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James C. Foster
Vitaly Osipov
Nish Bhalla
Niels Heinen

FOREWORD BY DAVE AITEL
FOUNDER AND CEO
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Over the last few years, Syngress has published many best-selling and critically acclaimed books, including Tom Shinder's *Configuring ISA Server 2000*, Brian Caswell and Jay Beale's *Snort 2.0 Intrusion Detection*, and Angela Orebaugh and Gilbert Ramirez's *Ethereal Packet Sniffing*. One of the reasons for the success of these books has been our unique **solutions@syngress.com** program. Through this site, we've been able to provide readers a real time extension to the printed book.

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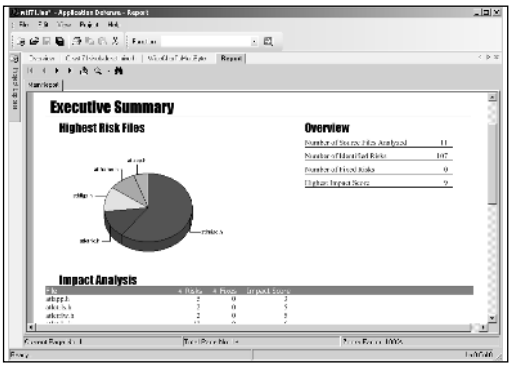

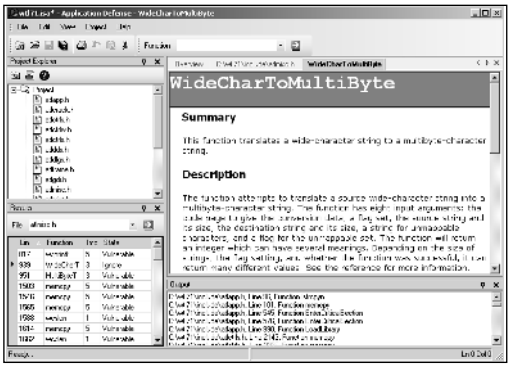

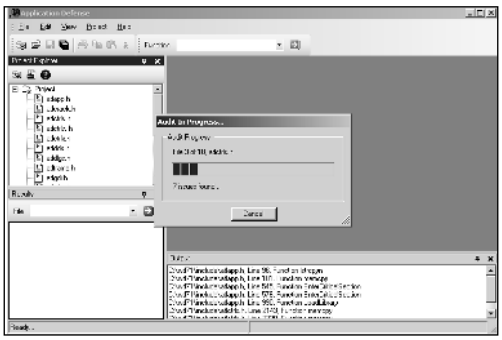

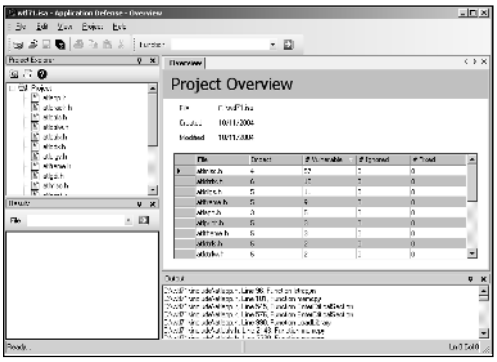

Application Defense Technology Features:

- Industry leading analysis engine can parse and examine entire software code base in under a minute
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For the men and woman who proudly
"serve in silence,"
dedicating their lives to
Mission, Workmate, and Country.

Lead Author

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-James Foster
December, 2004

Contents

Foreword

I can recall with crystal clarity three times relating to buffer overflows. I remember the first moments of when I used a buffer overflow in the wild and it worked (imapd for Linux). I remember the first buffer overflow that I found and exploited all by myself (a Linux local). And I remember the first time I got into a host by writing a buffer overflow.

When most people read Aleph1's seminal paper on buffer overflows "Buffer overflows for fun and profit," they think largely on the "profit." Someone skilled in the art of writing buffer overflows can make $90-120K USD a year as a consultant for any of the large companies in the market.

Getting that skill, on the other hand, has one major roadblock: most people think that they can "learn" it. Many knacks in the IT world can be learned. Once you realize them, they're yours to keep. But writing a buffer overflow is not like that. It's more like weight lifting, or judo. You can learn the basics from a book, or perhaps a short class, but the landscape you work in changes constantly. Microsoft is adding new protections to their code every day, as hackers are constantly finding new ways to make exploits more reliable, and finding ways to develop new types of bugs. Three months after you stop writing buffer overflows, your skills are ancient history. The hard part about writing buffer overflows is staring an endless treadmill of work in the face.

The tools you once used to use to write overflows are changing, too. It used to be something you could do alone, with nothing but a cracked copy of Softice or GDB. These days, Immunity invests heavily into infrastructure in order to write even a simple buffer overflow. For example, we have a proprietary debugger all our own, which allows us to query and script running programs. We have special purpose compilers which allow us to create and tune our shellcode to be exactly what the vulnerability needs. We purchase or create reverse engineering tools specialized for various problems. We have complete mySQL and SSL libraries written entirely in Python. A moderately complex exploit will involve our entire team working in unison on various parts of the problem.

And of course, afterwards, there's the inevitable paper on each difficult exploit, which must be written to share the knowledge gained with the difficult exploits within the team. It's no longer an individual sport.

The most powerful of buffer overflows are never going to be in worms. Custom exploits are what gets you in, and what keeps you in. If you see a truly top notch hacker going after someone, he'll have a complete mirror of the target hosts' environments, all for one purpose: To create a buffer overflow he only plans on using once.

There are levels in the game. James Foster will take you through basic training, giving you the broad view and skills you need to figure out what you want to specialize in. From there, you can walk away into management, confident that although you're not on the front line, you at least know how the fundamentals and can thereby make

informed decisions. Or you can dedicate yourself to the work, commit to the code, and develop the craft. If this is your choice, then I have a few maxims for you:

- Never be afraid. Microsoft has an entire army of marketing people telling you how hard it is to find and write buffer overflows against their newest software. My strategy is to fantasize about what I'm going to do with the exploit once it's working – it keeps me going. Writing exploits is going to require mastery of a lot of difficult and boring technology. HP-UX uses wacky quadrant memory access. Irix has inane caches. And learning the thousands of assembly languages this requires is no small feat. If you think you can do it, you can.
- Don't take yourself too seriously. Realize that no matter how good you get, some fifteen year-old in Sweden is dedicating twenty hours a day to be better than you. It's not a competition, and you'll burn out quick if you play the game as such.
- Find some friends. Like weight lifting or judo, this is not a skill you're going to keep up with if you do it all yourself. And you need people to tell you where you're weak.

Regardless of your goals, use this book as a worksheet, rather than a novel. Don't read it without a computer next to you. A book on buffer overflows can't deliver that hacker high with knowledge alone. Work along with the chapters and you'll find that you can't stop fiddling with your exploit when it's not working right. You'll give up food, sleep, or money to make it that much cleaner.

My belief is this: In the end, an exploit is a complex statement of truth. What you're saying is "This is possible." And saying it truthfully makes it beautiful.

Someday, I hope to appreciate your code as art.

—Dave Aitel
Founder, CEO
Immunity, Inc.

Part 1

Expanding on Buffer Overflows