

# Windows System Programming

## Course Summary Table

<b>Duration:</b>	5 Days
<b>Target Audience:</b>	Windows developers and researchers
<b>Objectives:</b>	<ul style="list-style-type: none"><li>• Understand the fundamentals of building Windows applications</li><li>• Work effectively with the Windows system-level API</li><li>• Leverage the capabilities of the OS, including processes, threads, memory, I/O, and much more</li></ul>
<b>Pre Requisites:</b>	<ul style="list-style-type: none"><li>• Real-world experience programming in C</li><li>• C++ experience is beneficial, but not mandatory</li><li>• Basic understanding of Windows OS concepts such as processes, threads, virtual memory and DLLs</li></ul>

Instructor: **Pavel Yosifovich**

## Abstract

The Windows system-level APIs provides a rich infrastructure for building Windows applications, whether client, server, and anything in between. This course guides the learner through the intricacies of the Windows API, while getting a deeper understanding of Windows mechanisms.

The course deals with the most important parts of the Windows OS, such as processes, threads, memory management, I/O, services, security and more. Lab exercises help put the theoretical material into practical use.

## Syllabus

- Module 1: Foundations
  - Windows architecture overview
  - Windows APIs
  - Using Visual Studio
  - Common Windows types and conventions
  - Working with Strings
  - API Errors
  - 32-bit vs. 64-bit Development
  - The Windows version
  - Summary
- Module 2: Objects and Handles
  - Kernel Objects

- Handles
- Working with Handles
- Sharing Objects
- Private object namespaces
- User and GDI objects
- Summary
  
- Module 3: Processes
  - Process creation
  - The main function(s)
  - Creating processes
  - Process termination
  - Enumerating processes
  - Summary
  
- Module 4: Jobs
  - Introduction to jobs
  - Creating jobs
  - Setting and getting limits
  - Nested jobs
  - Job notifications
  
- Module 5: Threads
  - Introduction to threads
  - Creating threads
  - A thread's stack
  - Terminating threads
  - Thread priorities
  - Basic thread scheduling
  - A thread's name
  - Affinity
  - Thread pools
  
- Module 6: Thread Synchronization
  - Synchronization basics
  - Atomic operations
  - Critical sections
  - Reader-writer locks
  - Synchronization with kernel objects
  - Mutexes, semaphores and events
  
- Module 7: File and Device I/O
  - The I/O system
  - The CreateFile function
  - Synchronous I/O
  - Asynchronous I/O

- Handling async I/O completion
  - I/O completion ports
  - Pipes and Mailslots
- Module 8: Memory Management
  - Process address space
  - System memory usage
  - Process memory counters
  - Reserving and committing memory
  - The heap manager
  - Memory mapped files
- Module 9: Dynamic Link Libraries
  - Why DLLs?
  - Building DLLs
  - Implicit and explicit linking
  - The DllMain function
  - Delay Load dlls
  - Injecting DLLs
- Module 10: Security
  - Windows security components
  - SIDs
  - Access tokens
  - Privileges
  - Security descriptors
  - User access control
  - Running elevated
  - Impersonation
- Module 11: Windowing
  - Windows and Threads
  - Window messages
  - Message loops
  - Enumerating windows
  - Building GUI (if time permits)