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Metaspoit
(Exploit automation and IPS evasion)
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Agenda

- Introduction
- Metasploit 3
- Automation
- IPS Evasion
- Examples
Introductions - Who?

- BreakingPoint Systems
  - Director of Security Research
  - We build hardware to break things

- The Metasploit Project
  - Founder, developer, researcher
  - We build software to break things
Introductions - What?

- **Metasploit v3.0**
  - New features, massive changes
  - Starting to be usable :-)

- **Automation**
  - Auxiliary modules, databases, events
  - “Turning Metasploit into Nessus”:-)

- **Evasion**
  - Finding the “bump in the wire”
  - Low-visibility IPS fingerprinting
  - Integration with Metasploit 3
Metasploit v2.5

- April 2006 status
  - 127 remote exploits, 75 payloads
  - Found in 17 books, 950 blogs, 190 articles
  - 27,000 IPs used msfupdate in 2006

- Growing pains...
  - Load time increasing (200+ modules)
  - Client-side exploits are a pain
  - Automation is doable, but klunky
  - Concurrency depends on fork()
Metasploit v3.0

- Completely rewritten in Ruby
  - Object oriented model was a better fit
  - Code compression at ~40%
  - 2.5 was 40K lines Perl, 3.0 is 86K lines Ruby

- New design, new features, new goals
  - Focused on flexibility and automation
  - Closer integration between features
  - Development guide and API docs!
Metasploit v3.0 – New features

- Multitasking through Ruby threads
  - Share single instance with many users
  - Great for team-based penetration testing
  - Multi-user plugin is only ~20 lines of code :-)

- Concurrent exploits and sessions
  - Support for passive exploits and recon mods
  - Multiple payload sessions open at once
  - Suspend and restore payload sessions
  - Share payload sessions with other users
  - Handle multi-victim exploits :-)


Extensive exploit module “Mixins”
- Write advanced exploits in only 3 lines :-)
- Mixins for SMB, DCERPC, HTTP, FTP...
- Huge boost for module consistency
- Example FTP server exploit:

```ruby
connect

text = Rex::Text.rand_text_english(2048, payload_badchars)
seh = generate_seh_payload(target.ret)
text[229, seh.length] = seh

send_cmd('USER', text, false)

handler
disconnect
```
Metasploit v3.0 – New features

- Shiny new interfaces!
  - Console uses module hierarchy/regex
  - Web interface uses ERB / AJAX
  - GUI version now in development:
Opcode DB has been enhanced
- Online database of win32 DLL information
- Stores the location of usable 'opcodes'
- Multi-language support being expanded

Framework integration
- New command-line tool for queries
- Building an 'opcode pool' system
- Automated return address updates
- Combine this with fingerprinting...
**Metasploit v3.0 – Executable processing**

- **msfpescan**
  - Command-line tool for EXE processing
  - Discovers usable return addresses
  - Partially used to create the Opcode DB
  - Now handles Resources and TLBs

- **msfrpcscan**
  - Extracts MIDL information from PE files
  - Creates boilerplate for new exploits
  - Still in development...
Metasploit v3.0 – Exploit upgrades

- Rewrite of all exploit modules
  - Massive number of bug fixes
  - Improved randomness, use of Mixins

- Exploit module structure
  - Single exploit can target many platforms
  - Simplified the meta-information fields
  - Mixins can also modify exploit behavior
    - Target brute forcing
    - Passive exploits
**Metasploit v3.0 – Payload upgrades**

- **Enhancements**
  - Bug fixes and size improvements
  - New “cmd” modules, “php” payloads...

- **Meterpreter**
  - Consolidation of standard modules
  - Wicked cool API and remote scripting

```bash
# Process migration
pid = client.sys.process['calc.exe']
client.core.migrate(pid)

# Mirror the remote hard drive in one line
client.fs.dir.download("/tmp/", "C:\", true)
```
Metasploit v3.0 – Auxiliary modules

- **The problem...**
  - Not all exploits fit into the standard structure
  - Recon modules overlapped with exploits
  - No standard for information sharing

- **Auxiliary modules**
  - Catch-all for interesting security tools
  - Perform reconnaissance and reporting
  - Integrate with third-party utilities
  - Report data in a standard format
Metasploit v3.0 – Events

- Event callbacks for common operations
  - Sessions – new session, closed session
  - Sockets – new socket, new connection
  - Database – object creation, modification
  - Interface – console start, other UI actions

- Event handlers hook and extend
  - Register with the EventManager
  - Export a method to hook the event
  - Catch the event, process the argument
  - Extend the object :-)
Metasploit v3.0 – Plugins

- The Ruby language rocks
  - Ability to redefine anything at runtime
  - Plugins can alter almost anything

- Framework plugins
  - Extend and replace Framework code
  - Hook events and filter parameters
  - Simplify feature development
  - Examples:
    - Socket tracing and filtering
    - Multiuser exploit console
Metasploit v3.0 – Database

- Support for common databases
  - Postgres, SQLite, MySQL, etc.
  - Based on ActiveRecord from RoR :-) 
  - Simplified API and thread-safety

- Implementation defined by plugins
  - Monitor sockets with db_tracker.rb
  - Interact with the database (search, etc)
  - DB object creation/modification throws events
  - Persistent storage of session data
  - Reporting is just another plugin
Metasploit v3.0 – Automation

- Turning Metasploit into Nessus
  - Database backend provides “KB” function
  - Auxiliary modules for assessment/discovery
  - Event coordinator for triggering modules
  - Report generator uses the database

- Development status
  - 75% of the database schema
  - 50% of the Auxiliary module API
  - Handful of discovery modules
  - Integration with Nessus/Nmap
Metasploit v3.0 – Automation

- Creating a professional mass-rooter
  - Auxiliary modules perform discovery
  - Exploit modules perform vuln checks
  - Plugins automate exploitation
  - Plugins automate post-exploitation
  - Dump XML reports via ActiveRecord

- Useful framework for all security tools
  - Extensive protocol support, friendly API
  - Passive tools work well with event system
  - Most APIs are accessible from Rex
Metasploit v3.0 – Evasion

- Evasion is finally taken seriously
  - Evasion options now a separate class
  - Protocol stacks integrate IDS evasion
  - Mixins expose these to exploit modules

- Strong evasion techniques
  - Multi-layered evasion defeats most solutions
  - Client-side attacks impossible to detect
    - WMF = HTTP + Compress + Chunked + JScript
  - Deep protocols offer so many options
    - LSASS = TCP + SMB + DCERPC
Example evasion options

TCP::max_send_size
TCP::send_delay
HTTP::chunked
HTTP::compression
SMB::pipe_evasion
DCERPC::bind_multi
DCERPC::alter_context
IPS fingerprinting
- Implemented as Auxiliary modules
- Use low-risk signature deltas to ID
- Linux-based IPS depends on bridging...

IPS evasion
- Configure an 'evasion profile'
- Override exploit / evasion options
- Uses per-IPS evasion techniques
IPS filtering for the attacker
- Socket hooking plugins can filter data
- Not all vendors encrypt their signatures
- Lets create an application layer IPS :-)

The “ips_filter” plugin
- Monitor all socket transactions
- Block packets that would trigger a alert

Challenges
- Signatures are often for decoded data
- Formats are difficult to convert to RE
Metasploit v3.0 – Status

- Metasploit Framework v3.0-alpha-r3
  - User interfaces are still a bit rough
  - Module caching a huge improvement
  - Over half of the exploits are ported
  - Only support Linux / OS X / BSD
  - Should work with Cygwin...but not Native yet

- Metasploit Framework v3.0-alpha-r4
  - Includes database, plugins, auxiliary modules
  - IPS detection features depend on time
  - Target release date is April 12th
Metasploit v3.0 – Other Projects

- Metasploit Research Toolkit (skape)
  - Standalone disassembler, emulator, mmu
  - eEye-style return detection, input tracing

- Metasploit Anti Forensics Tools (vinnie)
  - Standalone tools, moving to meterp modules
  - Completely hoses Encase :-)

- Miscellaneous small projects
  - IDARub – see it at RECon 2006 (spoonm)
  - Hamachi – publicly available (hdm)
• **Metasploit Framework License v1.0**
  - Keep source code open, prevent abuse
  - Restricts commercial product integration
  - Free to use for commercial services

• **Metasploit / Hacker Foundation**
  - Early stages, working on non-profit status
  - Pave the way for research grants
  - T-shirts, internships, educational material...
Questions?

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