

**Cloud Application Security in Python for AWS**

**Course Number:** SEC-142  
**Duration:** 5 days

**Overview**

This in-person or online Cloud Application Security in Python for AWS training course teaches developers how to ensure the security of their Python applications on the AWS platform. Participants learn how to avoid the security pitfalls of the Python programming language and the AWS cloud platform.

**Prerequisites**

All attendees must have general Python and web development experience.

**Materials**

All Application Security training attendees receive comprehensive courseware.

**Software Needed on Each Student PC**

Attendees will not need to install any software on their computers for this class. The class will be conducted in a remote environment that Accelebrate will provide; students will only need a local computer with a web browser and a stable Internet connection. Any recent version of Microsoft Edge, Mozilla Firefox, or Google Chrome will work well.

**Objectives**

* Understand cloud security specialties
* Get familiar with essential cyber security concepts
* Understand how cryptography supports security
* Use cryptographic APIs correctly in Python
* Understand Web application security issues
* Master the OWASP Top Ten elements
* Put Web application security in the context of Python
* Go beyond the low hanging fruits
* Manage vulnerabilities in third-party components
* Deal with cloud infrastructure security
* Incorporate input validation approaches and principles
* Identify vulnerabilities and their consequences
* Apply security best practices in Python

**Outline**

* Introduction
* Cyber Security Basics
  + What is security?
  + Threat and risk
  + Cyber security threat types – the CIA triad
  + Cyber security threat types – the STRIDE model
  + Consequences of insecure software
  + Cloud security basics
    - Cloud infrastructure basics
    - The Cloud Cube Model and Zero Trust Architecture
* Introducing the OWASP Top 10
* A01 – Broken Access Control
  + Access control basics
  + Failure to restrict URL access
  + Confused deputy
    - Insecure direct object reference (IDOR)
    - Lab – Insecure Direct Object Reference
    - Authorization bypass through user-controlled keys
    - Case study – Authorization bypass on Facebook
    - Horizontal authorization
  + File upload
    - Unrestricted file upload
    - Good practices
    - Unrestricted file upload
  + Open redirects and forwards
    - Case study – Unvalidated redirect at Epic Games
    - Open redirects and forwards – best practices
  + Cross-site Request Forgery (CSRF)
    - Cross-site Request Forgery
    - CSRF best practices
    - CSRF defense in depth
    - CSRF protection with tokens
* A02 – Cryptographic Failures
  + Cryptography for developers
    - Confidentiality protection
  + Certificates
    - Certificates and PKI
    - X.509 certificates
    - Chain of trust
    - PKI actors and procedures
    - PGP – Web of Trust
    - Certificate revocation
  + Transport security
    - Transport security weaknesses
    - The TLS protocol
* A03 – Injection
  + Injection principles
  + Injection attacks
  + SQL injection
  + SQL injection basics
    - SQL injection
    - Attack techniques
    - Content-based blind SQL injection
    - Time-based blind SQL injection
  + NoSQL injection
    - NoSQL injection basics
    - NoSQL injection in MongoDB
    - NoSQL injection in DynamoDB
  + SQL injection best practices
    - Input validation
    - Parameterized queries
    - Using prepared statements
    - Additional considerations
    - Case study – Hacking Fortnite accounts
  + Code injection
    - Code injection via input()
    - OS command injection
  + HTML injection – Cross-site scripting (XSS)
    - Cross-site scripting basics
    - Cross-site scripting types
    - Stored XSS
    - Reflected XSS
    - Case study – XSS in Fortnite accounts
  + XSS protection best practices
* A04 – Insecure 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
  + Client-side security
    - Frame sandboxing
* A05 – Security Misconfiguration
  + Cookie security
    - Cookie attributes
  + XML entities
    - DTD and the entities
    - Entity expansion
    - Billion laughs attack
    - External Entity Attack (XXE)
* A06 – Vulnerable and Outdated Components
  + Using vulnerable components
  + Untrusted functionality import
  + Malicious packages in Python
  + Vulnerability management
    - Patch management
    - Vulnerability databases
* A07 – Identification and Authentication Failures
  + Authentication
    - Authentication basics
    - Multi-factor authentication
    - Case study – PayPal 2FA bypass
  + Session management
    - Session management essentials
    - Why do we protect session IDs – Session hijacking
    - Session fixation
    - Session handling in Flask
  + Single sign-on (SSO)
    - Single sign-on concept
    - OAuth 2.0
    - SAML
  + Identity and access management in AWS
    - Groups, roles, and credentials
    - Access tokensIdentity and access management (IAM)
  + Password management
    - Inbound password management
    - Outbound password management
* A08 – Software and Data Integrity Failures
  + Integrity protection
    - Message Authentication Code (MAC)
    - Digital signature
  + Subresource integrity
    - Importing JavaScript
    - Lab – Importing JavaScript
    - Case study – The British Airways data breach
  + Insecure deserialization
    - Serialization and deserialization challenges
    - Integrity – deserializing untrusted streams
    - Deserialization with pickle
    - PyYAML deserialization challenges
    - Integrity – deserialization best practicesA09 – Security Logging and Monitoring Failures
* A09 – Security Logging and Monitoring Failures
  + Logging and monitoring principles
  + Insufficient logging
  + Case study – Plaintext passwords at Facebook
  + Logging best practices
  + Monitoring best practices
  + Detection and monitoring
    - Utilizing AWS monitoring for security
    - Protecting logs
    - The AWS Security Hub
* A10 – Server-Side Request Forgery (SSRF)
  + Server-side Request Forgery (SSRF)
  + Case study – SSRF and the Capital One breach
* Cloud  Security
  + AWS security
    - Security considerations
  + Container security
    - Container security concerns
    - Containerization, virtualization and security
    - The attack surface
    - Docker security
    - Kubernetes security
  + Data security in the cloud
    - Data confidentiality and integrity in the cloud
    - Data privacy in the cloud
    - Compliance considerations
    - Data security in AWS
    - Policies
    - Storing cryptographic keys
    - Protecting data at rest
    - Protecting data in transit
    - JSON security
* Web Application Security Beyond the Top Ten
  + Code quality
    - Language elements
    - Object-oriented programming pitfalls
  + Denial of service
    - Flooding
    - Resource exhaustion
    - Sustained client engagement
    - Infinite loop
    - Economic Denial of Sustainability (EDoS)
    - Algorithm complexity issues
* Input validation
  + Input validation principles
  + Denylists and allowlists
  + 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
  + Integer handling problems
    - Representing signed numbers
    - Integer visualization
    - Integers in Python
    - Integer overflow
    - Integer overflows in ctypes and NumPy
  + Files and streams
    - Path traversal
    - Path traversal-related examples
    - Additional challenges in Windows
    - Virtual resources
    - Path traversal best practices
    - Path canonicalization
  + Format string issues
  + Unsafe native code
    - Native code dependence
    - Best practices for dealing with native code
* Conclusion
  + Secure coding principles
    - Principles of robust programming by Matt Bishop
  + And now what?
    - Software security sources and further reading
    - Python resources