API security in Python (ASIP)

ID ASIP **Price** CHF 2,250.—(excl. VAT) **Duration** 3 days

Who should attend

Python API developers

Prerequisites

General Python development

Course Objectives

- Getting familiar with essential cyber security concepts
- Understanding API security issues
- Detailed analysis of the OWASP API Security Top Ten elements
- Putting API security in the context of Python
- Going beyond the low hanging fruits
- Managing vulnerabilities in third party components
- Input validation approaches and principles

Course Content

Day 1

- Cyber security basics
  - What is security?
  - Threat and risk
  - Cyber security threat types – the CIA triad
  - Consequences of insecure software
- OWASP API Security Top Ten
  - OWASP API Security Top 10 2023
- API1 – Broken Object Level Authorization
  - Confused deputy
  - Insecure direct object reference (IDOR)
  - Lab – Insecure Direct Object Reference
  - Authorization bypass through user-controlled keys
  - Case study – Remote takeover of Nexx garage doors and alarms
  - Lab – Horizontal authorization
  - File upload
  - Unrestricted file upload
  - Good practices
  - Lab – Unrestricted file upload
- API2 – Broken Authentication
  - Authentication basics
  - Multi-factor authentication (MFA)
  - Case study – The InfinityGauntlet attack
  - Passwordless solutions
  - Time-based One Time Passwords (TOTP)
  - Authentication weaknesses
  - Spoofing on the Web
  - Password management
  - Storing account passwords
  - Password in transit
  - Lab – Is just hashing passwords enough?
  - Dictionary attacks and brute forcing
  - Salting
  - Adaptive hash functions for password storage
  - Lab – Using adaptive hash functions in Python
  - Using password cracking tools
  - Password cracking in Windows
  - Password change
  - Password recovery issues
  - Password recovery best practices
  - Lab – Password reset weakness
  - Case study – Facebook account takeover via recovery code
  - Case study – GitLab account takeover
  - Anti-automation
  - Password policy
  - NIST authenticator requirements for memorized secrets
  - Password hardening
  - Using passphrases
  - Password database migration
  - (Mis)handling None passwords

Day 2

- API3 – Broken Object Property Level Authorization
  - Information exposure
  - Exposure through extracted data and aggregation
  - Case study – Strava data exposure
  - System information leakage
  - Leaking system information
  - Information exposure best practices
  - Secrets management
  - Hard coded passwords
  - Best practices
  - Lab – Hardcoded password
  - Protecting sensitive information in memory

    - Challenges in protecting memory
    - Case study – Microsoft secret key theft via dump files
- API4 – Unrestricted Resource Consumption
    - Denial of service
    - Flooding
    - Resource exhaustion
    - Sustained client engagement
    - Infinite loop
    - Economic Denial of Sustainability (EDoS)
    - Algorithmic complexity issues
    - Regular expression denial of service (ReDoS)
    - Lab – ReDoS
    - Dealing with ReDoS
    - Case study – ReDoS vulnerabilities in Python
- API5 – Broken Function Level Authorization
    - Authorization
    - Access control basics
    - Access control types
    - Missing or improper authorization
    - Failure to restrict URL access
    - Cross-site Request Forgery (CSRF)
    - Lab – Cross-site Request Forgery
    - CSRF best practices
    - CSRF defense in depth
    - Lab – CSRF protection with tokens
- API6 – Unrestricted Access to Sensitive Business Flows
    - Security by design
    - The STRIDE model of threats
    - Secure design principles of Saltzer and Schroeder
    - Economy of mechanism
    - Fail-safe defaults
    - Complete mediation
    - Open design
    - Separation of privilege
    - Least privilege
    - Least common mechanism
    - Psychological acceptability
    - Logging and monitoring
    - Logging and monitoring principles
    - Insufficient logging
    - Case study – Plaintext passwords at Facebook
    - Log forging
    - Web log forging
    - Lab – Log forging
    - Log forging – best practices
    - Logging best practices
    - Monitoring best practices
- API7 – Server Side Request Forgery
    - Server-side Request Forgery (SSRF)
    - Case study – SSRF in Ivanti Connect Secure
- API8 – Security Misconfiguration
    - Information exposure through error reporting
    - Information leakage via error pages
    - Lab – Flask information leakage
    - Case study – Information leakage via errors in Apache Superset
    - Cookie security
    - Cookie attributes
    - Same Origin Policy
    - Simple request
    - Preflight request
    - Cross-Origin Resource Sharing (CORS)
    - Lab – Same-origin policy demo
    - Configuring XML parsers
    - DTD and the entities
    - Entity expansion
    - External Entity Attack (XXE)
    - File inclusion with external entities
    - Server-Side Request Forgery with external entities
    - Lab – External entity attack
    - Preventing XXE
    - Lab – Prohibiting DTD
    - Case study – XXE vulnerability in Ivanti products

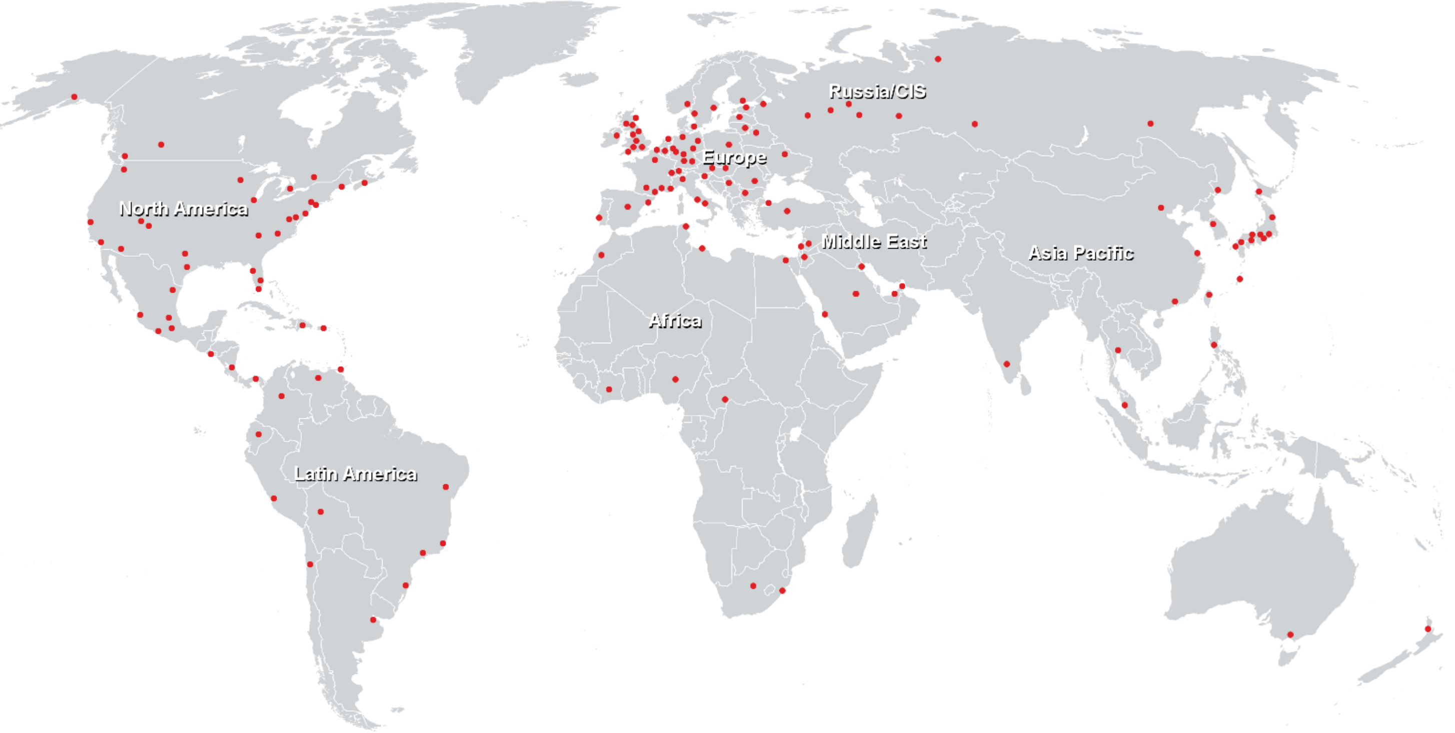
Day 3

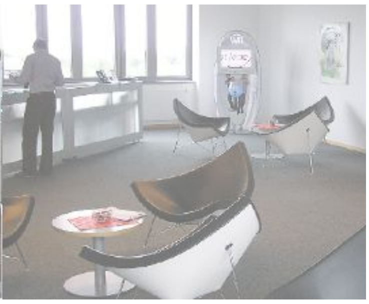
- API9 – Improper Inventory Management
    - Documentation blindspots
    - Dataflow blindspots
    - Using vulnerable components
    - Untrusted functionality import
    - Malicious packages in Python
    - Case study – The Polyfill.io supply chain attack
    - Vulnerability management
    - Lab – Finding vulnerabilities in third-party components
- API10 – Unsafe Consumption of APIs
    - Input validation
    - Input validation principles
    - Denylists and allowlists
    - Case study – Denylist failure in urllib.parse.urlparse()
    - What to validate – the attack surface
    - Where to validate – defense in depth
    - When to validate – validation vs transformations
    - Output sanitization
    - Encoding challenges
    - Unicode challenges
    - Validation with regex
    - Injection
    - Injection principles
    - Injection attacks
    - SQL injection
    - SQL injection basics
    - Lab – SQL injection
    - Attack techniques
    - Content-based blind SQL injection

- Time-based blind SQL injection
- SQL injection best practices
- Input validation
- Parameterized queries
- Lab – Using prepared statements
- Database defense in depth
- Case study – SQL injection against US airport security
- Code injection
- Code injection via input()
- OS command injection
- Lab – Command injection
- OS command injection best practices
- Avoiding command injection with the right APIs
- Lab – Command injection best practices
- Case study – Shellshock
- Lab – Shellshock
- Case study – Command injection in Ivanti security appliances
- Open redirects and forwards
- Open redirects and forwards – best practices
- Files and streams
- Path traversal
- Lab – Path traversal
- Additional challenges in Windows
- Case study – File spoofing in WinRAR
- Path traversal best practices
- Lab – Path canonicalization
- Wrap up
- Secure coding principles
- Principles of robust programming by Matt Bishop
- Secure design principles of Saltzer and Schroeder
- And now what?
- Software security sources and further reading
- Python resources

API security in Python (ASIP)

Training Centres worldwide





Fast Lane Institute for Knowledge Transfer (Switzerland) AG

Husacherstrasse 3
CH-8304 Wallisellen
Tel. +41 44 832 50 80

info@flane.ch, https://www.flane.ch