

**C and C++ Secure Coding**

**Course Number:** SEC-126
**Duration:** 3 days

**Overview**

Accelebrate's C and C++ Secure Coding training teaches developers the common security weaknesses that allow hackers to attack systems and the best practices needed to prevent these attacks. Attendees learn core programming issues of C and C++ and identify potential security pitfalls and solutions.

**Note:** To ensure ample one-on-one engagement with the instructor, this class is capped at 12 people, overriding Accelebrate’s default cap of 15.

**Prerequisites**

All students must have C/C++ development experience.

**Materials**

All Secure Coding training attendees receive comprehensive courseware.

**Software Needed on Each Student PC**

Attendees will not need to install any software on their computer 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 be fine.

**Objectives**

All attendees will:

* Handle security challenges in your C and C++ code
* Identify vulnerabilities and their consequences
* Learn the security best practices in C and C++

**Outline**

* Cybersecurity Basics
	+ What is security?
	+ Threat and risk
	+ Cybersecurity threat types
	+ Consequences of insecure software
	+ Constraints and the market
	+ The dark side
* Buffer Overflow
	+ Assembly basics and calling conventions
		- x64 assembly essentials
		- Registers and addressing
		- Most common instructions
		- Calling conventions on x64
	+ Memory management vulnerabilities
		- Memory management and security
		- Vulnerabilities in the real world
	+ Buffer security issues
		- Buffer overflow on the stack
		- Buffer overflow on the heap
		- Pointer manipulation
		- Some typical mistakes leading to BoF
	+ BoF protection best practices
		- Safe and unsafe functions
		- base\_string and std::string
		- Some less-known dangerous functions
		- Lab – Fixing buffer overflow
		- Securing the toolchain
		- Compiler options and instrumentation
		- Stack smashing protection
		- Runtime protection
		- Address Space Layout Randomization (ASLR)
		- Non-executable memory areas
* Common Software Security Weaknesses
	+ Input validation
		- Input validation principles
	+ Injection
		- Injection principles
		- Injection attacks
		- Code injection
	+ Integer handling problems
		- Representing signed numbers
		- Integer visualization
		- Integer overflow
		- Lab – Integer overflow
		- Signed / unsigned confusion
		- Lab – Signed / unsigned confusion
		- Integer truncation
		- Lab – Integer truncation
		- Case study – Wannacry
		- Best practices
	+ Other numeric problems
		- Division by zero
		- Working with floating-point numbers
	+ Files and streams
		- Path traversal
		- Path traversal-related examples
		- Lab – Path traversal
		- Link and shortcut following
		- Virtual resources
		- Path traversal best practices
	+ Format string issues
		- The problem with printf()
		- Lab – Exploiting format string
* Time and State
	+ Race conditions
		- Race condition in object data members
		- File race condition
		- Potential race condition
* Common Software Security Weaknesses
	+ Security features
		- Authentication
		- Password management
	+ Errors
		- Error and exception handling principles
		- Error handling
		- Exception handling
	+ Code quality
		- Type mismatch
		- Lab – Type mismatch
		- Function return values
		- Unreleased resource
		- Object-oriented programming pitfalls
		- Memory and pointers
* Wrap Up
	+ Secure coding principles
		- Principles of robust programming by Matt Bishop
		- Secure design principles of Saltzer and Schröder
	+ And now what?
		- Further sources and readings
		- C and C++ resources