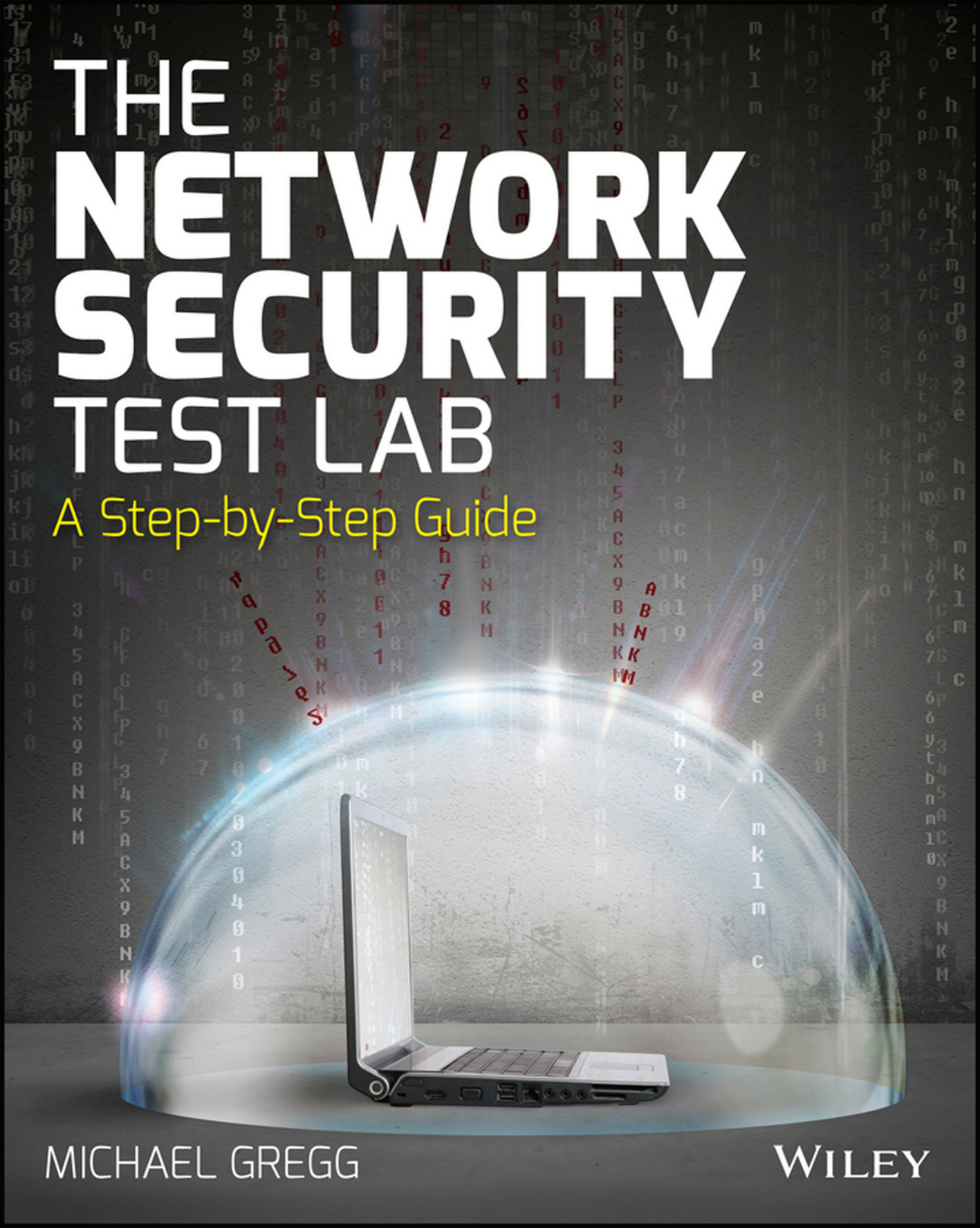
THE NETWORK SECURITY TEST LAB

A Step-by-Step Guide



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About the Author

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Michael has testified before the United States Congress on privacy and security breaches. He also testified before the Missouri State Attorney General's committee on cybercrime and the rise of cell phone hacking. He has spoken at major IT/Security conferences such as the NCUA auditors conference in Arlington, Virginia. He is frequently cited by major print publications as a cybersecurity expert and has also appeared as an expert commentator for network broadcast outlets and print publications such as CNN, FOX, CBS, NBC, ABC, The Huffington Post, Kiplinger's, and The New York Times.

Michael enjoys giving back to the community; some of his civic engagements include Habitat for Humanity and United Way.

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Contents

Introduction

Welcome to *The Network Security Test Lab*. With this book, you can increase your hands-on IT security skills. The techniques and tools discussed in this book can benefit IT security designers and implementers. IT security designers will benefit as they learn more about specific tools and their capabilities. Implementers will gain firsthand experience from installing and practicing using software tools needed to secure information assets.

Overview of the Book and Technology

This book is designed for individuals who need to better understand the functionality of security tools. Its objective is to help guide those individuals in learning when and how specific tools should be deployed and what any of the tools' specific limitations are. This book is for you if any of the following are true:

- You want to learn more about specific security tools.
- You lack hands-on experience in using security tools.
- You want to get the skills needed to advance at work or move into a new position.
- You love to tinker or expand your skills with computer software and hardware.
- You are studying for a certification and want to gain additional skills.

How This Book Is Organized

The contents of this book are structured as follows:

- **Chapter 1, "Building a Hardware and Software Test Platform"**—Guides you through the process of building a hardware test platform.
- **Chapter 2, "Passive Information Gathering"**—Reviews the many ways that information can be passively gathered. This process starts at the organization's website, and then moves to WHOIS records. This starting point allows you to build a complete profile of the organization.
- **Chapter 3, "Analyzing Network Traffic"**—Reviews methods and techniques for packet analysis. You will learn firsthand how common packet analysis tools such as Wireshark, Capsa, and Netwitness are used.
- **Chapter 4, "Detecting Live Systems and Analyzing Results"**—Once IP ranges have been discovered and potential systems have been identified, you will move quickly to using a host of tools to determine the status of live systems. Learn how Internet Control Message Protocol (ICMP) and other protocols work, while using both Linux and Windows lab systems.
- **Chapter 5, "Enumerating Systems"**—Explores how small weaknesses can be used to exploit a system and gain a foothold or operational control of a system. You will learn firsthand how to apply effective countermeasures by changing default banners, hardening systems, and disabling unwanted services.
- **Chapter 6, "Automating Encryption and Tunneling Techniques"**—Provides insight into how cryptographic systems are used to secure information and items such as passwords. You learn firsthand how these systems are attacked and which tools are used.
- **Chapter 7, "Automated Attack and Penetration Tools"**—Presents you with an overview of how attack and penetration tools work. These are the same tools that may be used against real networks, so it is important to understand how they work and their capabilities.
- **Chapter 8, "Securing Wireless Systems"**—Offers an overview of the challenges you'll face protecting wireless networks. Although wireless systems are easy to deploy, they can present a real security challenge.
- **Chapter 9 "An Introduction to Malware"**—Takes you through a review of malware and demonstrates how to remove and control virulent code. You learn how to run rootkit detectors and spyware tools, and use integrity-verification programs.

- **Chapter 10, "Detecting Intrusions and Analyzing Malware"**—Introduces intrusion detection systems (IDSs) and discusses the ways in which malware can be analyzed. This chapter gives you the skills needed to set up and configure Snort and use tools such as IdaPro.
- **Chapter 11, "Forensic Detection"**—Reviews the skills needed to deal with the aftermath of a security breach. Forensics requires the ability to acquire, authenticate, and analyze data. You learn about basic forensic procedures and tools to analyze intrusions after security breaches.

Who Should Read This Book

This book is designed for the individual with intermediate skills. While this book is focused on those who seek to set up and build a working security test lab, this does not means that others cannot benefit from it. If you already have the hardware and software needed to review specific tools and techniques, Chapter 2 is a good starting point. For other even more advanced individuals, specific chapters can be used to gain additional skills and knowledge. As an example, if you are looking to learn more about password hashing and password cracking, proceed to Chapter 6. If you are specifically interested in wireless systems, Chapter 8 is for you. So, whereas some readers may want to read the book from start to finish, there is nothing to prevent you from moving around as needed.

Tools You Will Need

Your desire to learn is the most important thing you have as you start to read this book. I try to use open source "free" software as much as possible. After all, the goal of this book is to try to make this as affordable as possible for those wanting to increase their skills. Because the developers of many free tools do not have the development funds that those who make commercial tools do, these tools can be somewhat erratic. The upside is that, if you are comfortable with coding or developing scripts, many of the tools can be customized. This gives them a wider range of usability than many commercial tools.

Tools are only half the picture. You will also need operating systems to launch tools and others to act as targets. A mixture of Linux and Windows systems will be needed for this task. We will delve into many of these issues in the first chapter. You may also want to explore sites like `http://www.linuxlinks.com/distributions`. There is more on this in the next section.

What's on the Wiley Website

To make the process as easy as possible for you to get started, some of the basic tools you will need are available on the Wiley website that has been setup for this book at `www.wiley.com/go/networksecuritytestlab`.

Summary (From Here, Up Next, and So On)

The Network Security Test Lab is designed to take readers to the next stage of personal knowledge and skill development. Rather than presenting just the concept or discussing the tools that fit in a specific category, *The Network Security Test Lab* takes these topics and provides real-world implementation details. Learning how to apply higher-level security skills is an essential skill needed to pursue an advanced security career, and to make progress toward obtaining more complex security certifications, including CISSP, CASP, GSEC, CEH, CHFI, and the like. I hope that you enjoy this book, and please let me know how it helps you advance in the field of cyber security.

CHAPTER

1

Building a Hardware and Software Test Platform

This book is designed for those who need to better understand the importance of IT security. This chapter walks you through what you need to set up a hardware/software test platform. As a child, you may have loved to take things apart, TVs, radios, computers, and so on, in a quest to better understand how they worked. Your tools probably included soldering irons, screwdrivers—maybe even a hammer! That is similar to what you will be doing throughout this book. While you won't be using a hammer, you will be looking at protocols and applications to understand how they work. You will also examine some common tools that will make your analysis easier. The objective is to help you become a better network analyst, and improve and sharpen your IT security skills.

Because no two networks are the same, and because they change over time, it is impossible to come up with a one-size-fits-all list of hardware and software that will do the job for you. Networks serve the enterprises that own them, and enterprises must change over time. In addition, the scale of operation impacts security considerations. If you pursue a career as a security consultant, your goals (and inevitably your needs) will differ, depending on whether you work for a large multinational corporation (and even here, your goals and needs will depend on the type of industry) or a small office/home office (SOHO) operation or a small business. Clearly, a whole spectrum of possibilities exists here.

This chapter provides the first step in building your own network security lab. You will start to examine the types of hardware and gear that you can use

to build such a test environment, and then look at the operating systems and software you should consider loading on your new equipment.

Why Build a Lab?

A laboratory is as vital to a computer-security specialist as it is to a chemist or biologist. It is the studio in which you can control a large number of variables that come to bear upon the outcome of your experiments. And network security, especially, is a field in which the researcher must understand how a diverse range of technologies behave at many levels. For a moment, just consider the importance of the production network to most organizations. They must rely on an always-on functioning, which means that many tests and evaluations must be developed in a lab on a network that has been specifically designed for such experiments.

NOTE **A laboratory is a controlled environment in which unexpected events are nonexistent or at least minimized. Having a lab provides a consequence-free setting in which damage that might result from experimentation is localized (and can, it is hoped, be easily corrected).**

Consider something as basic as patch management. Very few organizations move directly from downloading a patch to installing it in the production environment. The first step is to test the patch. The most agreed-upon way to accomplish this is to install it on a test network or system. This allows problems to be researched and compatibility ensured. You might also want to consider a typical penetration test. It may be that the penetration-testing team has developed a new exploit or written a specific piece of code for this unique assignment. Will the team begin by deploying this code on the client's network? Hopefully not. The typical approach would be to deploy the code on a test network to verify that it will function as designed. The last thing the penetration test team needs is to be responsible for a major outage on the client's network. These types of events are not good for future business.

Building a lab requires you to become familiar with the basics of wiring, signal distribution, switching, and routing. You also need to understand how you might tap into a data stream to analyze or, potentially, attack the network. The mix of common network protocols must be understood; only by knowing what is normal on the network can you recognize and isolate strange behavior. Consider some of the other items that might motivate you to construct such a lab:

- Certification
- Job advancement
- Knowledge

- Experimentation
- Evaluation of new tools

To varying degrees, networking- and security-related certifications require knowledge of the hardware and software of modern networks. There is no better vehicle for learning about networking and security issues firsthand than to design and build your own network lab. This provides a place where you can add and remove devices at will and reconfigure hardware and software to your liking. You can observe the interaction between the systems and networking devices in detail.

Advancing in your field is almost never an accident. The IT industry is an area of constant change, and the best way to build a career path in the world of IT is to build your skill set. By mastering these technologies, you will be able to identify the knowledgeable people on the job or at a customer's site, and align yourself with them. You might even uncover some gifts that you did not previously realize you possessed, such as a love for hexadecimal—well, maybe.

Building a lab demonstrates your desire and ability to study and control networks. One key item that potential employers always consider is whether a candidate has the drive to get the job done. Building your own security lab can help demonstrate to employers that you are looking for more than just a job: You want a career. As you use the network resources in your lab, you will invariably add to your knowledge and understanding of the technologies that you employ. Learning is a natural consequence.

Experimentation is a practical necessity if you are to fully understand many of the tools and methods employed by security professionals and hackers alike. Just consider the fact that there are many manuals that explain how Windows Server 2012 works, or how a Check Point firewall works, but no manual can account for every single situation and what is 'unique' to any environment you encounter. Some combinations and interactions are simply unknown. By building your own lab, you will discover that when deployed in complex modern networks, many things do not work the way the documentation says they will. And many times, it does not suffice to simply understand *what* happens; you need to appreciate the timing and sequence of events. This requires the control that a laboratory environment provides.

Because IT is an industry of continual change, new software, new security tools, new hacking techniques, and new networking gizmos constantly appear. A network security lab provides you with a forum in which to try these things out. You certainly don't want to risk corrupting a computer that you depend on every day to do your job. And you don't want to negatively impact the work of others; doing so is a good way to quickly put the brakes on your budding career.

A laboratory thus provides a place where you can try new things. This is a setting in which you can gain a detailed understanding of how things are put together and how they normally interact. It is an environment in which you can likely predict the outcome of your experiments, and if an outcome is unexpected, you can then isolate the cause.

BUILDING YOUR OWN SECURITY LAB

A common question among students and those preparing for certification is, "How do I really prepare for the job or promotion I am seeking?" The answer is always the same: know the material, but also get all the hands-on experience you can. Many times they don't have enough money in their IT budget, or they are a struggling student. That is totally understandable. Yet the fact remains that there is no way to pick up many of the needed skills by reading alone. And many tests cannot be conducted on a live Internet-connected network.

With a little work and effort, you can find the equipment required to practice necessary skills at a reasonable price—network professionals have been doing this for years. There are even sites such as `certificationkits.com` that are set up exclusively to provide students with a full set of networking gear needed to complete a Cisco Certified Network Associate (CCNA) or a Cisco Certified Network Professional (CCNP) certification.

Hardware Requirements

Before you can get started with any testing, you need to assemble some hardware. Your goal, as always, will be to do this as inexpensively as possible. Many things might be included in a network security laboratory. Some of these items are mandatory (for example, cables), and some things can be added according to your needs and as they become available or affordable. Although it is possible to contain everything within one computer, your requirements will vary from time to time based on the scenario that you are modeling.

Here are some of the things that will likely end up in your mix:

- Computers
- Networking tools
- Cables
- Network-attached storage (NAS)
- Hubs
- Switches
- Routers
- Removable disk storage
- Internet connection
- Cisco equipment
- Firewalls
- Wireless access points