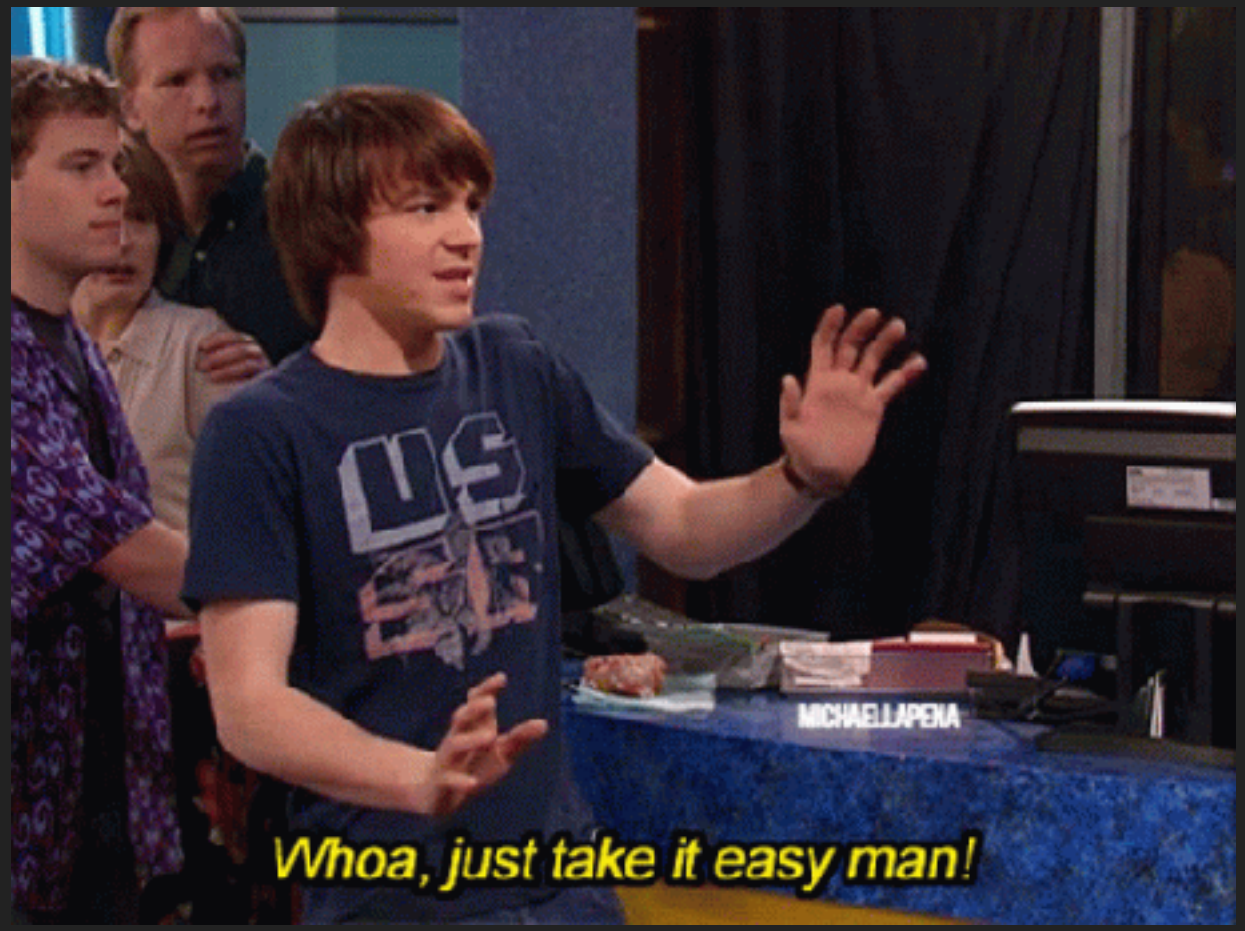
Security Vulnerabilities Decomposition

Katy Anton

OWASP Top 10

When the report is published



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Katy Anton

- Software development background
- Project co-leader for
  OWASP Top 10 Proactive Controls
  (@OWASPControls)
- Principle Application Security Consultant

VERACODE

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Common Weakness Enumeration

A formal list for of software security weaknesses in:

- *architecture*
- *design*
- *code*

Source: https://cwe.mitre.org/

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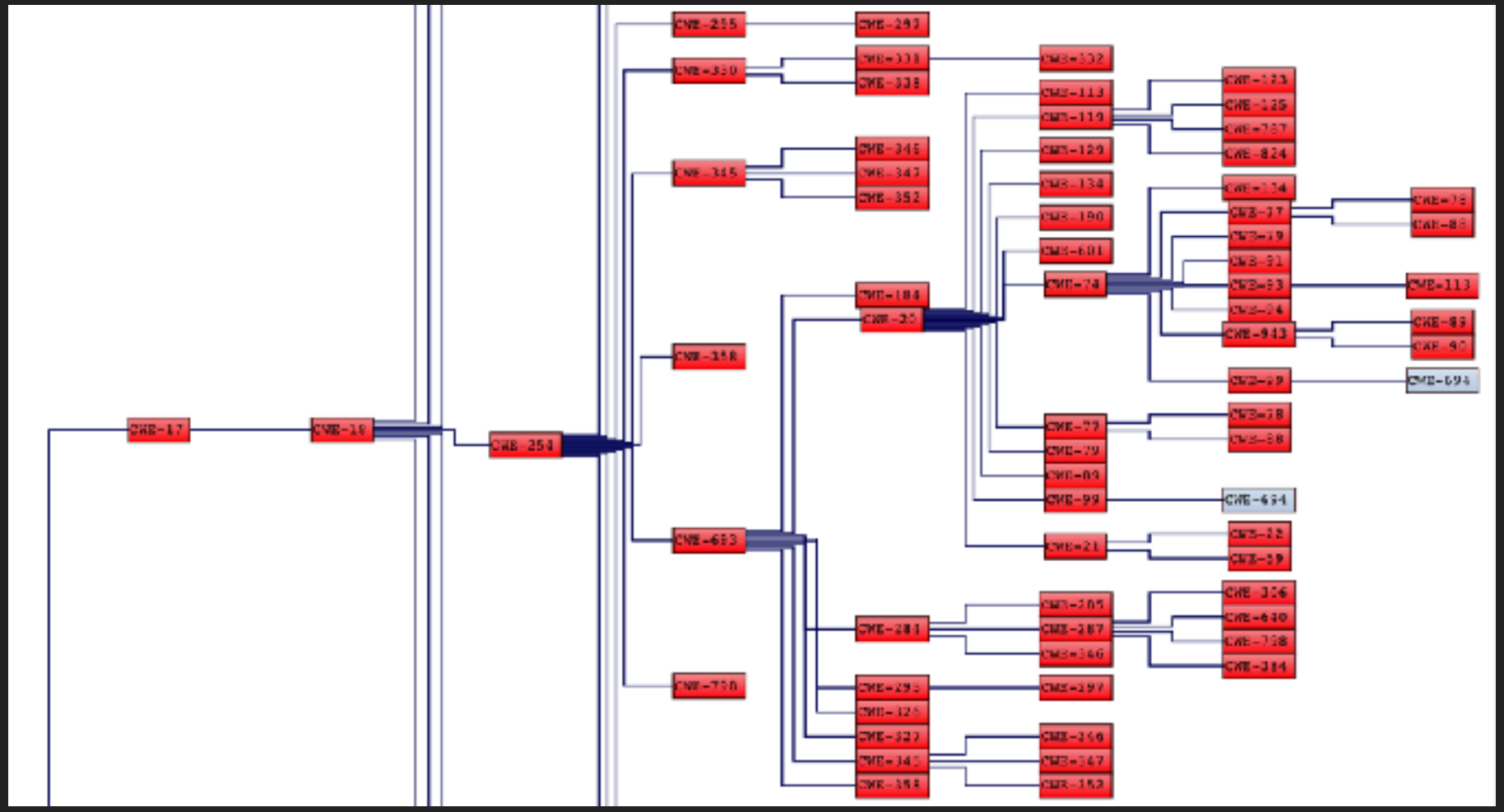
NVD: CWE Categories



Source: https://nvd.nist.gov/vuln/categories/cwe-layout

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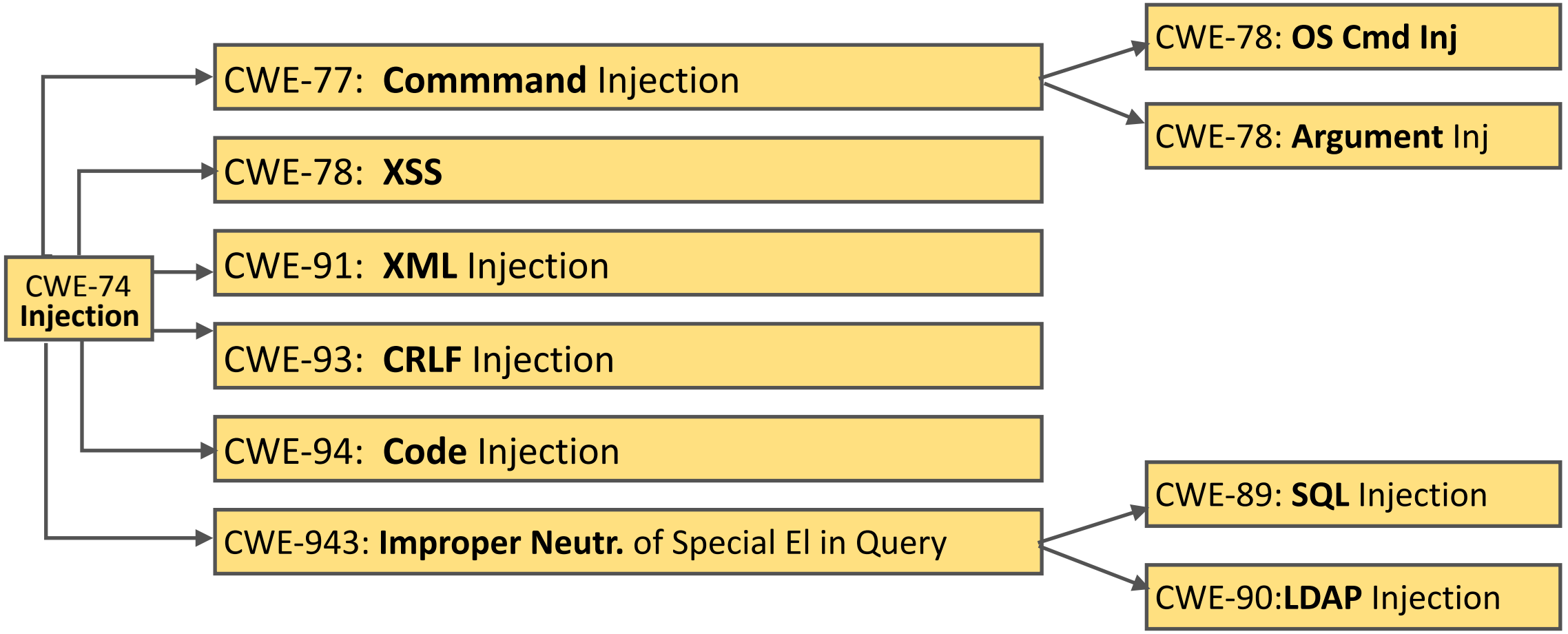
Injection Category

CWEs in Injection Category



Source: NVD

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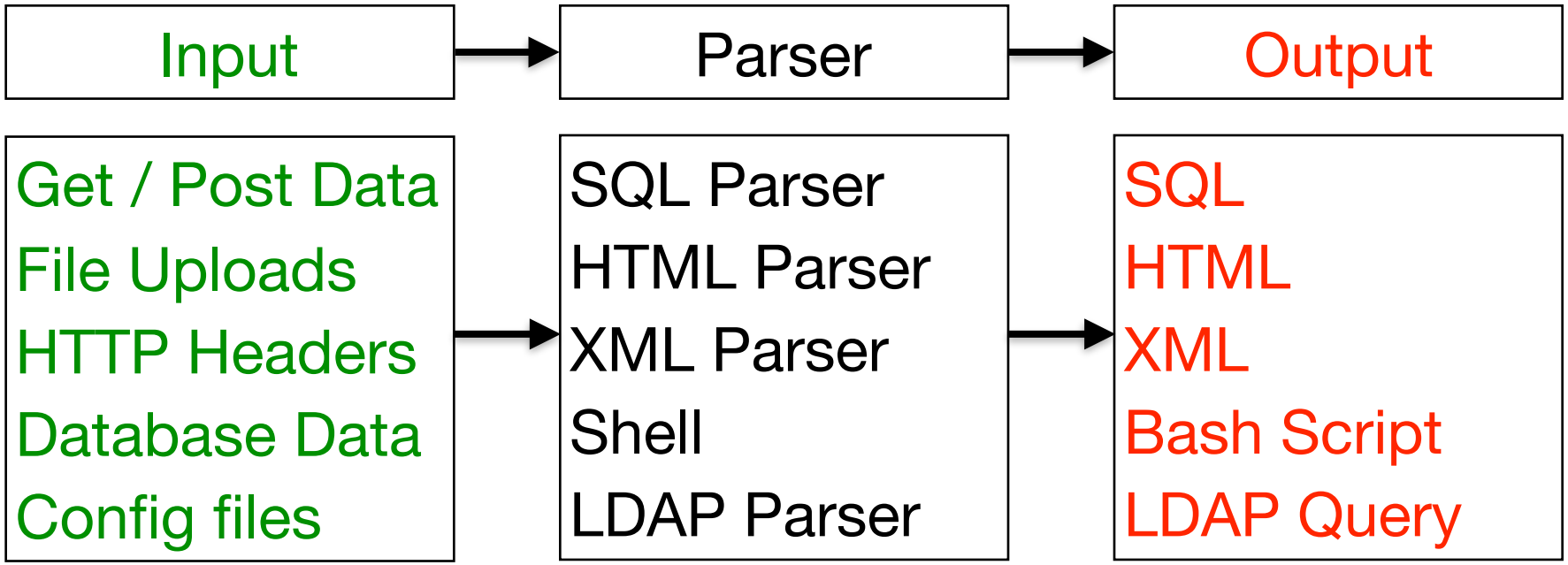
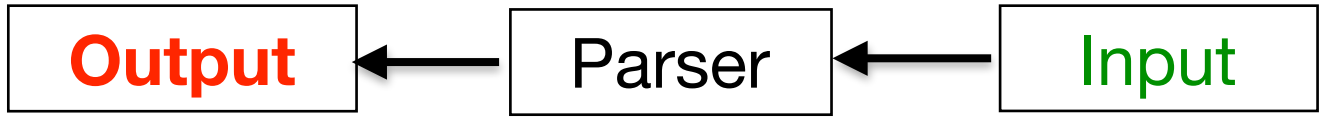
Is there another way to look at it?

Decompose the Injection

Data interpreted as Code



Extract Security Controls



Vulnerability	Encode Output	Parameterize	Validate Input
XSS	☑		☑
SQL Injection		☑	☑
XML Injection	☑		☑
Code Injection	☑		☑
LDAP Injection	☑		☑
Cmd Injection		☑	☑

Primary Controls

Defence in depth

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Intrusions

(or lack of Intrusion Detection)

If a pen tester is able to get into a system without being detected, then there is insufficient logging and monitoring in place

Security Controls: Security Logging

The security control developers can use to log security information during the runtime operation of an application.

The 6 Best Types of Detection Points

Good attack identifiers:

1. Authorisation failures
2. Authentication failures
3. Client-side input validation bypass
4. Whitelist input validation failures
5. Obvious code injection attack
6. High rate of function use

Examples of Intrusion Detection Points

Request Exceptions

- Application receives GET when expecting POST
- Additional form /URL parameters

Examples of Intrusion Detection Points

Authentication Exceptions

- Additional variables received during an authentication

  like ‘admin=true’’

- Providing only one of the credentials

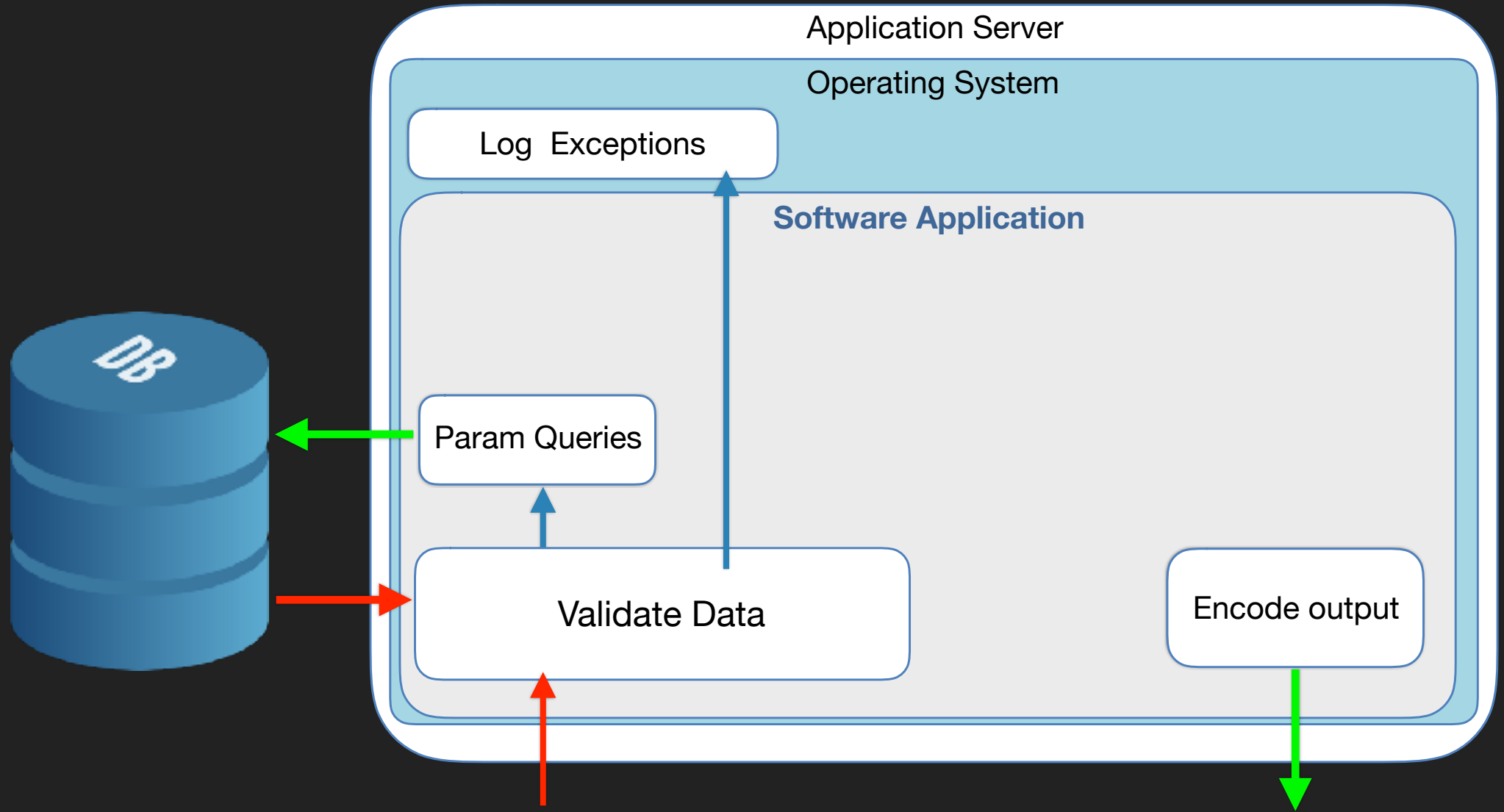
  The user submits POST request which only contains the username variable. The password was removed.

Examples of Intrusion Detection Points

Input Exceptions

- Input validation failure on server despite client side validation
- Input validation failure on server side on non-user editable parameters
  - e.q:hidden fields, checkboxes, radio buttons, etc

Secure Data Handling: Basic Workflow



Sensitive Date Exposure

Data at Rest and in Transit

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Data

Data Types	Encryption	Hashing
Data at **Rest**: Requires initial value E.q: credit card	☑	
Data at **Rest**: Doesn't require initial value E.q: user passwords		☑
Data in **Transit**	☑	

Data at Rest: Design Vulnerability example

How Not to Do it !

In the same folder - 2 file:

```
encrypted-password.txt
password-entities.txt
```

The content of password.txt:

```
cryptography.seed=abcd
cryptography.salt=12345
cryptography.iterations=1000
```

encryption_key = PBKF2(psswd, salt, iterations, key_length);

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Encryption: Security Controls

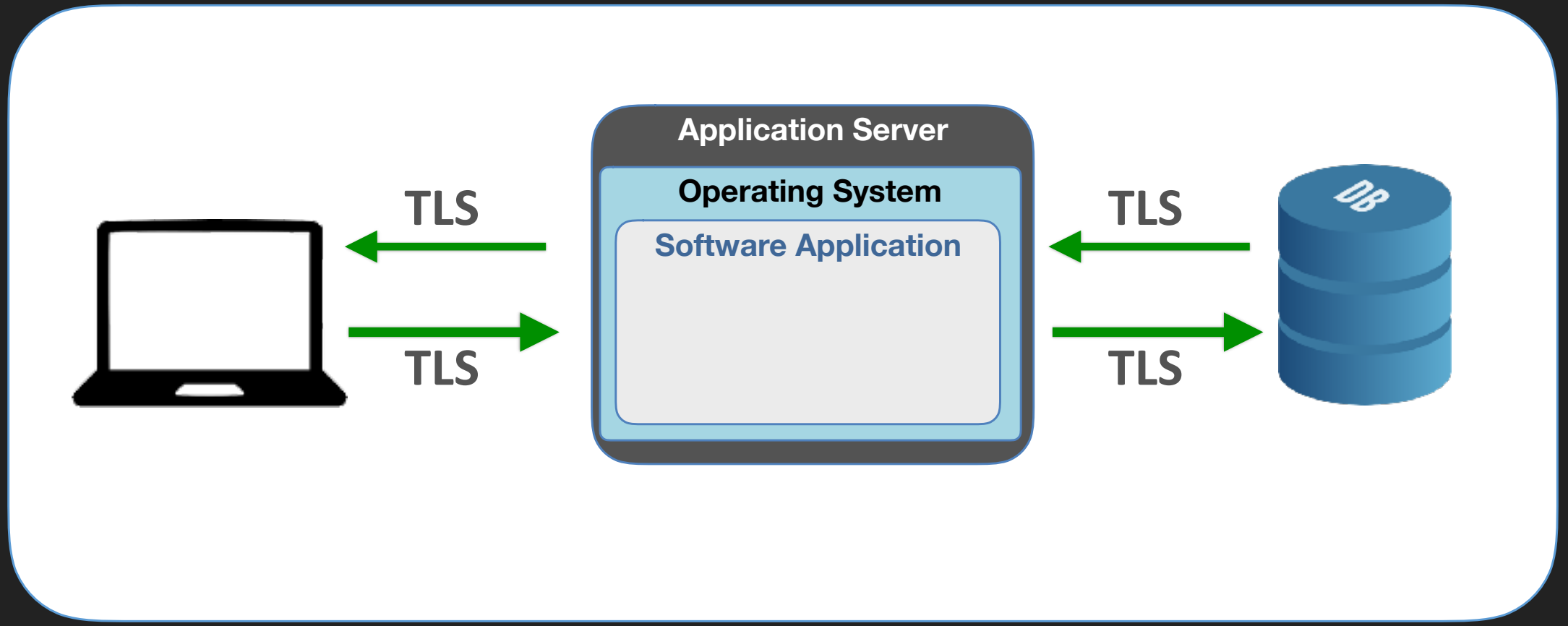
Strong Encryption Algorithm: AES

Key Management

- Store unencrypted keys away from the encrypted data.
- Protect keys in a Key Vault (Hashicorp Vault / Amazon KMS)
- Keep away from home grown key management solutions.
- Define a key lifecycle.
- Build support for changing algorithms and keys when needed
- Document procedures for managing keys through the lifecycle

Source: https://cheatsheetseries.owasp.org/cheatsheets/Cryptographic_Storage_Cheat_Sheet.html

Data in Transit: Security Controls



Third Party Components

Using Software Components with Known Vulnerabilities

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State of Software Security

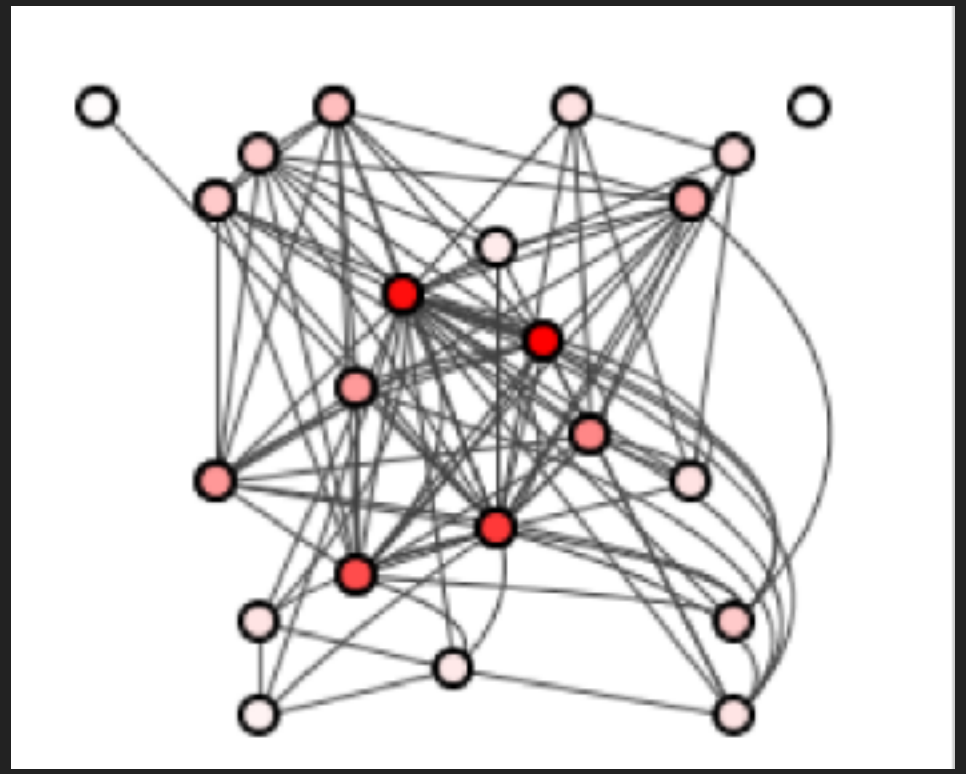
Apps with at least 1 vulnerable component:

- 85.7% of .Net applications
- 92% of C++ applications

Source: https://www.veracode.com/state-of-software-security-report

Root Cause

- Difficult to understand
- Easy to break
- Difficult to test
- Difficult to upgrade
- Increase technical debt



What is Attack Surface?

Sum of the total different points through which a malicious actor can try to enter data into or extract data from an environment.

Fundamental Security Principle

Minimize the attack surface area

Components Examples

Example of external components:

- Open source libraries - for example: a logging library
- APIs - for example: vendor APIs
- Packages by another team within same company

Example 1: Implement Logging Library

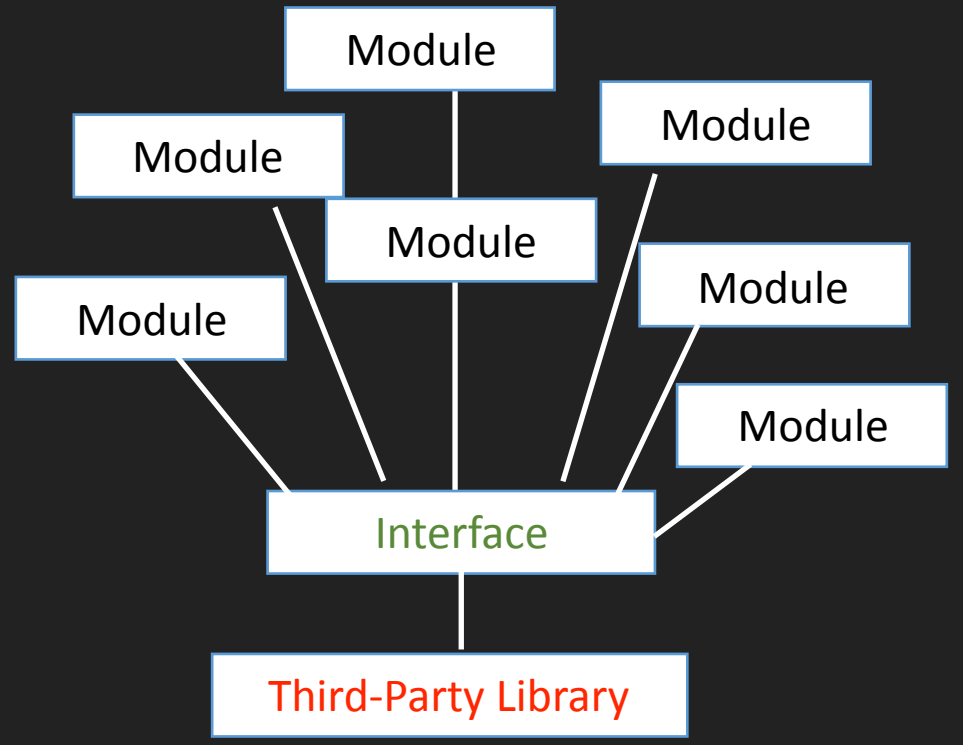
- Third-party - provides logging levels:
- FATAL, ERROR, WARN, INFO, DEBUG.

- We need only:
- DEBUG, WARN, INFO.

Simple Wrapper

Helps to:

- Expose only the functionality required.
- Hide unwanted behaviour.
- Reduce the attack surface area.
- Update or replace libraries.
- Reduce the technical debt.



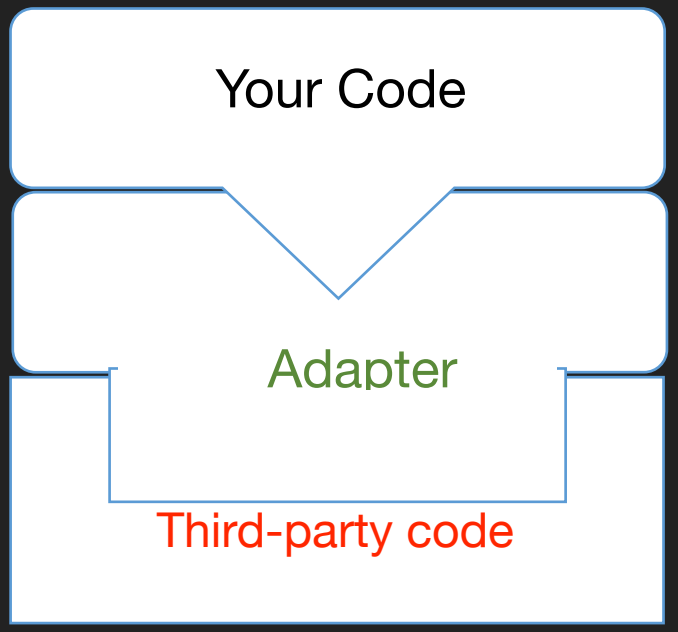
Example 2: Implement a Payment Gateway

Scenario:

- Vendor APIs - like payment gateways
- Can have more than payment gateway one in application
- Require to be inter-changed

Adapter Design Pattern

- Converts from provided interface to the required interface.
- A single Adapter interface can work with many Adaptees.
- Easy to maintain.

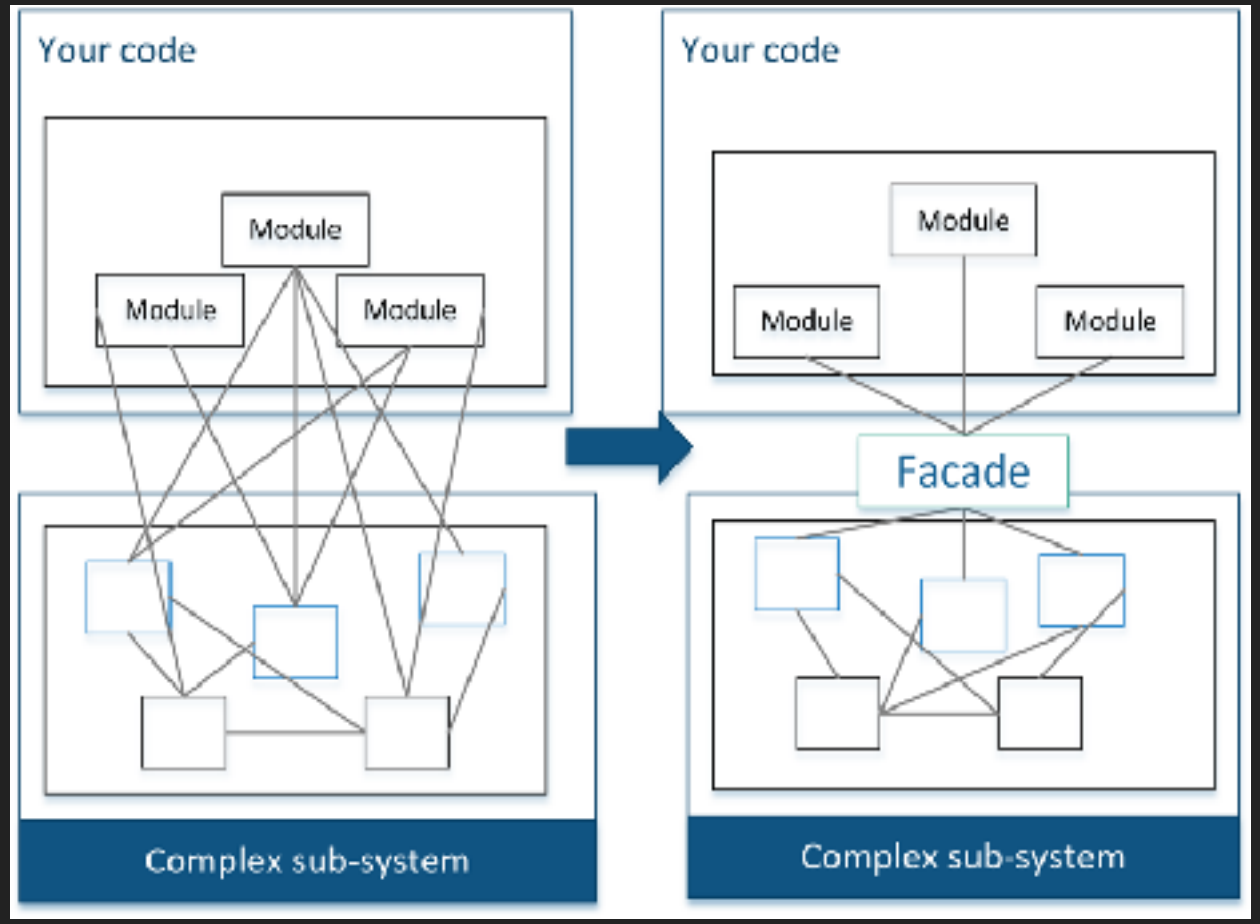


Example 3: Implement a Single Sign-On

- Libraries / packages created by another team within same company
- Re-used by multiple applications
- Common practice in large companies

Façade Design Pattern

- Simplifies the interaction with a complex sub-system
- Make easier to use a poorly designed API
- It can hide away the details from the client.
- Reduces dependencies on the outside code.



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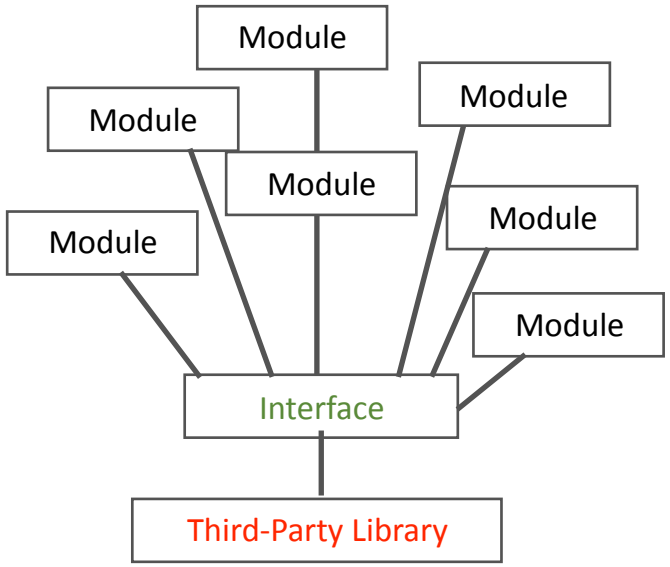
Secure Software Starts from Design !

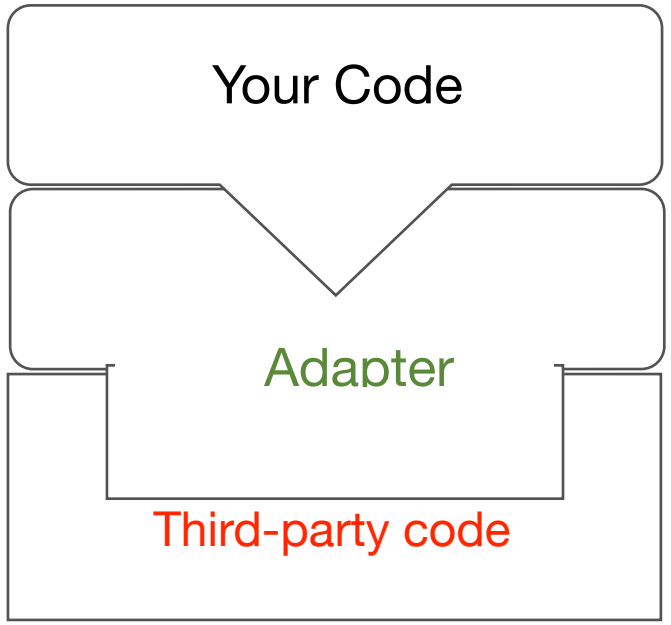
Wrapper

To expose only required functionality and hide unwanted behaviour.



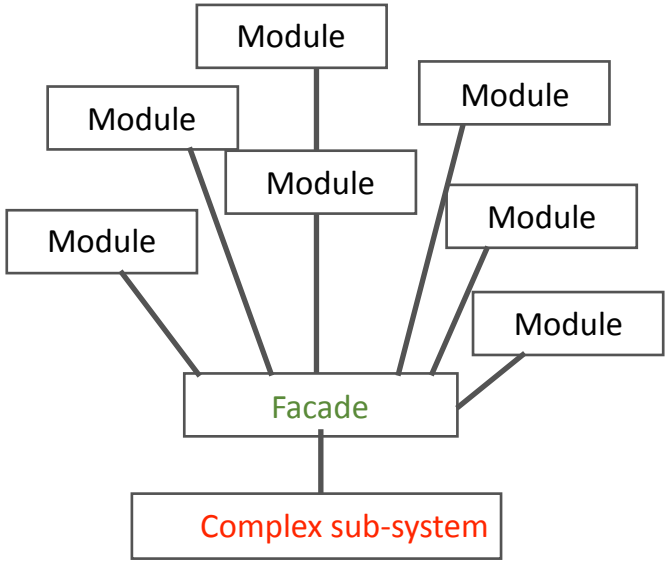
Adapter Pattern

To convert from the required interface to provided interface



Façade Pattern

To simplify the interaction with a complex sub-system.



How often ?

Rick Rescorla

- United States Army office of British origin
- Born in Hayle, Cornwall, UK
- Director of Security for Morgan Stanley at WTC

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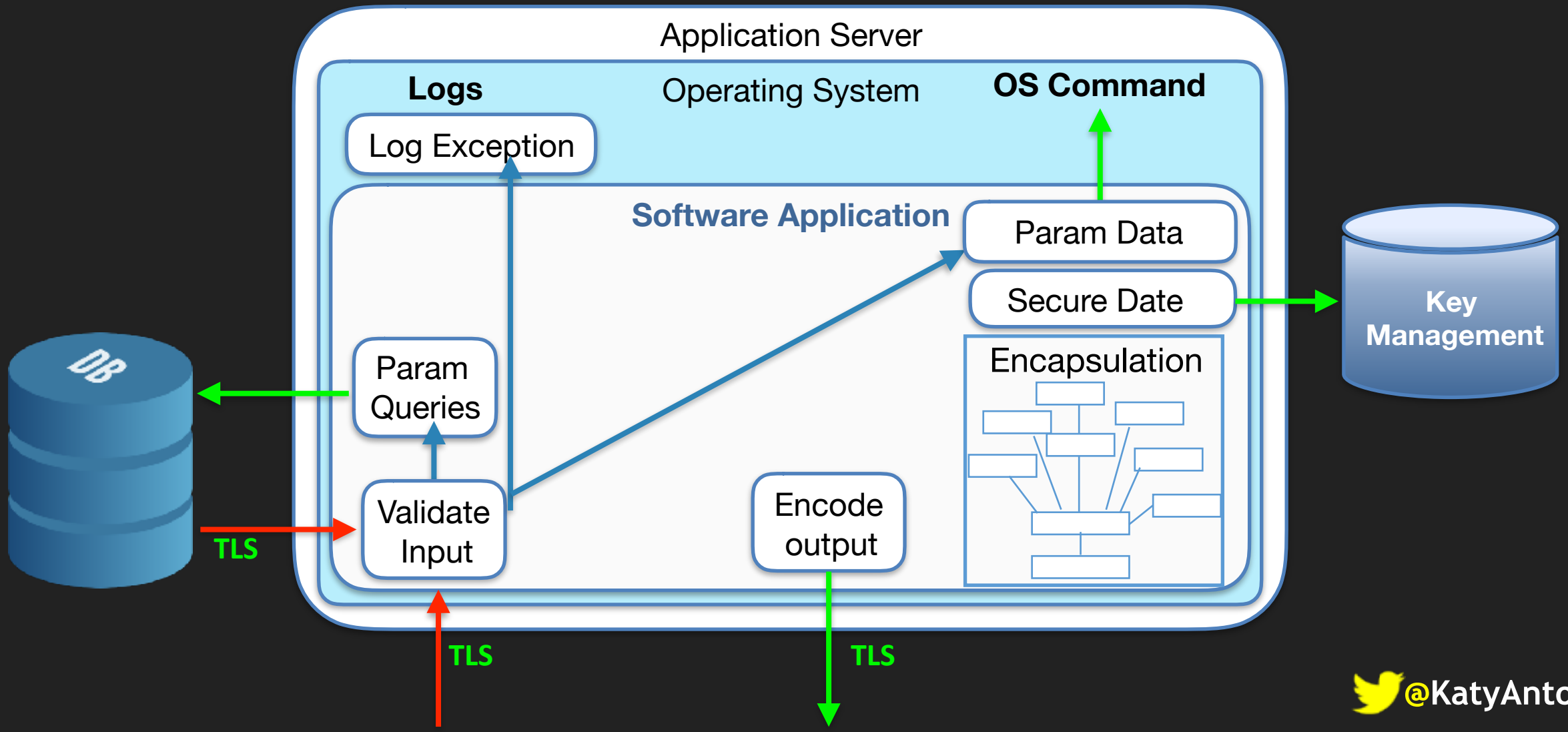
Security Controls Recap

Security Controls In Development Cycle



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Final Takeaways

Focus on Security Controls

CWEs

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References

- OWASP Top 10 Proactive Controls
  https://owasp.org/www-project-proactive-controls/

- OWASP Cheat Series
  https://cheatsheetseries.owasp.org/


Thank you very much
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