

# CNFE - Certified Network Forensics Examiner

## Course Overview

This course will introduce students to examining network forensics. Topics covered include investigative methodology, physical interception, wireless traffic capture and analysis, malware forensics, and more.

### Module 1 - Digital Evidence Concepts

21m

Digital Evidence Concepts  
Concepts in Digital Evidence  
Overview  
Background  
Real Evidence  
Best Evidence  
Direct Evidence  
Circumstantial Evidence  
Hearsay  
Business Records  
Digital Evidence  
Network-Based Digital Evidence  
Section Summary

### Module 2 - Network Evidence Challenges

24m

Network Evidence Challenges  
Challenges Relating to Network Evidence  
Overview  
Acquisition  
Content  
Storage  
Privacy  
Seizure  
Admissibility  
Section Summary

### Module 3 - Network Forensics Investigative Methodology

43m

Network Forensics Investigative Methodology  
Oscar Methodology  
Overview  
Obtain Information  
Obtain Information  
Strategize  
Strategize  
Collect Evidence  
Collect Evidence  
Collect Evidence

Collect Evidence  
Analyze  
Analyze  
Analyze  
Analyze  
Analyze  
Report  
Section Summary

**Module 4 - Network-Based Evidence**

1h 3m

Network-Based Evidence  
Sources of Network-Based Evidence  
Overview  
Background  
Background  
On the Wire  
In the Air  
Switches  
Routers  
DHCP Servers  
Name Servers  
Authentication Servers  
Network Intrusion Detection/Prevention Systems  
Firewalls  
Web Proxies  
Application Servers  
Central Log Servers  
A Quick Protocol Review  
A Quick Protocol Review  
Internet Protocol Suite Review  
IPv4 vs IPv6  
IPv4 vs IPv6  
TCP vs UDP  
TCP vs UDP  
Section Summary

**Module 5 - Network Principles**

27m

Network Principles  
Principles of Internetworking  
Overview  
Background  
History  
Functionality  
Figure 5-1 The OSI Model  
Functionality  
Functionality  
Encapsulation/De-encapsulation  
Encapsulation/De-encapsulation  
Figure 5-2 OSI Model Encapsulation

Encapsulation/De-encapsulation  
Encapsulation/De-encapsulation  
Encapsulation/De-encapsulation  
Figure 5-3 OSI Model Peer Layer Logical Channels  
Encapsulation/De-encapsulation  
Figure 5-4 OSI Model Data Names  
Section Summary

## **Module 6 - Internet Protocol Suite**

1h 19m

Internet Protocol Suite  
Overview  
Background  
History of Internet Protocol Suite  
Application Layer  
Application Layer Examples  
Transport Layer  
Layer 4 Protocols  
Internet Layer  
Network Access Layer  
Comparing the OSI Model and TCP/IP Model  
Similarities of the OSI and TCP/IP Models  
Differences of the OSI and TCP/IP Models  
Internet Architecture  
IPv4  
IP Address as a 32-Bit Binary Number  
Binary and Decimal Conversion  
IP Address Classes  
IP Address Classes  
IP Addresses as Decimal Numbers  
Hosts for Classes of IP Addresses  
IP Addresses as Decimal Numbers  
Network IDs and Broadcast Addresses  
Private Addresses  
Reserved Address Space  
Basics of Subnetting  
Subnetworks  
Subnetworks  
Subnet Mask  
Subnet Mask  
IPv6  
IPv4 versus IPv6  
Transmission Control Protocol  
User Datagram Protocol  
ARP  
ARP Operation Within a Subnet  
ARP Process  
Advanced ARP Concepts  
Default Gateway  
How ARP Sends Data to Remote Networks  
Proxy ARP  
Section Summary

## **Module 7 - Physical Interception**

47m

Physical Interception

Overview

Goal

Background

Pigeon Sniffing

Cables

Copper

Optical

Radio Frequency

Information that Can Be Gained from Wi-Fi Traffic

Inline Network Tap

Vampire Tap

Radio Frequency

Radio Frequency

Hubs

Switches

Obtaining Traffic from Switches

Sniffing on Switches

Section Summary

## **Module 8 - Traffic Acquisition Software**

50m

Traffic Acquisition Software

Agenda

Libpcap and WinPcap

Background

Libpcap - Introduction

Installing Libpcap using the RPMs

Installing Libpcap using the RPMs

Installing Libpcap from the Source Files

Installing Libpcap from the Source Files (Configure)

Installing Libpcap from the Source Files (Make/Make Install)

WinPcap - Introduction

Installing WinPcap

Section Summary

The Berkeley Packet Filter (BPF) Language

Overview

Background

BPF Primitives

Filtering Packets by Byte Value

Examples

Filtering Packets by Bit Value

Filtering Packets by Bit Value

Section Summary

Tcpdump

Overview

Background

Basics

Basics

Installing tcpdump (Windows Installation)

Installing tcpdump (Windows Installation)  
Installing tcpdump (Linux Installation)  
Installing tcpdump (Linux Installation)  
Installing tcpdump (Linux Installation)  
Filtering Packets with tcpdump  
Filtering Packets with tcpdump  
Section Summary  
Wireshark  
Overview  
Background  
Installing Wireshark  
Installing Wireshark (Microsoft Windows Systems)  
Installing Wireshark (Linux Systems)  
Wireshark Protocol Analyzer  
Section Summary  
Tshark  
Overview  
Background  
Examples of tshark  
Statistics  
Examples  
Section Summary

## **Module 9 - Live Acquisition**

1h 10m

Live Acquisition  
Agenda  
Common Interfaces  
Overview  
Background  
Console  
Secure Shell (SSH)  
Secure Copy (SCP) and SFTP  
Telnet  
Simple Network Management Protocol (SNMP)  
SNMP  
Web and Proprietary Interfaces  
Section Summary  
Inspection without Access  
Overview  
Background  
Port Scanning  
Vulnerability Scanning  
Section Summary  
Strategy  
Overview  
Refrain  
Connect  
Record the Time  
Collect Evidence  
Record Investigative Activities  
Section Summary

## **Module 10 - Layer 2 Protocol**

31m

Layer 2 Protocol  
The IEEE Layer 2 Protocol Series  
Overview  
Background  
Layer 2 Protocols  
CSMA/CD  
CSMA/CD  
802.11 Protocol Suite: Frame Types  
802.11 Protocol Suite: Frame Types (Management Frames)  
802.11 Protocol Suite: Frame Types (Management Frames)  
802.11 Protocol Suite: Frame Types (Control Frames)  
802.11 Protocol Suite: Frame Types (Data Frames)  
802.11 Protocol Suite: Frame Analysis  
802.11 Protocol Suite: Network-Byte Order  
802.11 Protocol Suite: Endianness  
802.11 Protocol Suite: Network-Byte Order  
802.11 Protocol Suite: Wired Equivalent Privacy  
802.11 Protocol Suite: Wired Equivalent Privacy  
An 802.11 Packet Capture Displayed in Wireshark  
802.1X  
Section Summary

## **Module 11 - Protocol Analysis**

1h 28m

Protocol Analysis  
Agenda  
Protocol Analysis  
Overview  
Background  
Tools  
Tools  
Tools  
Techniques  
Section Summary  
Packet Analysis  
Agenda  
Fundamentals and Challenges  
Protocol Analysis  
Documentation  
Protocol Analysis Tools  
Packet Details Markup Language and Packet Summary Markup Language  
Packet Details Markup Language and Packet Summary Markup Language  
Packet Details Markup Language and Packet Summary Markup Language  
Wireshark  
Wireshark Display  
Tshark  
Tshark Display  
Protocol Analysis Techniques  
Protocol Identification  
Protocol Decoding

Exporting Fields  
Defined  
Packet Analysis Tools  
Wireshark and Tshark Display Filters  
ngrep  
Hex Editors  
Packet Analysis Techniques  
Pattern Matching  
Parsing Protocol Fields  
Packet Filtering  
Section Summary  
Flow Analysis  
Agenda  
Overview  
Background  
Defined  
Tools  
Follow TCP Stream  
Tools  
Flow Analysis Techniques  
Lists Conversations and Flows  
List TCP Flows  
Export Flow  
Manual File and Data Carving  
Automatic File Carving  
Higher-Layer Traffic Analysis  
HTTP  
DHCP  
SMTP  
DNS  
Higher-Layer Analysis Tools  
Higher-Layer Analysis Tools  
Section Summary

**Module 12 - Wireless Access Points**

20m

Wireless Access Points  
Overview  
Background  
Background  
Background  
Background  
Background  
Why Investigate WAPs?  
Types of WAPs  
Types of WAPs  
Types of WAPs  
Volatile Data and Persistent Data  
Section Summary

**Module 13 - Wireless Traffic Capture and Analysis**

25m

Wireless Traffic Capture and Analysis  
Overview  
Spectrum Analysis  
Spectrum Analysis  
Spectrum Analysis  
Wireless Passive Evidence Acquisition  
Wireless Passive Evidence Acquisition  
Wireless Passive Evidence Acquisition  
Analyzing 802.11 Efficiently  
Section Summary

**Module 14 - NIDS/Snort**

57m

NIDS/Snort  
Agenda  
Investigating NIDS/NIPS and NIDS/NIPS Functionality  
Overview  
Background  
Sniffing  
Higher-Layer Protocols Awareness  
Alerting on Suspicious Bits  
Section Summary  
NIDS/NIPS Evidence Acquisition  
Overview  
Background  
Types of Evidence: Configuration  
Types of Evidence: Alert Data  
Types of Evidence: Packet Header/Content Data  
Types of Evidence: Activities Correlated Across Multiple Sensors  
NIDS/NIPS Interfaces  
Section Summary  
Comprehensive Packet Logging  
Overview  
Background  
Background  
Evidence  
Section Summary  
Snort  
Overview  
Background  
Basic Architecture  
Snort File Locations  
Snort Rule Language  
Snort Rules  
Section Summary

**Module 15 - Centralized Logging and Syslog**

52m

Centralized Logging and Syslog  
Agenda  
Sources of Logs



Overview  
Operating System Logs  
Operating System Logs  
Operating System Logs  
Operating System Logs  
Operating System Logs  
Application Logs  
Application Logs  
Physical Device Logs  
Network Devices  
Section Summary  
Network Log Architecture  
Overview  
Three Types of Logging Architectures  
Three Types of Logging Architectures  
Three Types of Logging Architectures  
Remote Logging: Common Pitfalls and Strategies  
Remote Logging: Common Pitfalls and Strategies  
Remote Logging: Common Pitfalls and Strategies  
Remote Logging: Common Pitfalls and Strategies  
Log Aggregation and Analysis Tools  
Log Aggregation and Analysis Tools  
Section Summary  
Collecting and Analyzing Evidence  
Overview  
Obtain Information  
Obtain Information  
Obtain Information  
Strategize  
Strategize  
Strategize  
Strategize  
Collect Evidence  
Collect Evidence  
Collect Evidence  
Collect Evidence  
Analyze  
Report  
Section Summary

**Module 16 - Investigating Network Devices**

54m

Investigating Network Devices  
Agenda  
Storage Media  
Overview  
Background  
DRAM (Dynamic Random-Access Memory)  
CAM (Content-Addressable Memory)  
NVRAM (Non-Volatile Random-Access Memory)  
Hard Drive

ROM  
Section Summary  
Switches  
Overview  
Background  
CAM Tables (Content-Addressable Memory)  
ARP  
Types of Switches  
Types of Switches  
Switch Evidence  
Section Summary  
Routers  
Overview  
Background  
Types of Routers  
Router Evidence  
Section Summary  
Firewalls  
Overview  
Background  
Types of Firewalls  
Types of Firewalls  
Firewall Evidence  
Section Summary

**Module 17 - Web Proxies and Encryption**

45m

Web Proxies and Encryption  
Agenda  
Web Proxy Functionality  
Overview  
WAP Attacks  
Caching  
URI Filtering  
Content Filtering  
Section Summary  
Web Proxy Evidence  
Overview  
Background  
Types of Evidence  
Obtaining Evidence  
Section Summary  
Web Proxy Analysis  
Overview  
Background  
Log Analysis Tools  
Log Analysis Tools  
Log Analysis Tools  
Log Analysis Tools  
Section Summary  
Encrypted Web Traffic

Overview  
Background  
Transport Layer Security (TLS)  
Gaining Access to Encrypted Content

**Module 18 - Network Tunneling**

36m

Network Tunneling  
Tunneling for Functionality  
Overview  
VLAN Trunking  
Inter-Switch Link (ISL)  
Generic Routing Encapsulation (GRE)  
IPv4 over IPv6 with Teredo  
Implications for the Investigator  
Section Summary  
Tunneling for Confidentiality  
Overview  
Background  
Internet Protocol Security (IPsec)  
TLS/SSL  
Implications for the Investigator  
Section Summary  
Covert Tunneling  
Overview  
Covert Tunneling Strategies  
TCP Sequence Numbers  
DNS Tunnels  
Implications for the Investigator

**Module 19 - Malware Forensics**

33m

Malware Forensics  
Trends in Malware Evolution  
Overview  
Background  
Botnets  
Encryption and Obfuscation  
Distributed Command-and-Control Systems  
Automatic Self-Updates  
Metamorphic Network Behavior  
Section Summary

**Module 20 - Network Forensics and Investigating Logs**

51m

Network Forensics and Investigating Logs  
Agenda  
Key Term  
Network Forensics  
Analyzing Network Data  
The Intrusion Process  
Looking for Evidence  
Looking for Evidence

Looking for Evidence  
Looking for Evidence  
End-to-End Forensic Investigation  
End-to-End Forensic Investigation  
End-to-End Forensic Investigation  
Log File as Evidence  
Legality of Using Logs  
Legality of Using Logs  
Legality of Using Logs  
Legality of Using Logs  
Examining Intrusion and Security Events  
Examining Intrusion and Security Events  
Intrusion Detection  
Using Multiple Logs as Evidence  
Maintaining Credible IIS Log Files  
Log File Accuracy  
Logging Everything  
Extended Logging in IIS Server  
Extended Logging in IIS Server  
Extended Logging in IIS Server  
Keeping Time  
UTC (Coordinated Universal Time)

**Total Duration: 15h 18m**