

An Introduction to SPIKE, the Fuzzer Creation Kit



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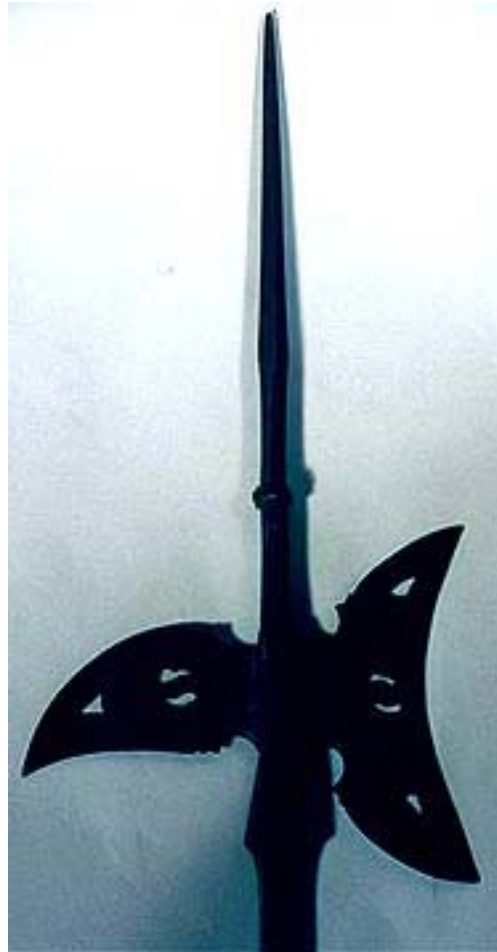
<http://www.immunitysec.com>

Agenda

- Demo and Vulnerability
- Theory
 - Goals
 - Using the SPIKE API
 - Useful samples included with SPIKE
- Questions throughout and at end

<GOBBLES> i used to laugh at fuzzers, but then you changed my whole outlook on life!

Demo of SPIKE in Action



Theory

- SPIKE is a GPL'd API and set of tools that allows you to quickly create network protocol stress testers
- Most protocols are built around extremely similar data formatting primitives
- Many of these are already supported in SPIKE
- Others soon will be. :>

Fes: "I'm always surprised at how effective fuzzers actually are!"

The Goals of SPIKE

- Find new vulnerabilities by
 - Making it easy to quickly reproduce a complex binary protocol
 - Develop a base of knowledge within SPIKE about different kinds of bugclasses affecting similar protocols
 - Test old vulnerabilities on new programs
 - Make it easy to manually mess with protocols

How the SPIKE API works

- Unique SPIKE data structure supports lengths and blocks

- `s_block_start()`, `s_block_end()`,
`s_blocksize_halfword_bigendian()`;

- SPIKE utility routines make dealing with binary data, network code, and common marshalling routines easy

- `s_xdr_string()`

- SPIKE fuzzing framework automates iterating through all potential problem spots

- `s_string("Host: "); s_string_variable("localhost");`

The SPIKE Datastructure

- A SPIKE is a kind of First In First Out Queue or “Buffer Class”
- A SPIKE can automatically fill in “length fields”
 - `s_size_string(“post”,5);`
 - `s_block_start(“Post”);`
 - `s_string_variable(“user=bob”);`
 - `s_block_end(“post”);`

Length Fields

- Length fields come in many varieties
 - Word/halfword/string
 - Big endian, little endian
- More than one length field can “listen” for a particular block to be closed
- Blocks can be nested or intertwined

A few basic calls

- The main call is `s_push(buffer,size)` underneath everything
 - Currently, there is no `s_pop()`;
- String calls:
 - `s_string("hi");`
 - `s_string_variable("hi");`
- `s_binary("\\x41 4141 0x41 41 00");`
 - Can take in all sorts of cut and pasted hexadecimal data without choking
 - Handles white space cleanly

Setting up/destroying a SPIKE

- Global variables you have to deal with:
 - `set_current_spike(*struct spike);`
 - `spike_clear();`
- Malloc fun
 - `spike_new();`
 - `spike_free();`

Network SPIKE calls

- Basic TCP connectivity
 - `spike_tcp_connect(host,port);`
 - `spike_send();`
 - `spike_close_tcp();`
- Basic UDP Connectivity
 - `spike_udp_connect(host,port);`
 - `spike_send();`

Fuzzing Framework SPIKE calls

- `s_string_variable("");`
- `s_string_repeat("A",5000);`
 - Equivalent to `s_push("perl -e 'print \"A\" x 5000'")`
- While loop support
 - `s_incrementfuzzstring();`
 - `s_incrementfuzzvariable();`

Advantages to using SPIKE's fuzzing framework over a perl script

- Size values will automatically get updated
- Can handle binary data cleanly via `s_binary()`;
- Already knows about many different types of interesting strings to use for fuzzstrings
- Integrates cleanly with libntlm or other GPL'd libraries in C for doing encryption or other things for which you don't already have perl modules

The Process of Using SPIKE on an unknown protocol

- Use Ethereal to cut and paste the packets into `s_binary()`;
- Replace as much of the protocol as possible with deeper level spike calls
 - `s_xdr_string()`; `s_word()`; etc
- Find length fields and mark them out with size calls and `s_block_start()`, `s_block_end()`;
- Make sure protocol still works :>
- Integrate with fuzzing framework (2 `while()` loops) and let the SPIKE fuzzer do the boring work
- Manually mess with the packets to see if you can cause any aberrant behaviour (attach ollydebug first)
- Write up the exploits

The SPIKE scripting language

- ...is C.
- `s_parse("filename.spk");`
 - Loads the file line by line and does limited C parsing on it
 - Uses `dlopen()` and `dlsym()` and some demarshalling to call any functions found within
 - `printf("Hi %s %s\n", "dave", "what's up?");`
 - `s_clear();`
 - `s_binary("41 42 43 44 45");`
- Typically a “generic” framework is built, then SPIKE script is used to quickly play with the protocol

Current Demo SPIKEs

- Web Focused
- MSRPC protocol support
- Miscellaneous other demos

SPIKE Programs for non Web Apps

- msrpcfuzz
- Citrixfuzz
- Quake,halflife (UDP demos)

Quickstart: msrpcfuzz

- First use DCEDUMP (basically rpcinfo against Windows)
- Then chose a program and port to fuzz
 - Sends valid, but random data structures to that program
- Watch it crash!

SPIKE Programs for Web Apps

- `ntlm2/ntlm_brute`
- `webmitm`
- `makewebfuzz.pl`
- `webfuzz.c`
- `closed_source_web_server_fuzzer`
- `generic_web_server_fuzz`

ntlm_brute and ntlm2

- Tries to do a dictionary attack on NTLM authenticating web servers
- Somewhat slow but easy to parallelize
- Very simple to use with provided `do_ntlm_brute.sh`
- Ntlm2 useful for doing “webfuzz” activity on a page that requires NTLM authentication

Webmitm (SPIKE version, not dsniff Version)

- Transparent proxy (originally from dsniff)
- Used to generate http_request files
- Can do SSL
- Rewrites Host: headers
- Cool with “Connection: keep-alive”

Makewebfuzz.pl

- Creates webfuzz.c files from http_request files
- Superceeded by SPIKE Console wizardry and generic .spk scripts, but still useful

Webfuzz

- Sends the valid request, but incrementally goes through each variable in the request and checks it for common vulnerabilities

A Standard Request

GET /login.asp?Username=**Dave**&Password=**Justine**

Host: bobsbagoffish.com

Content-Length: 16

Server=**whitebait**

A webfuzz request

GET /login.asp?Username=../../etc/hosts%00&Password=**Justine**

Host: bobsbagoffish.com

Content-Length: 16

Server=whitebait

Closed_source_webserver_fuzz

- Uses same set of fuzz strings to locate common web server overflows, format string bugs, etc
- Also useful for rigorous manual testing of one CGI

Automating the process of finding SQL injection bugs

■ `odbcwebfuzz.sh`

- Make a directory of captured `http_requests` using `webmitm`
- Compile each of these into a `webfuzz` using `makewebfuzz.pl`
- Run each of these against the server
- Grep through results for interesting errors (such as ODBC)
- You just saved 20K! :>

When Automation Fails

- This is an exponential problem!
 - Unlike commercial alternatives to SPIKE every part of SPIKE is open
 - SPIKE can be extended with any other GPL code
 - I accept patches

Examples where automation fails

- User Registration that requires a sequence of pages to be hit
 - use SPIKE to automate hitting the first two and then fuzz every variable on a third page
- More complex web applications that use characters other than '&' to split up variables
- Page sequences that require some parsed input from a previous page to be included in a submitted request

The SPIKE Console

- wxPython
 - cross platform
 - pretty
- Wizards enable quick utilization of SPIKE's capabilities
- Currently beta, but useful
- Under heavy development

The Future of SPIKE

- SPIKE Console Improvements
- Additional SPIKE protocol demos and updates

Conclusion

- For most standard web applications SPIKE can quickly help you find SQL injection, overflow, and format string bugs
- SPIKE can be quickly customized for your specific needs
- Use SPIKE to reverse engineer and fuzz binary protocols in less time than you otherwise could
- Download for FREE today!
 - <http://www.immunitysec.com/spike.html>
- Comments to dave@immunitysec.com