Hacking Online Games

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Agenda

- Importance
- Attack Tree for Cheating On-line Poker
- Bots
- Denial of Service
- Collusion
- Software Exploits
- Conclusion

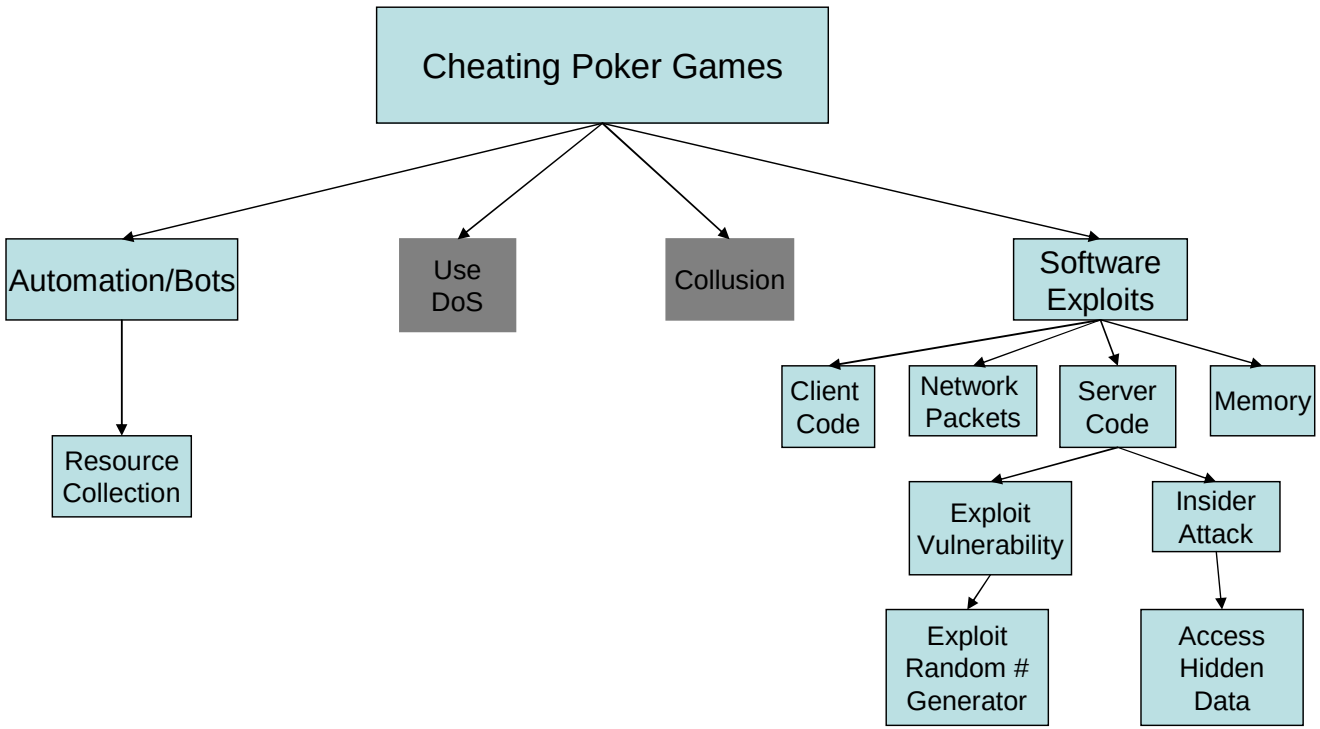
Importance

- Out-of-band market for virtual equipment
  - *EverQuest* example
    - In 2004, "the Gross National Product of EverQuest, measured by how much wealth all the players together created in a single year inside the game ... turned out to be $2,266 U.S. per capita."
    - 77th wealthiest country: equivalent to Russia - ahead of India, Bulgaria, and China
- Most gaming companies frown upon these markets

Importance (cont'd)

- Question
  - If the markets are outside of the game itself, should they add any more motivation for gaming companies to prevent cheating?
  - Real motivation for gaming companies is to keep the customer happy
    - 2005 survey showed "no game hacking and cheating" as the #2 reason users chose a particular game and the #1 reason they stopped playing a game
    - "Any behavior that hurts business is bad behavior." - Raph Koster, Creative Director for *Star Wars Galaxies*
- Focus on on-line gambling
  - The "market" in on-line gambling is in-band
  - Obvious added motivation to prevent cheating

Attack Tree for Cheating Online Poker



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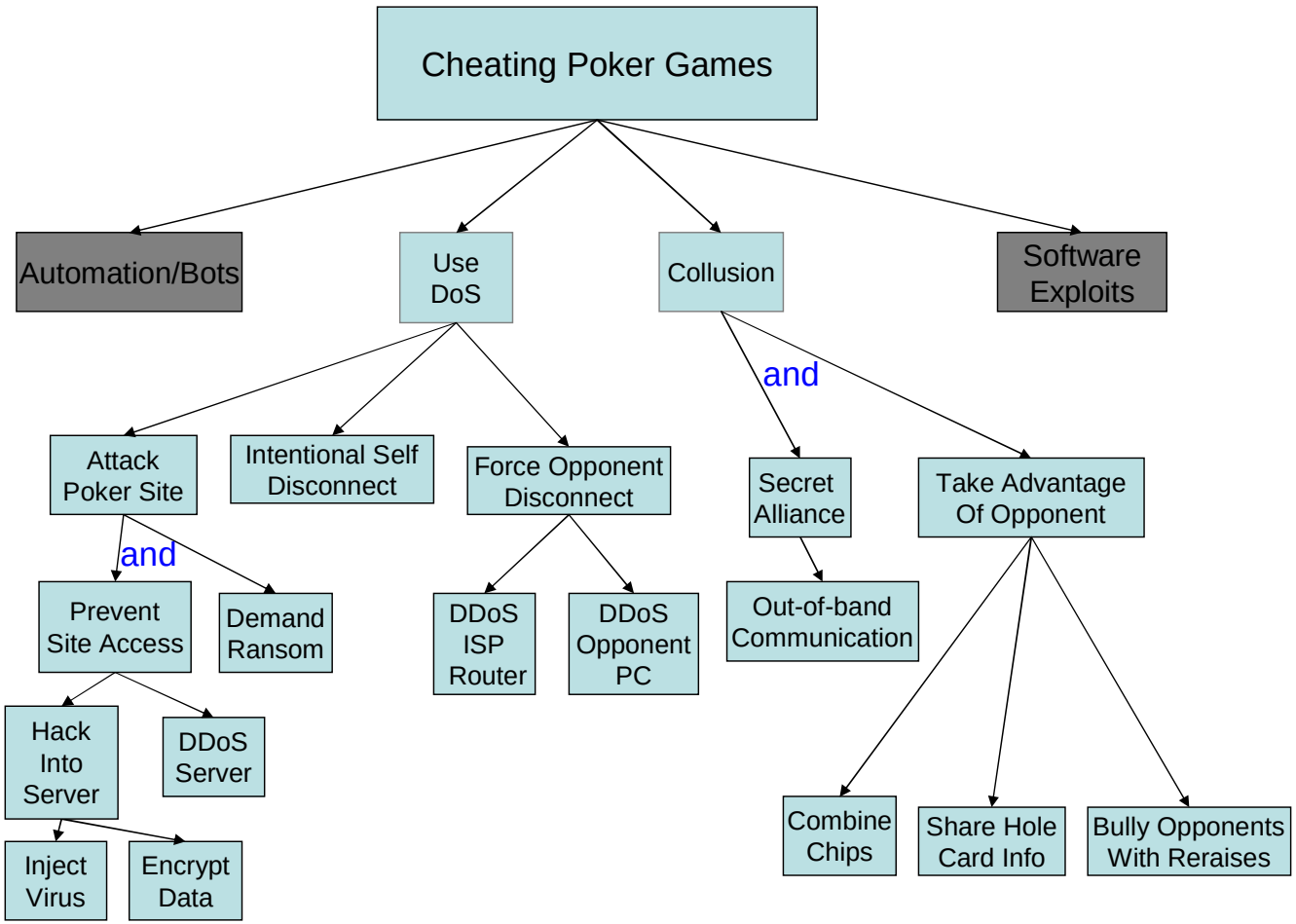
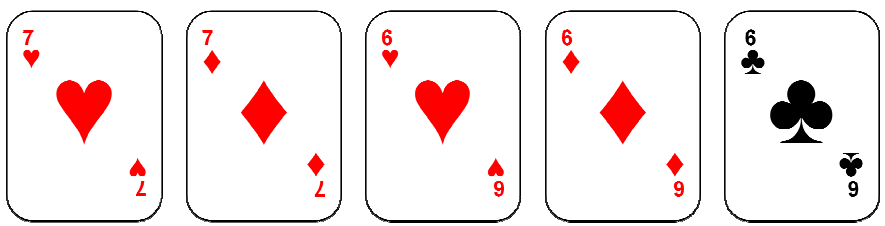


Poker Tutorial

- Card game where card ranks and forming "hands" are used to determine winner.
  - High card, Pair, Two Pair, Three of a Kind, Straight, Flush, Full House, Four of a Kind, Straight Flush
- Skilled players understand game statistics and human psychology
- Many variations of the game(hand definitions fairly standard)
  - Texas Hold'em, Omaha, Stud, etc.
- Actions include Bet, Check, Fold, Call, Raise



Bots

- Resource collection
  - Simple poker bots that win most of the time are sufficient for making money
  - cheater can deploy large number of bots
  - each bot may only make a small dollar amount per hour but having several that run simultaneously and around the clock can add up to significant amounts of money
  - More complex bots with advanced AI can improve win percentages
  - Polaris Pokerbot won 2008 Man vs. Machine Poker Championship

Macros

- Macros
  - Scripts used to create bots that can play a game
  - Farming - having a bot perform a repetitive process to gain game resources
    - e.g. In WOW find a location where an enemy spawns, have bot locate and kill enemy, then wait for respawn, rinse and repeat
  - AC Tool is a powerful Macro builder (http://www.actool.net/)
  - Macros have many legitimate purposes, such as GUI automation testing

AC Tool

- AC Tool
  - Macro builder - build sequence of commands
  - Press any number of keys for any amount of time
  - Move mouse to specific mouse location and click left or right mouse button
  - Hold left mouse button down and move mouse to drag windows
  - Sample pixels
    - Allows you to locate items on the screen (e.g. enemies)
  - Simple programming logic (if/else, loops, variables, procedures, etc.)
  - Can even ftp

Bots

- Countermeasures
  - Players can chat to try to discover a bot
    - Some players play several games at once and can't respond
    - In a game of revolving around misdirection, players may refuse to respond to try to disguise themselves as a bot
  - CAPTCHAs - prompt players periodically during long periods of play
  - Scan player's computers

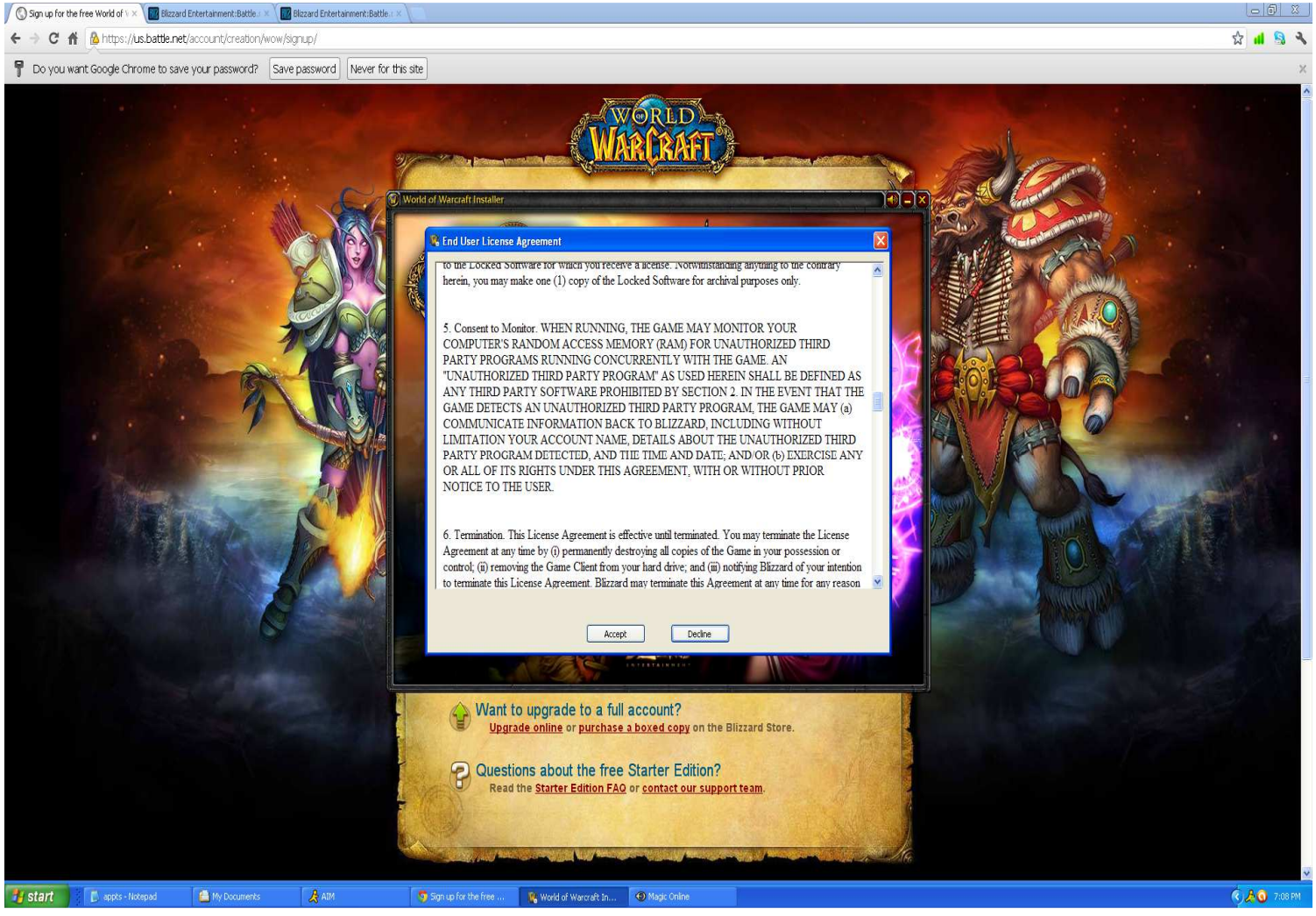
Bot Detection

- World of Warcraft (WOW) has client progam called "Warden"
  - Runs every 15 seconds (new versions of Warden come from the server whenever Blizzard's wants)
  - Checks every dll injected into WOW.exe
  - Reads the titlebar text of every open window
  - Also reads memory of every open process

Countermeasures (cont'd)

- Greg Hoglund wrote program called "The Governor" to monitor Warden and see exatly what it looks at
- Greg noticed email addresses, open URLs, IM contacts and program names being sent back to server
- Considers Warden spyware and a major privacy issue
- Do you agree?

Countermeasures (cont'd)



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- If the site policy is to place the player "all-in"
  - Players can intentionally disconnect themselves

DoS (cont'd)

- DoS attacks for ransom
  - Attack on Grafix Softech
  - Hackers bypassed firewalls and security systems to insert virus that encrypted data on all five production servers
  - Grafix paid ransom to get the encryption key
  - Lost $75,000 per day for approx 1 week

DoS (cont'd)

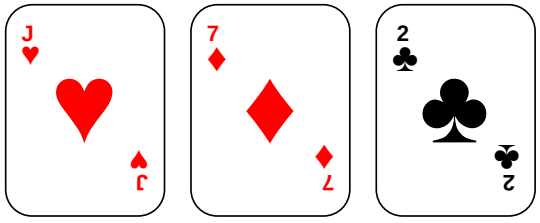
- DoS Countermeasures
  - Don't provide IP addresses of other users
  - Use multiple ISPs
  - Disaster-recovery plan and replication
  - Track user disconnect history

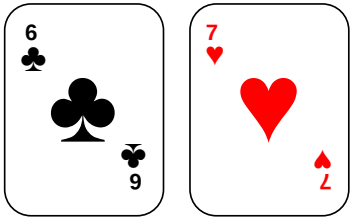
Collusion

- One of the major issues in on-line poker
- Requirement: out-of-band communication
- Two or more players acting together have a significant advantage
  - *Whipsawing* - coordinated raises to isolate opponents
  - Can share information on hole cards – improves odds calculations

Collusion (cont'd)

The Board

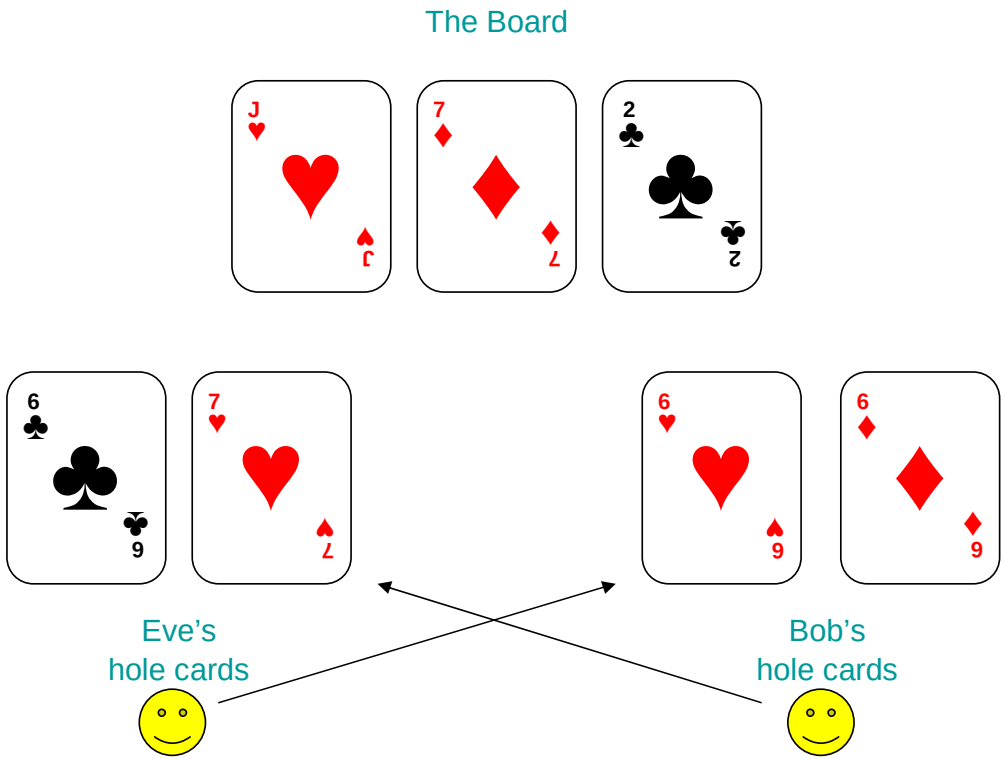




Eve's
hole cards

- 5 cards left that could improve Eve's hand
  - three 6's, two 7's
- Eve needs at least 4:1 pot odds

Collusion (cont'd)



- 3 cards left that could improve Eve's hand
  - one 6, two 7's
- Eve now needs over **7:1** pot odds
- Bob also gains information
- This information saves both Eve and Bob money

Collusion (cont'd)

- Combining chip stacks in a tournament
  - In tournament play, size matters
  - Colluding players can purposefully lose to one member to create a large chip stack
- A single player with multiple accounts can also employ these cheats

Collusion (cont'd)

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  - Collusion-detection algorithms
    - effective against whipsawing
    - unlikely to detect players sharing hole card information
  - Track player stats, investigate anomalies

Software Exploits

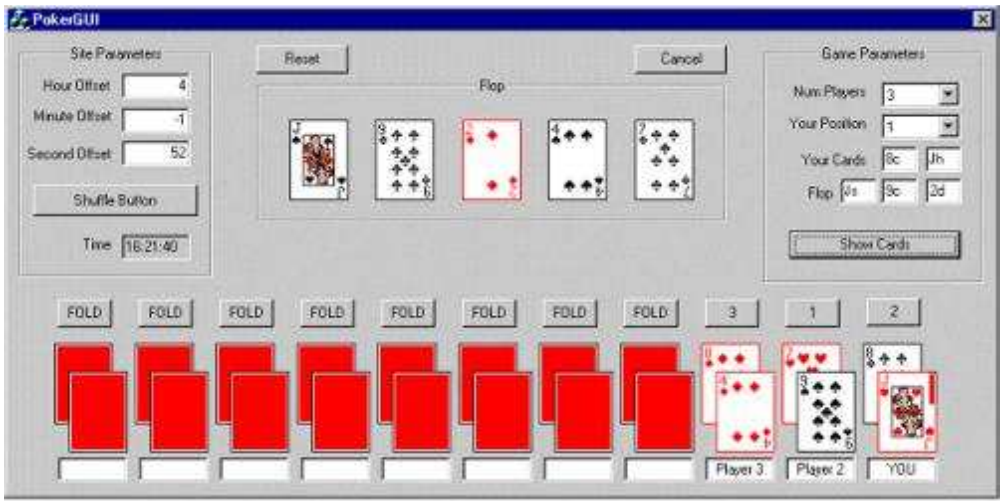
- Software Exploits
  - Client code
  - Network Packets
  - Server Code
    - Exploit Vulnerability
    - Insider Attack
  - Memory or data modifications

Software Exploits

- Exploit the game's card shuffling algorithm
  - ASF Software displayed shuffling algorithm online to show how fair it was
  - Cigital Software was able to break it in real time
  - A seed is used for random number generator
  - Seed just 32 bits, which allows 4 billion shuffles, much less than a real deck's 52!

Computer Randomness - Shuffling - cont.

- Seed set with number of miliseconds since midnight, but just 86 million milliseconds in a day, so now just 86 million possible shuffles
- Guessing system clock and seed allowed Cigital to reduce number of shuffles to 200,000 possbilities
- Once 5 cards were known they were easily able to tell how the deck was shuffled



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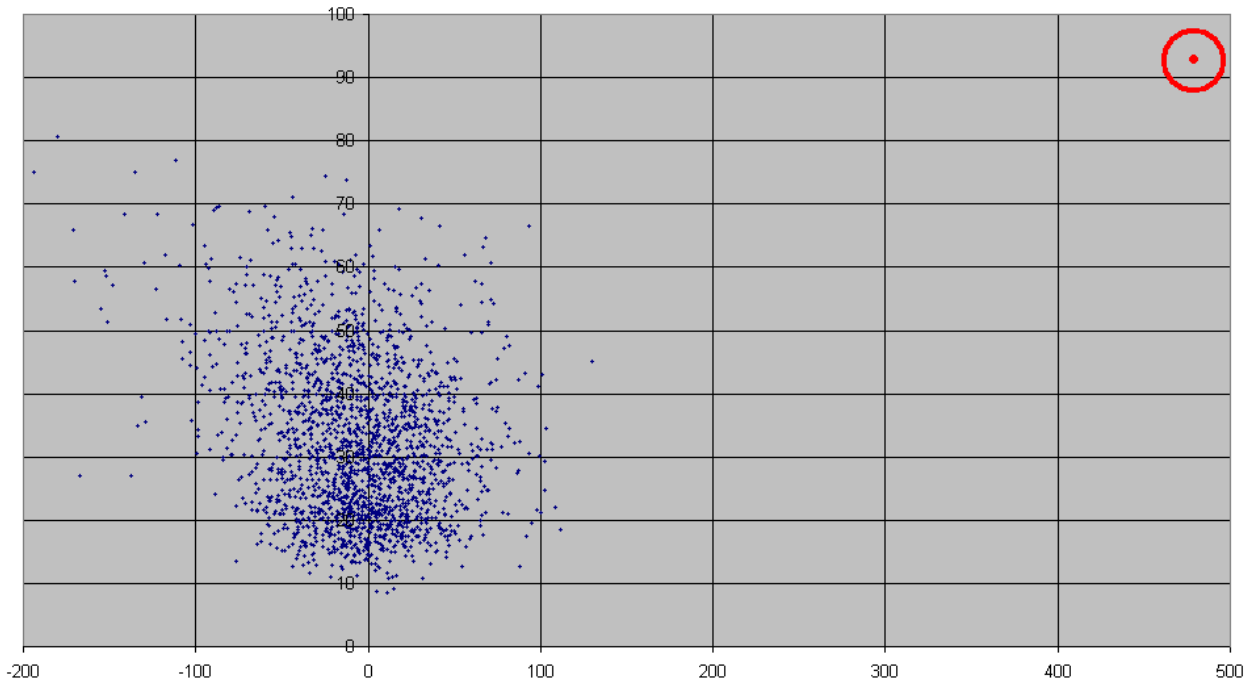
  - Win rate was 15 standard deviations above the mean
  - Video of reconstructed game: http://www.youtube.com/watch?v=FczbS7FiWSM

Software Exploits (cont'd)

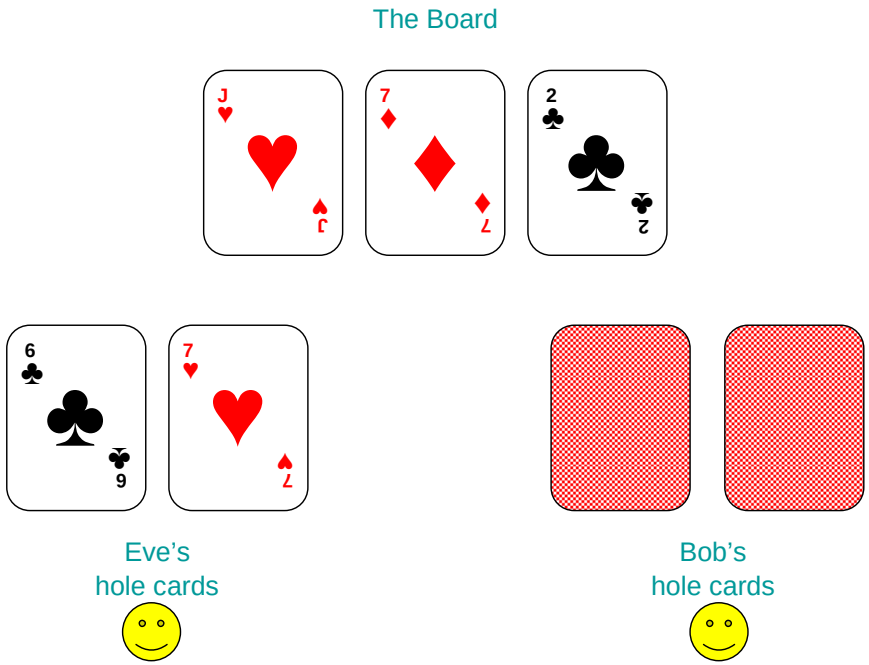
Win rates of 5,200 online players

- X-axis represents the number of blinds won per 100 hands
- Y-axis represents the percent of hands the user enters
- Cheater's win rate is the equivalent of winning a lottery with one-in-a-million odds 6 times in a row



Software Exploits (cont'd)

- Hacking
  - Insider attacks which allow a player to see opponents' hole cards



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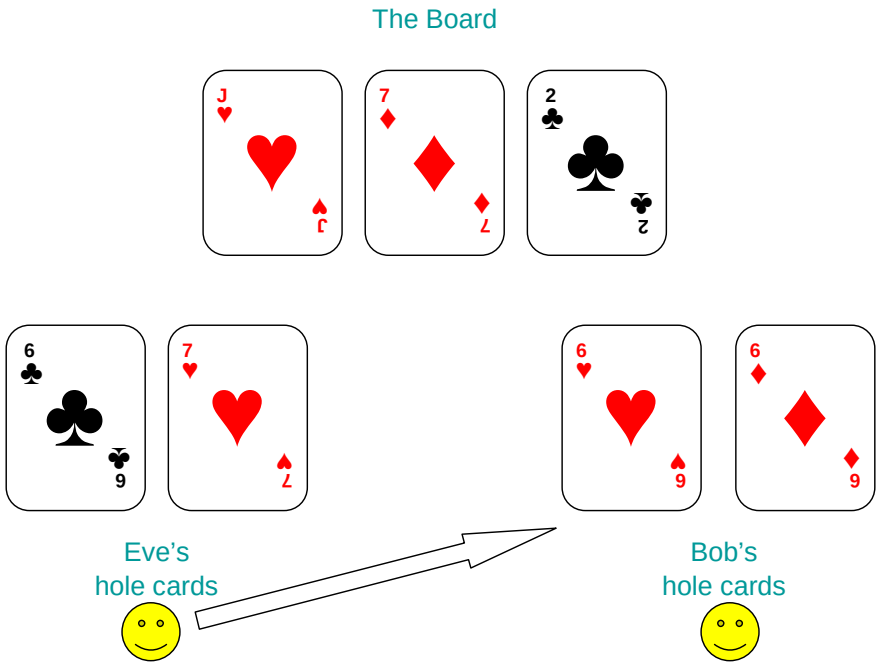


- if Eve is heads up against Bob then pot odds no longer matter
- Eve has Bob beat
- she can even attempt to induce a bluff out of Bob

Software Exploits (cont'd)

- Hacking Client Side
  - Hacking client code itself (need source access or decompile from exe)
  - Modifying network packets
  - Modifying client memory (memory modifying tools or DLL Injection)

Software Exploits - DLL Injection

- DLL Injection - get application to run your DLL
- DLL vs EXE
  - exe is executable program, has main()
  - exe runs in own memory
  - dll is dynamic linked library, no main()
  - dll is like a library, can be loaded dynamically in memory by many processes
  - Can link dll at load time or run time

Software Exploits - DLL Injection

- DLL Injection - get apllication to run your DLL cont
- Three examples:
  - CreateRemoteThread
    - Use Windows API to start a thread (running your dll) in another process
  - SetWindowsHookEx
    - "Hook" onto a Windows message for a remote thread
    - Your dll will run in remote thread when message is received
  - Code Cave Method
    - Suspend target thread (use SuspendThread)
    - Save address of next instruction to be executed (look in register for stack pointer)
    - Allocate and load dll in memory (use VirtualAllocEx). Set target thread's next execution instruction to the beginning of our dll's location in memory
    - Resume suspended target thread. When we finish our work, call back what would have been the next instruction
    - Can imagine running some code each pass in game loop

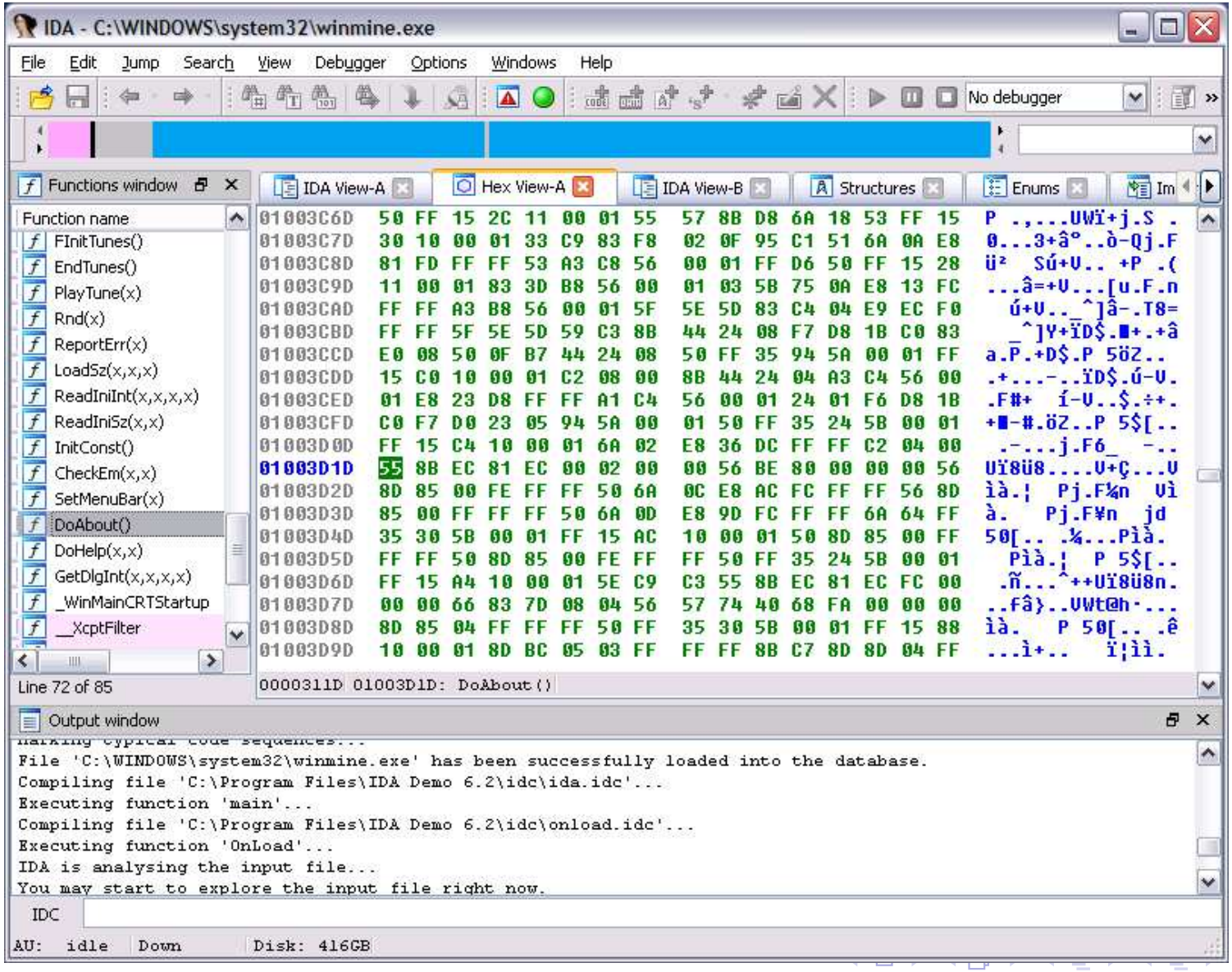
Software Exploits - Create Remote Thread Demo

- CreateRemoteThread example with Minesweeper
  - Used Ollydbg and IDA to learn Minesweeper timer memory location and function signatures
  - Allows me to change time and open about dialog
  - Fairly trivial using Microsoft Visual C++ (see http://www.blizzhackers.cc/viewtopic.php?p=2483118)

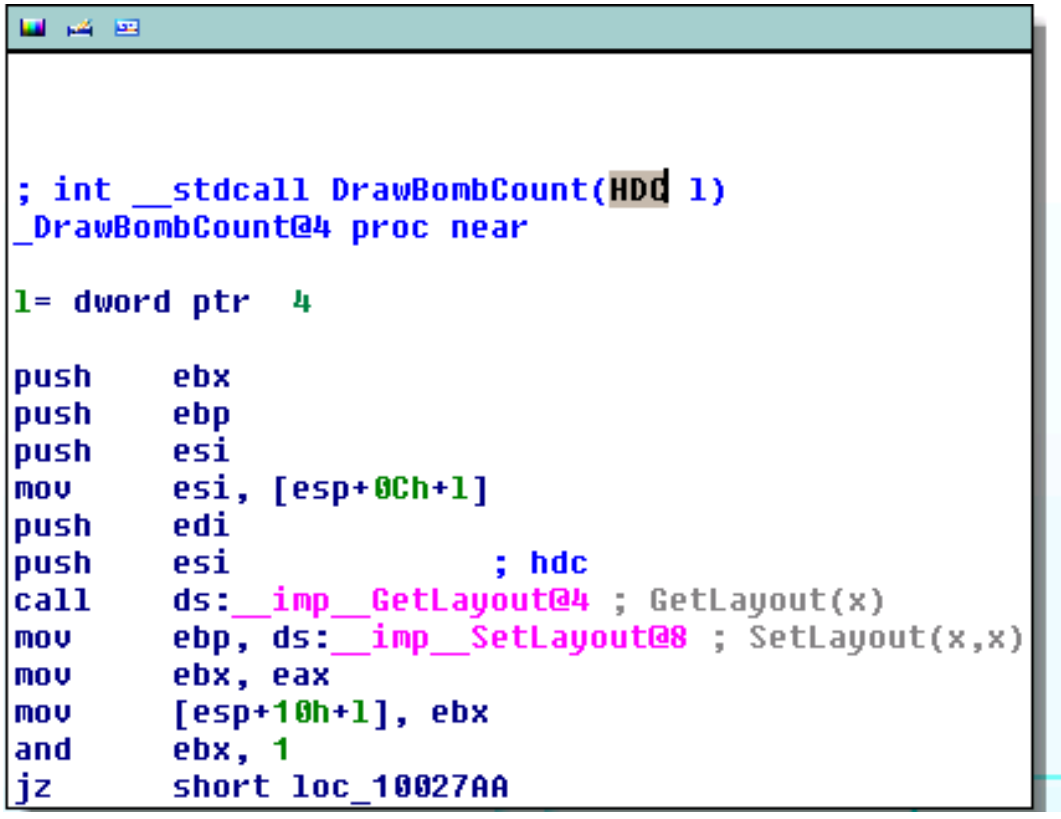
Disassembler

- Interactive Disassembler (IDA)
  - Generates assembly code from exe
  - Show imported functions from other dlls
  - By analyzing stack and register usage and cross referencing with known libraries can generate function names and parameters
  - Has debugger capabilities
- http://www.hex-rays.com/products/ida/index.shtml

IDA - Software Exploits cont.



IDA - Software Exploits cont.

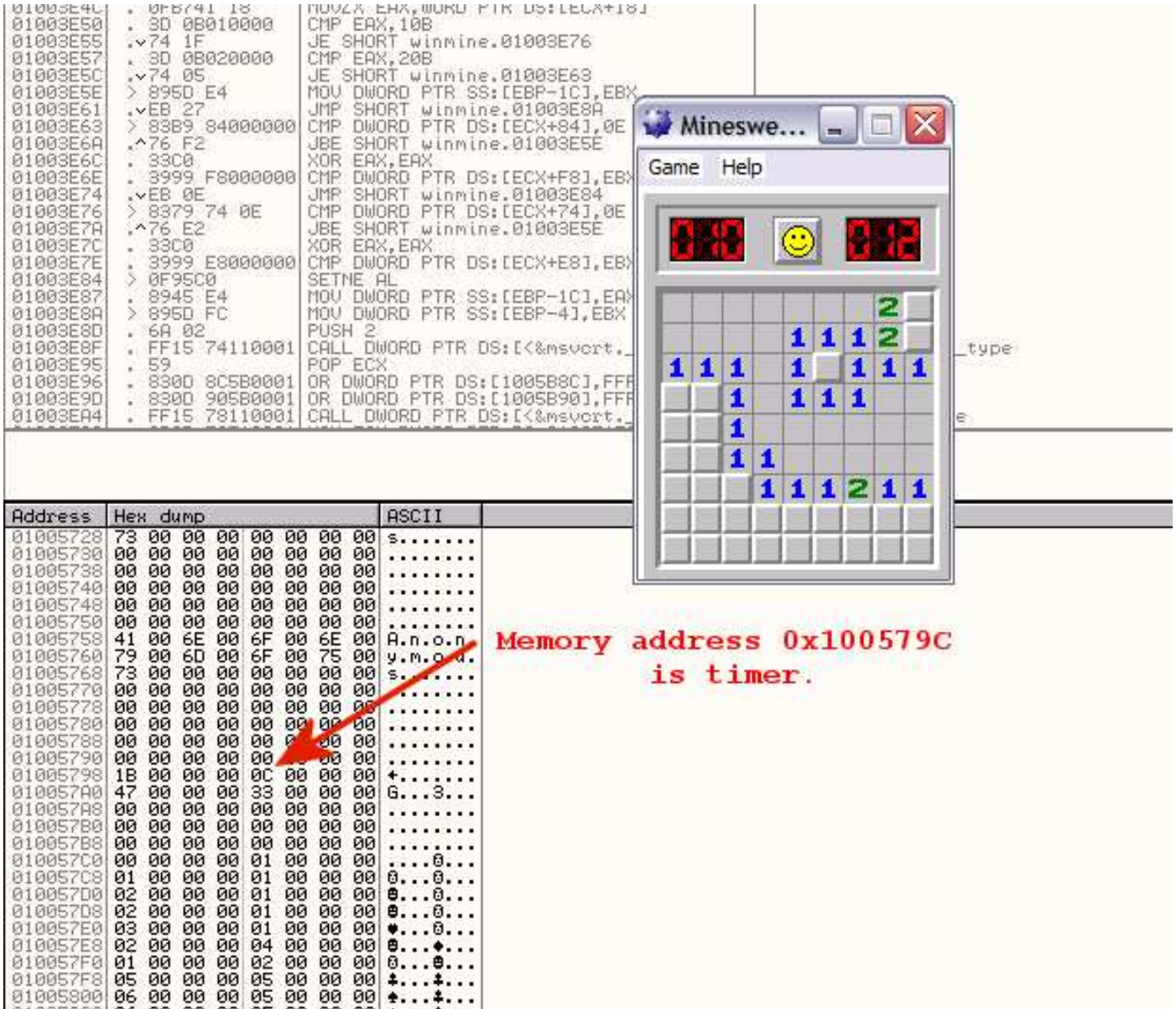


```
; int __stdcall DrawBombCount(HDC l)
_DrawBombCount@4 proc near

l= dword ptr  4

push    ebx
push    ebp
push    esi
mov     esi, [esp+0Ch+l]
push    edi
push    esi                 ; hdc
call    ds:__imp__GetLayout@4 ; GetLayout(x)
mov     ebp, ds:__imp__SetLayout@8 ; SetLayout(x,x)
mov     ebx, eax
mov     [esp+10h+l], ebx
and     ebx, 1
jz      short loc_10027AA
```

Debugger

- OllyDbg
  - Also shows assembly, but can set breakpoints in code
  - View stack and registers
- http://www.ollydbg.de/

Olly - Software Exploits cont.



Software Exploits (cont'd)

- Hacking Countermeasures
  - Employ insider attack safeguards (background checks, code reviews, access to critical info requires multiple people, etc.)
  - Simple client
    - Minimize data available to client
    - All critical decisions should be made by server
  - Tools that check for injected DLLs or checksums on client code

Conclusion

- As a user
  - On-line gamblers need to do their homework
  - Review the security features employed by the gambling site
- As a gaming company
  - Security precautions need to be regularly reviewed and updated – security is an ongoing and evolving battle
- Even out-of-band markets provide motivation
  - "of course, there is one kind of help you usually don't want: the government." – Stephen Davis

- End of Document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