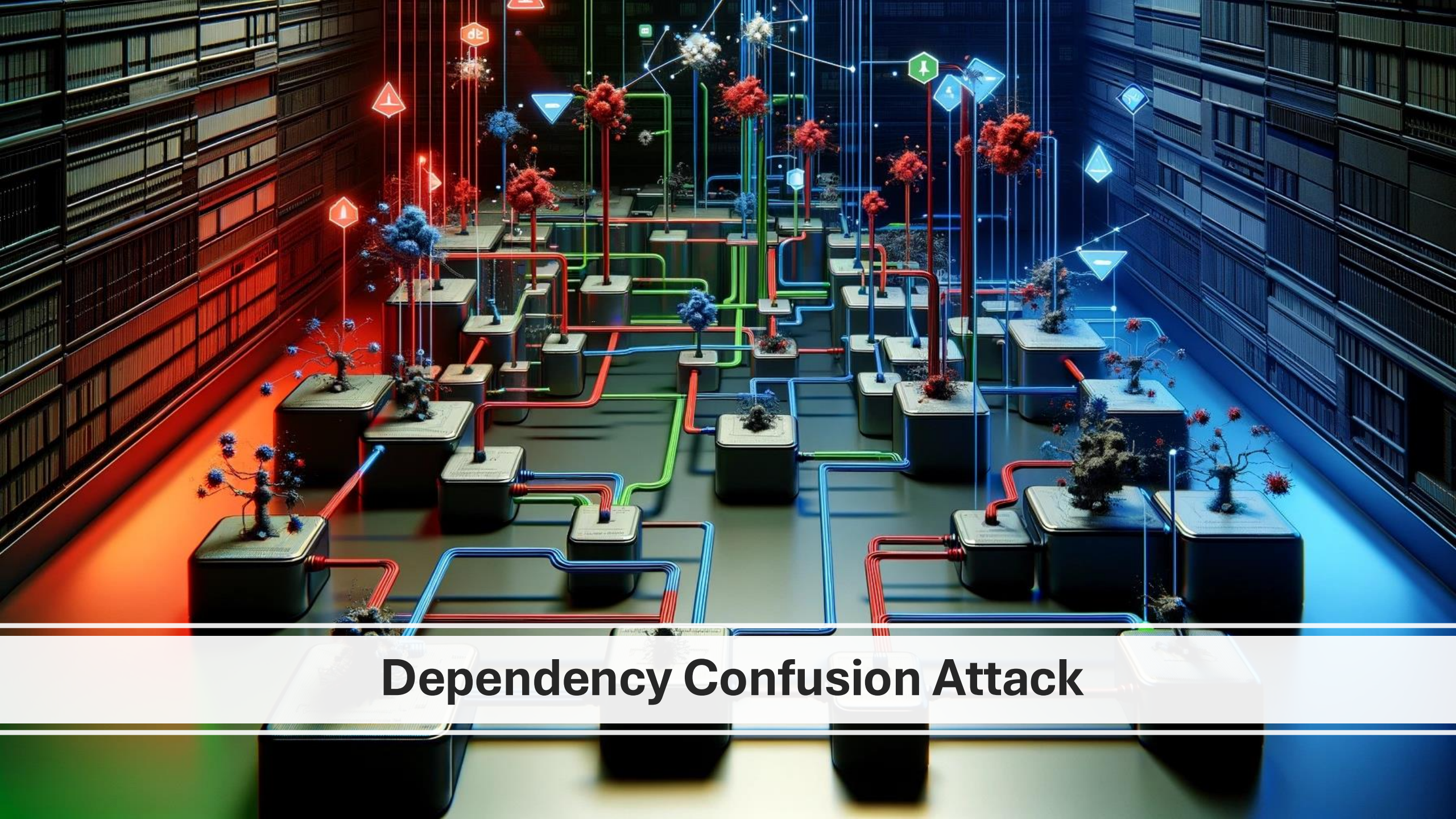
OWASP - https://owasp.org/

- https://owasp.org/www-project-dependency-track/
- https://owasp.org/www-project-top-ten/
- https://cyclonedx.org/
- https://github.com/CycloneDX/cyclonedx-maven-plugin

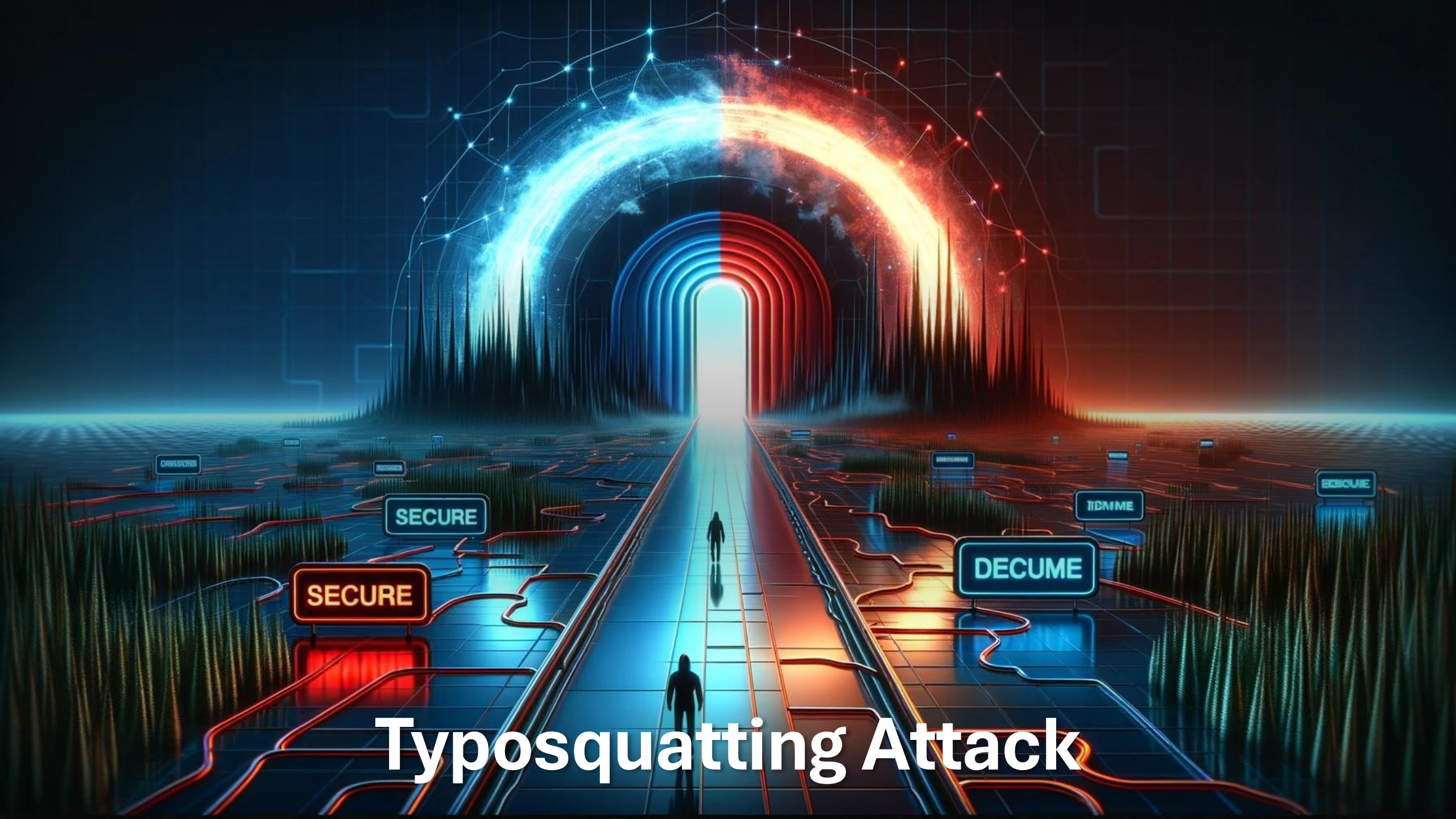
OWASP - https://owasp.org/

Input validation
Output validation
Database Security
File Management
Memory Management
Session Management
Access Control
General Coding Practices
Cryptographic Practices
Error Handling and Logging
Data Protection
Communication Security
System Configuration
Authentication and Password Management

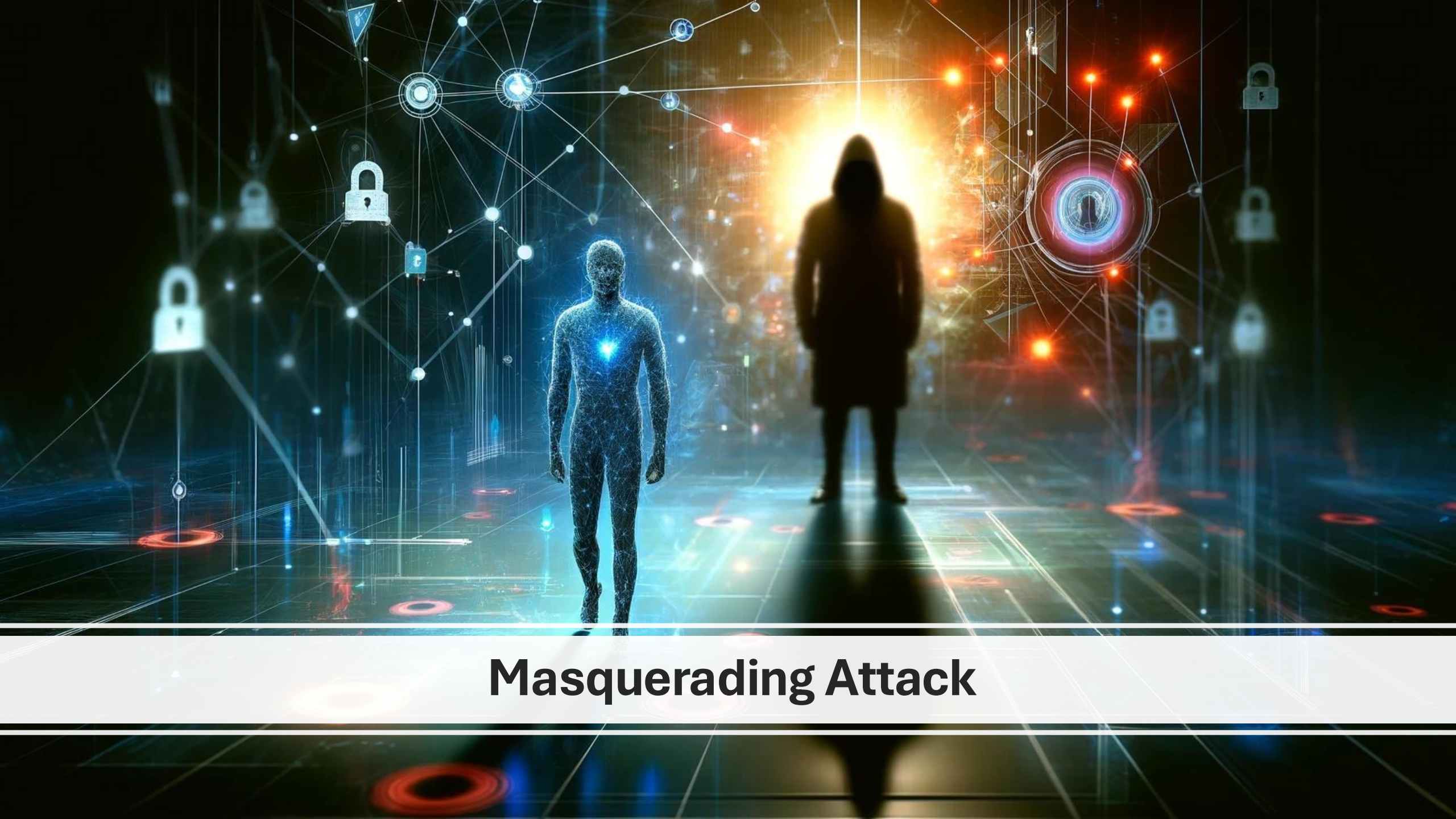
Infection Methods



Dependency Confusion Attack



Typosquatting Attack



Masquerading Attack

Trojan Package Attack

Code obfuscation techniques

- Off-the-shelf public obfuscators
  - Pyarmor - https://github.com/dashingsoft/pyarmor
  - obfuscator.io - https://obfuscator.io/
  - Python obfuscation tool - https://www.development-tools.net/python-obfuscator/
- Custom obfuscation techniques
  - Mangling variable names
  - Encrypting strings
  - Control flow flattening
- Invisible backdoors - homoglyphs

Obfuscation techniques

Python obfuscation tool - https://www.development-tools.net/python-obfuscator/

Used in “noblesse2” malicious packages we found last year

Encode Python code text with base64

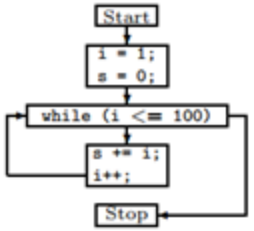
Decode, compile and evaluate the code

```
import base64, codecs
magic = 'cHJpbnQ'
love = 'bVxuyoT'
god = 'xvIHdvc'
destiny = 'zkxVFVc'
joy = '\x72\x6f\x74\x31\x33'
trust = eval('\x6d\x61\x67\x69\x63') + eval('\x63\x6f\x64\x65\x63\x73\x2e\x64\x65\x63\...
eval(compile(base64.b64decode(eval('\x74\x72\x75\x73\x74')),'<string>','exec'))
```

Obfuscation techniques

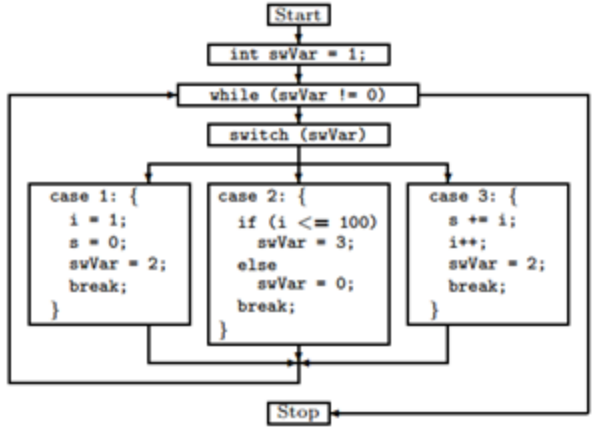
original

```
i = 1;
s = 0;


while (i <= 100) {



  s += i;
  i++;


}
```



control-flow flattening applied

```
int swVar = 1;
while (swVar != 0) {
  switch (swVar) {
    case 1: {
      i = 1;
      s = 0;
      swVar = 2;
      break;
    }
    case 2: {
      if (i <= 100)
        swVar = 3;
      else
        swVar = 0;
      break;
    }
    case 3: {
      s += i;
      i++;
      swVar = 2;
      break;
    }
  }
}
```



Obfuscation techniques

Unicode homoglyph characters are characters that look like standard ASCII/Latin characters

Can be used by supply-chain attackers to plant "invisible" backdoors

Example: changing a string literal check to make it always succeed / fail

```
void sayHello() {
    std::cout << "Hello, World!\n";
}

void sayHello() {
    std::cout << "Bye, World!\n";
}
```

Obfuscation techniques

Unicode bidirectional (BiDi) control characters

Normally used to control the flow of text (left-to-right or right-to-left)

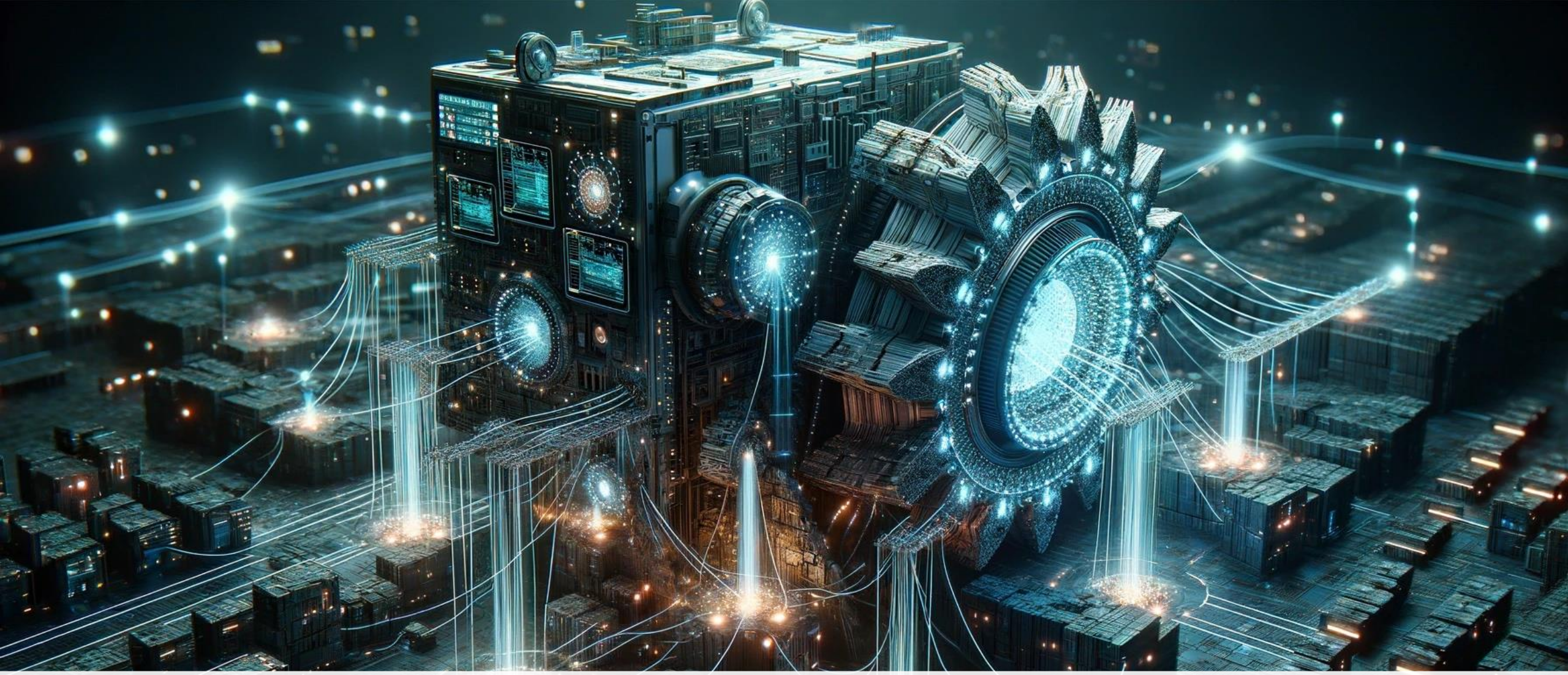
Can be used to change the order of the compiled / interpreted source code

An example - invisibly comment out a condition check

```
int main() {
bool isAdmin = false;
/* begin admins only */ if (isAdmin) {
    printf("You are an admin.\n");
/* end admins only */ }
return 0;
}
```

```
int main() {
bool isAdmin = false;
/* begin admins only if (isAdmin) */ {
    printf("You are an admin.\n");
/* end admins only */ }
return 0;
}
```

Security Payloads



Cryptominer

Sensitive Data Stealer

Text Steganography

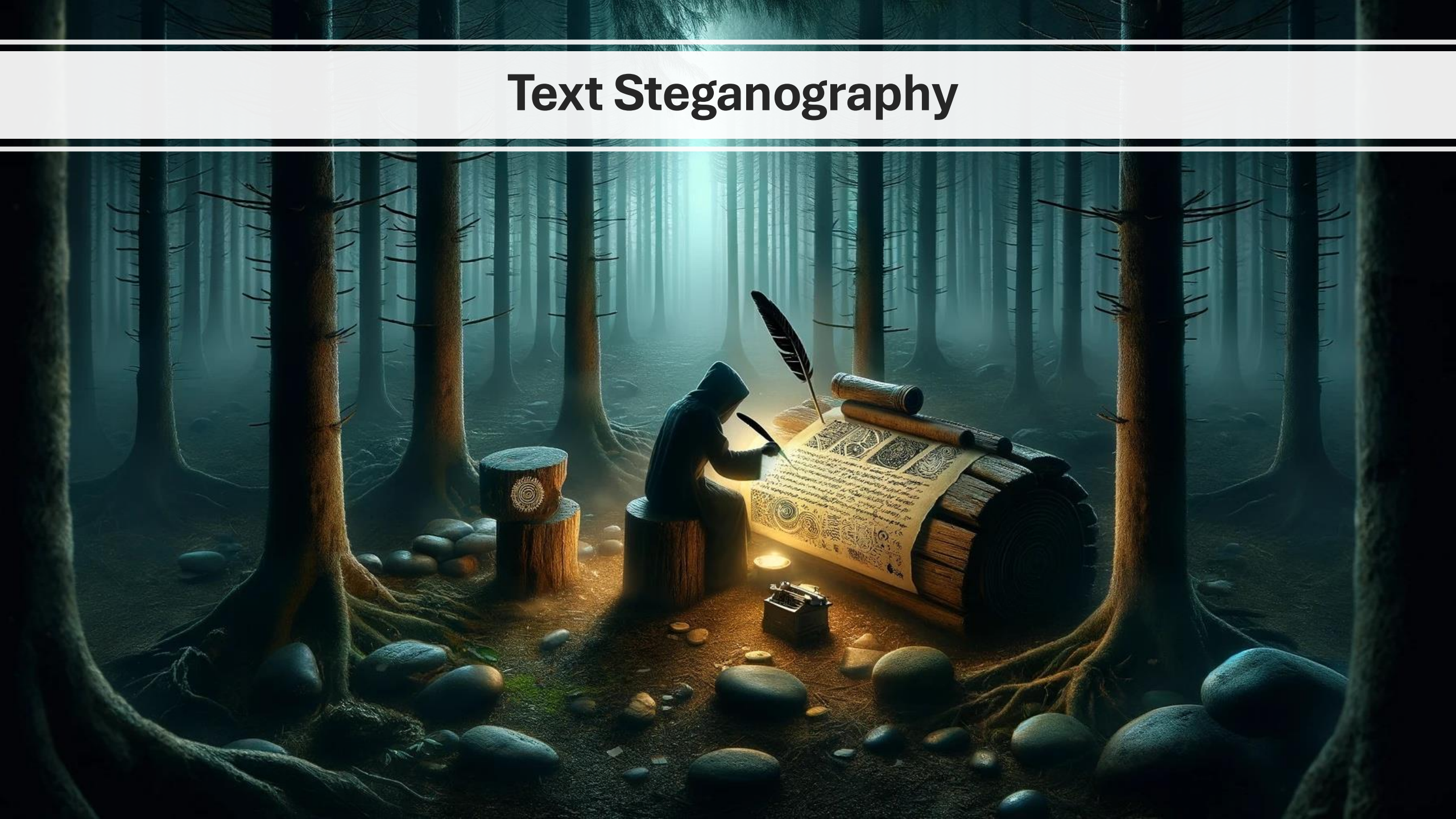


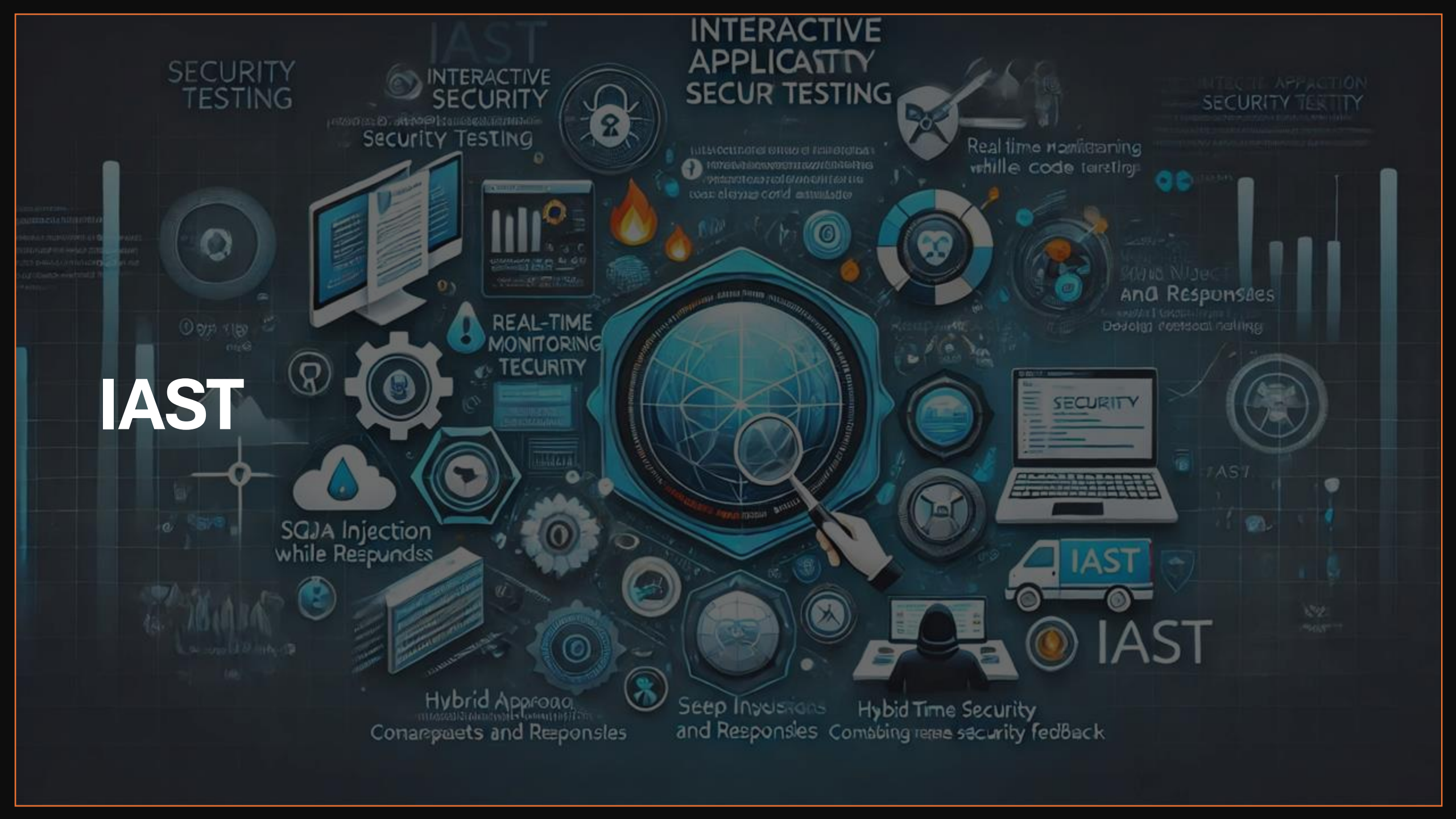
Image Steganography


Audio Steganography

Video Steganography

SAST

DAST


IAST
SECURITY TESTING
INTERACTIVE SECURITY
Security Testing
INTERACTIVE APPLICATTY SECUR TESTING
Real time
while code
REAL-TIME MONITORING TECURITY
And Responses
SECURITY
IAST
IAST
Hybrid Approaq
Conaepuets and Reponsles
and Responsles
Hybid Time Security
security fedBack

IAST

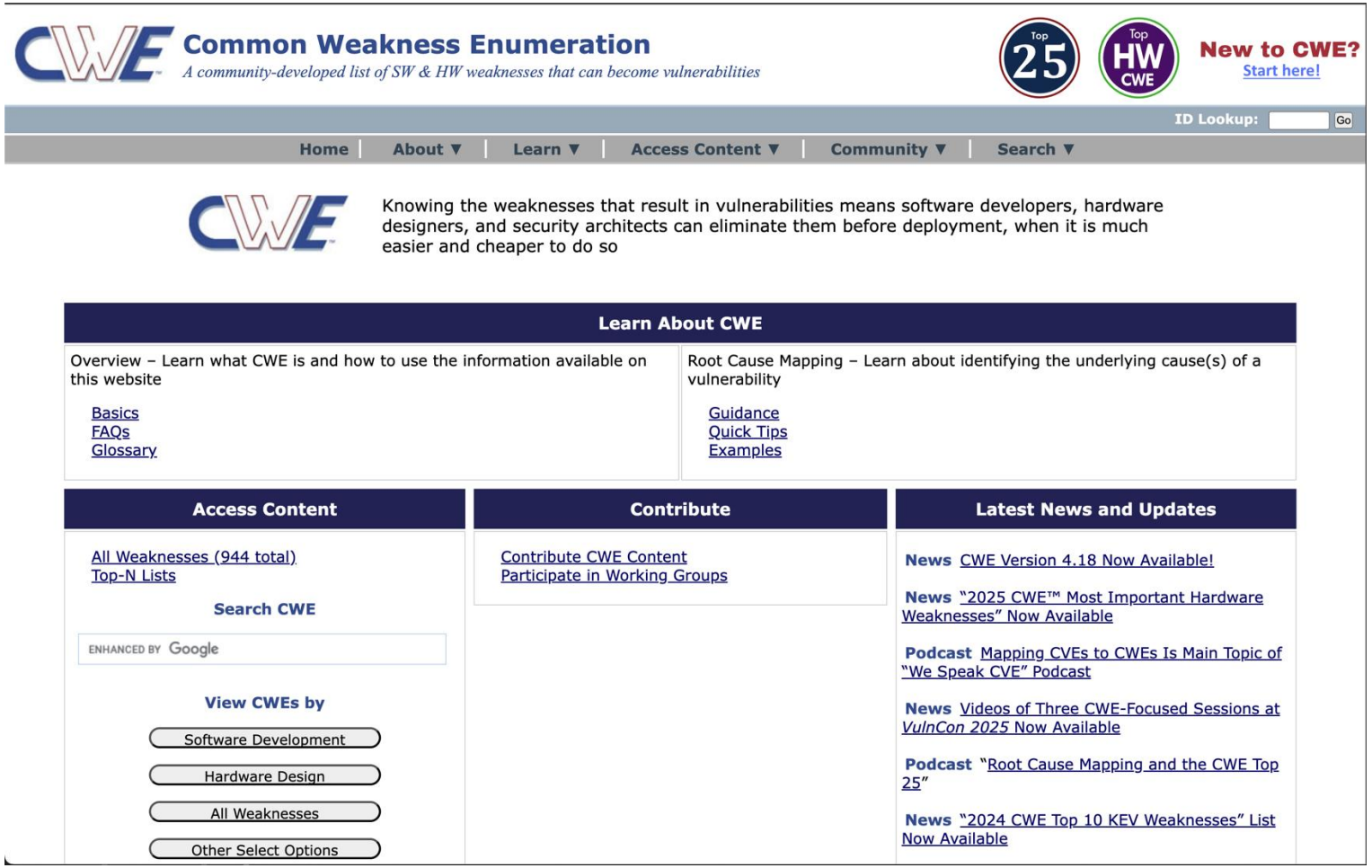
RASP


RUNTIME APPLICATION SELF-PROTECTION
RUNTIME SELF-PROTECTION
INTELIGENT APPLICATION SELF-PROTECTION
RASP
RASP
INTELIGENT SECURITY
INTELLIGIME SECURITY
REAL-TIME
RESPONSE

Common Weakness Enumeration

https://cwe.mitre.org/

Common Weakness Enumeration



https://cwe.mitre.org/

Common Weakness Enumeration

699 - Software Development

- API / Function Errors - *(1228)*
- Audit / Logging Errors - *(1210)*
- Authentication Errors - *(1211)*
- Authorization Errors - *(1212)*
- Bad Coding Practices - *(1006)*
- Behavioral Problems - *(438)*
- Business Logic Errors - *(840)*
- Communication Channel Errors - *(417)*
- Complexity Issues - *(1226)*
- Concurrency Issues - *(557)*
- Credentials Management Errors - *(255)*
- Cryptographic Issues - *(310)*
- Key Management Errors - *(320)*
- Data Integrity Issues - *(1214)*
- Data Processing Errors - *(19)*
- Data Neutralization Issues - *(137)*
- Documentation Issues - *(1225)*
- File Handling Issues - *(1219)*
- Encapsulation Issues - *(1227)*
- Error Conditions, Return Values, Status Codes - *(389)*
- Expression Issues - *(569)*
- Handler Errors - *(429)*
- Information Management Errors - *(199)*
- Initialization and Cleanup Errors - *(452)*
- Data Validation Issues - *(1215)*
- Lockout Mechanism Errors - *(1216)*
- Memory Buffer Errors - *(1218)*
- Numeric Errors - *(189)*
- Permission Issues - *(275)*
- Pointer Issues - *(465)*
- Privilege Issues - *(265)*
- Random Number Issues - *(1213)*
- Resource Locking Problems - *(411)*
- Resource Management Errors - *(399)*
- Signal Errors - *(387)*
- State Issues - *(371)*
- String Errors - *(133)*
- Type Errors - *(136)*
- User Interface Security Issues - *(355)*
- User Session Errors - *(1217)*

https://cwe.mitre.org/

Common Weakness Enumeration

- Documentation Issues - *(1225)*
- File Handling Issues - *(1219)*
  - Improper Limitation of a Pathname to a Restricted Directory ('Path Traversal') - *(22)*
  - Improper Resolution of Path Equivalence - *(41)*
  - Improper Link Resolution Before File Access ('Link Following') - *(59)*
  - Improper Handling of File Names that Identify Virtual Resources - *(66)*
  - Creation of Temporary File With Insecure Permissions - *(378)*
  - Creation of Temporary File in Directory with Insecure Permissions - *(379)*
  - Untrusted Search Path - *(426)*
  - Uncontrolled Search Path Element - *(427)*
  - Unquoted Search Path or Element - *(428)*
- Encapsulation Issues - *(1227)*

https://cwe.mitre.org/

Common Weakness Enumeration

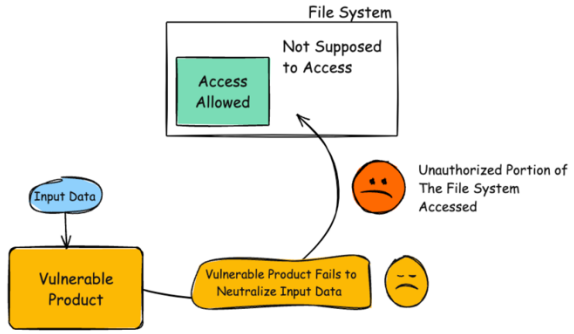
CWE-22: Improper Limitation of a Pathname to a Restricted Directory ('Path Traversal')

Weakness ID: 22
Vulnerability Mapping: ALLOWED
Abstraction: Base

View customized information: Conceptual | Operational | Mapping Friendly | **Complete** | Custom

Description

The product uses external input to construct a pathname that is intended to identify a file or directory that is located underneath a restricted parent directory, but the product does not properly neutralize special elements within the pathname that can cause the pathname to resolve to a location that is outside of the restricted directory.



Extended Description

Many file operations are intended to take place within a restricted directory. By using special elements such as ".." and "/" separators, attackers can escape outside of the restricted location to access files or directories that are elsewhere on the system. One of the most common special elements is the "../" sequence, which in most modern operating systems is interpreted as the parent directory of the current location. This is referred to as relative path traversal. Path traversal also covers the use of absolute pathnames such as "/usr/local/bin" to access unexpected files. This is referred to as absolute path traversal.


Common
Vulnerability
Scoring System
www.first.org/cvss/


Exploit Prediction
Scoring System
www.first.org/epss/

Penetration Testing

Fuzzing

TDD and Security


TEST COVERAGE
DEPENDENCIES
VULNERABILITIES

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