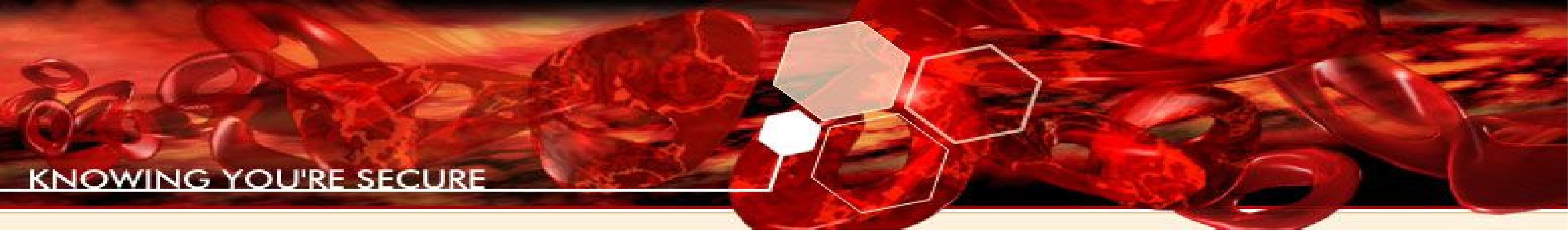
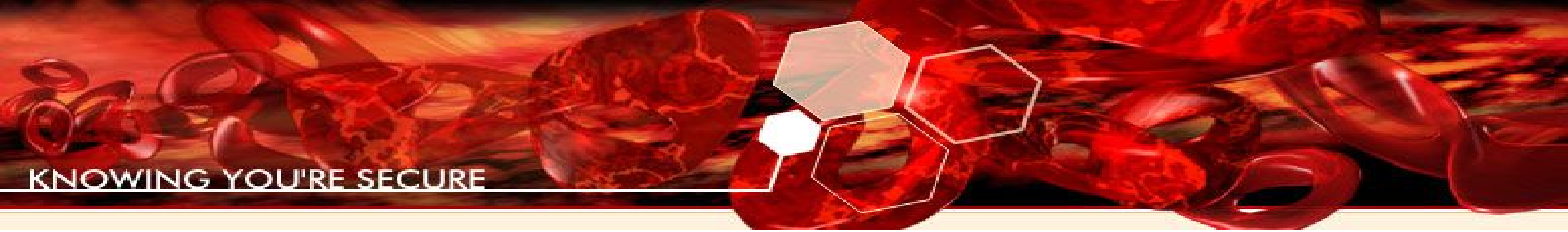


0days: How hacking really works

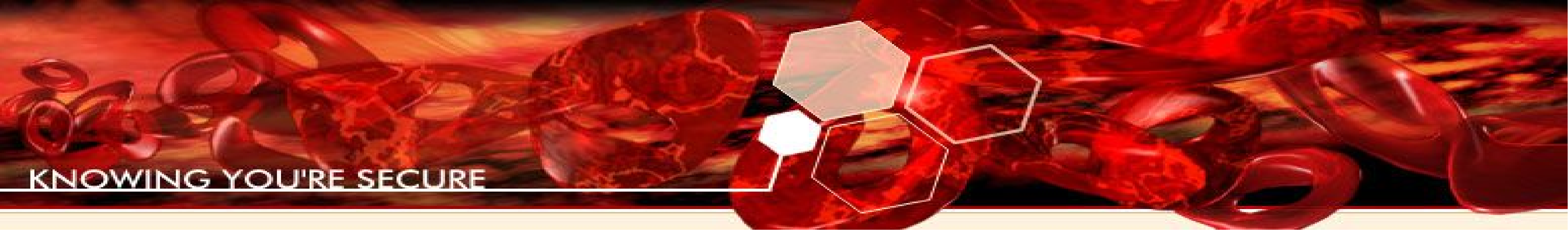
V 1.0
Jan 29, 2005

Dave Aitel
dave@immunitysec.com



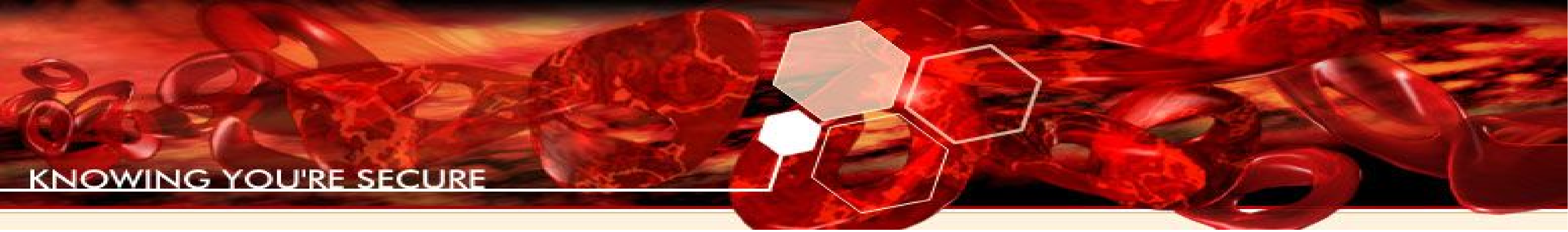
Who am I?

- NSA->@stake->Immunity
- CEO of Immunity, Inc.
  - Consulting (product assessments)
  - Immunity CANVAS
  - Immunity Vulnerability Sharing Club
  - Training
  - Ongoing research in exploits and software vulnerabilities



Common Questions

- Why have I been hacked?
- How have I been hacked?
  - Specifically
  - Generally, how could this happen to me when I put all that money into firewalls and patching systems?



Agenda

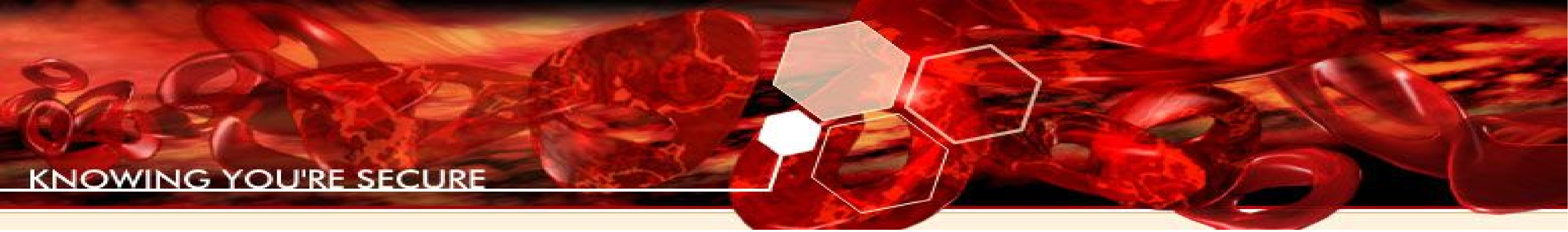
- Examine different types of vulnerabilities from a hacker's standpoint
- Look at the future of hacking
- Look into the future of defensive measures

Quick note

- Some of the following slides are from a hacker's perspective
- We're not backing this up with academic papers and equations, consider it all opinion

Exploits vs Vulnerabilities

- An exploit is a working program that takes advantage of one **or more** vulnerabilities in order to break security boundaries
  - A good exploit often costs a lot more to develop than the initial cost of discovering a vulnerability
- A vulnerability may be something as simple as a memory leak or DoS
- It's hard to say if a vulnerability is exploitable without an exploit
  - GOBBLES and Apache



Working Exploits

- What does a hacker want to know about a given exploit?
  - Reliability
    - “Will this work in the wild?”
  - Target set
    - “Do I even care if it does?”

Exploit Reliability/Usage

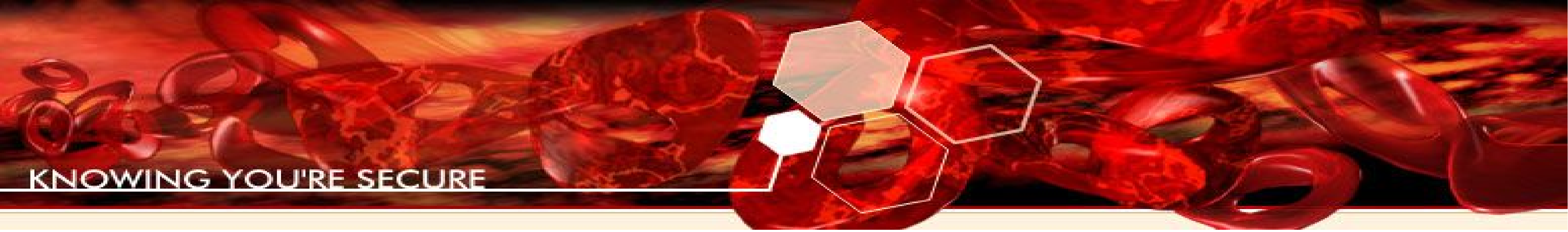
- Logging
  - Logging can be both too succinct to be useful, or two verbose
- Does the service restart vs. One-Shot
  - Many Windows services are one-shot attacks, but Win32 threading models can make for very reliable one-shot attacks
- Failure modes
  - Even very good exploits fail sometimes

Target Set

- Interesting boxes?
  - SSHD vs SADMIND vs WUFTPD
- Default/common configuration?
- Multiple configurations?
  - Increase in targeting complexity
- Is this an exploit I can easily scan for?
  - fingerprinting

Survivability

- Exploits require large amounts of investment
  - Scanning/fingerprinting is non-trivial
  - QA on a complex piece of software is expensive
- How long is this vulnerability going to be valid?
  - Turn “windows of vulnerability” upside down
  - Multiple independent discoveries are more the rule than the exception



Easy vs. Hard Targets

RealServer

dtlogin

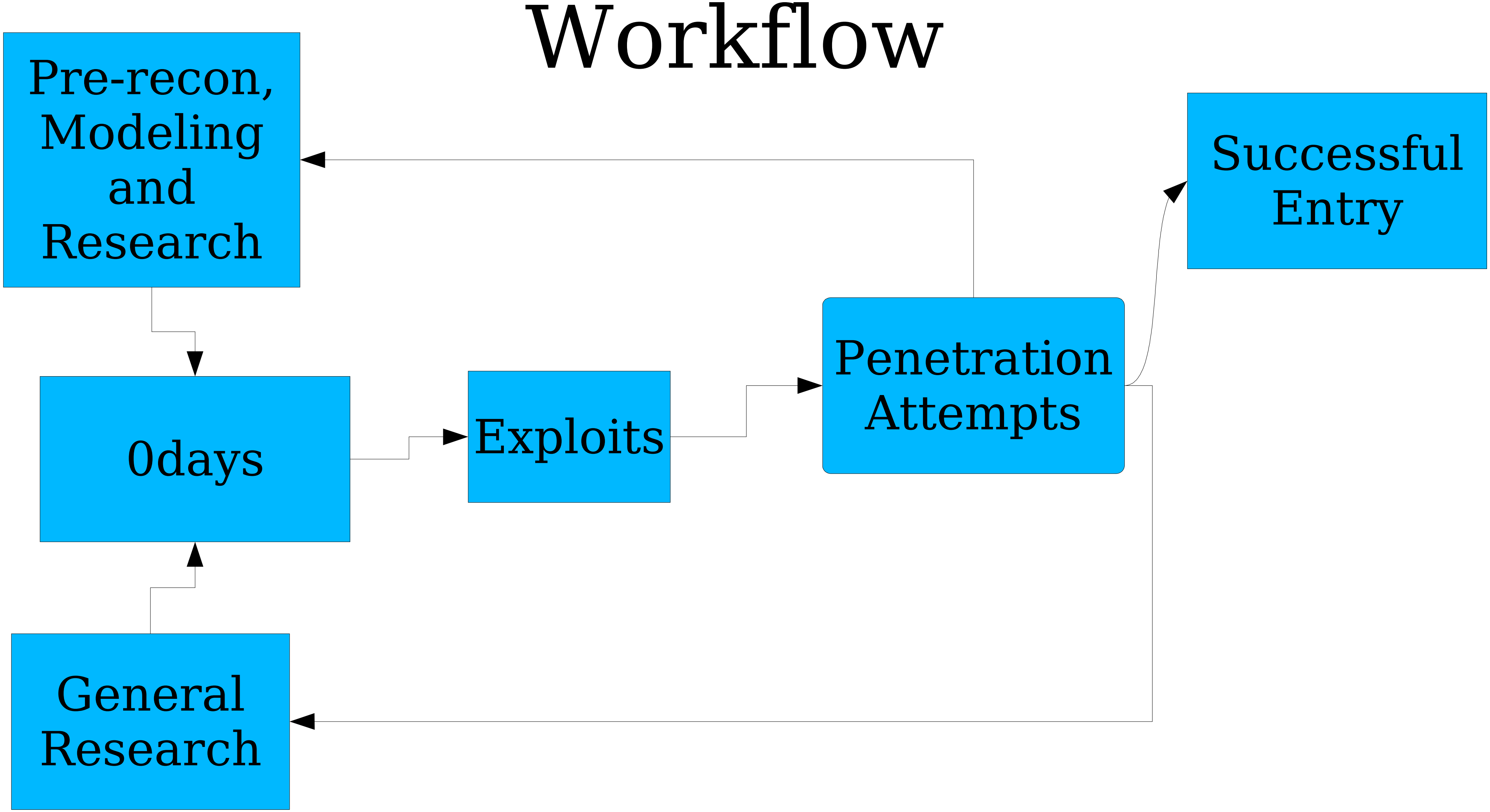
Where do I invest my time?

- Realserver: Multi-shot target-less self-fingerprinting stack overflow
- dtlogin: one shot heap corruption
- Compounded by question: What are your most important targets running?

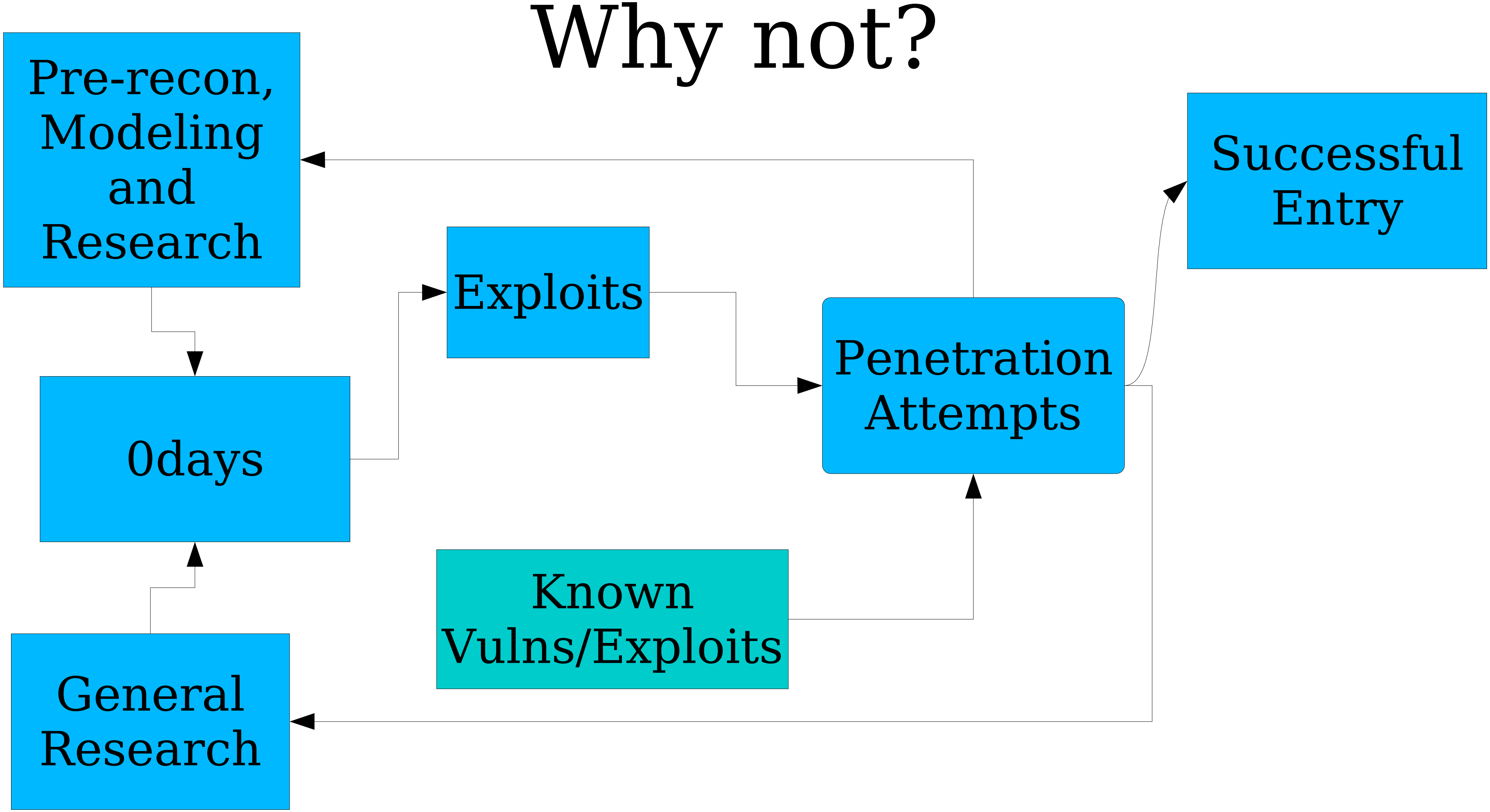
Custom Exploitation

- The most covert exploit is one that is used only once
  - – Custom web application hacking
  - – Custom analysis of target's environment
    - Example: Exploit for cam.exe with Entercept installed in the exact configuration you have for all your servers

Workflow


Pre-recon, Modeling and Research
0days
Exploits
Penetration Attempts
Successful Entry
General Research

Why not?



Pre-recon, Modeling and Research

Exploits

Successful Entry

Penetration Attempts

0days

Known Vulns/Exploits

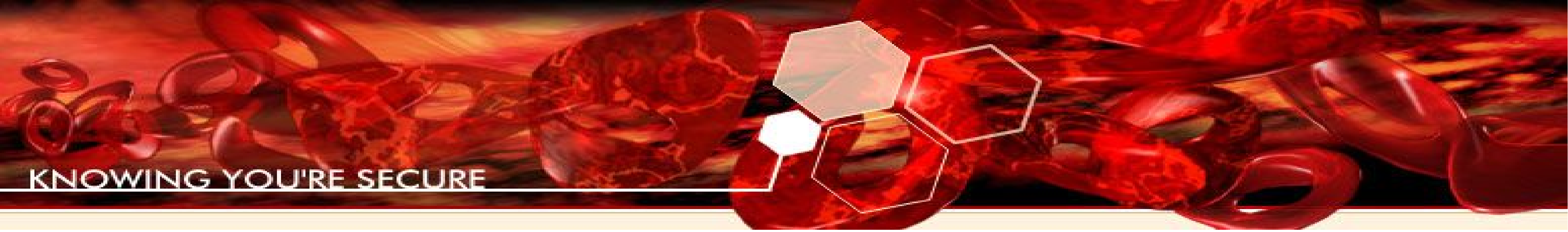
General Research

Why not to use known vulns/exploits

- A bad investment, even if it works
  - May be detected by IDS, allowing target to track your methodology and toolkit
    - toolkits are expensive ($100K->$1M)
    - methodologies are more expensive
      - a trained team: $1M->$10M
- Worse, if it doesn't work
  - Each attack burns a bounce host
  - Each attack alerts target they are under attack

One shot, one kill

- But we have to make all our bullets by hand
  - Is it logistically possible to write an 0day for each target?
  - What is the “cost” of using an exploit?
- Our toolkits and methodologies are even more expensive
  - Can we afford complete duplication of effort?



Writing an 0day per target network

- Costs
  - Between $10-100K per network for a given exploit
- Benefits
  - Research can be version specific (cuts costs)
  - No IDS catches you
  - Getting caught does not blow other targets
    - backwards operational security is as valuable as forwards

Windows of Vulnerability

- Arbaugh, et. al. in 2000 IEEE Computer paper
  - http://www.cs.umd.edu/~waa/vulnerability.html
  - (2002) Active Systems Management: The Evolution of Firewalls
- Accepted general model of security industry
  - To defeat the industry, hackers have defeated this generic model

Intuitive?

IEEE
(Dec
2000)
Arbaugh
Fithen,
McHugh

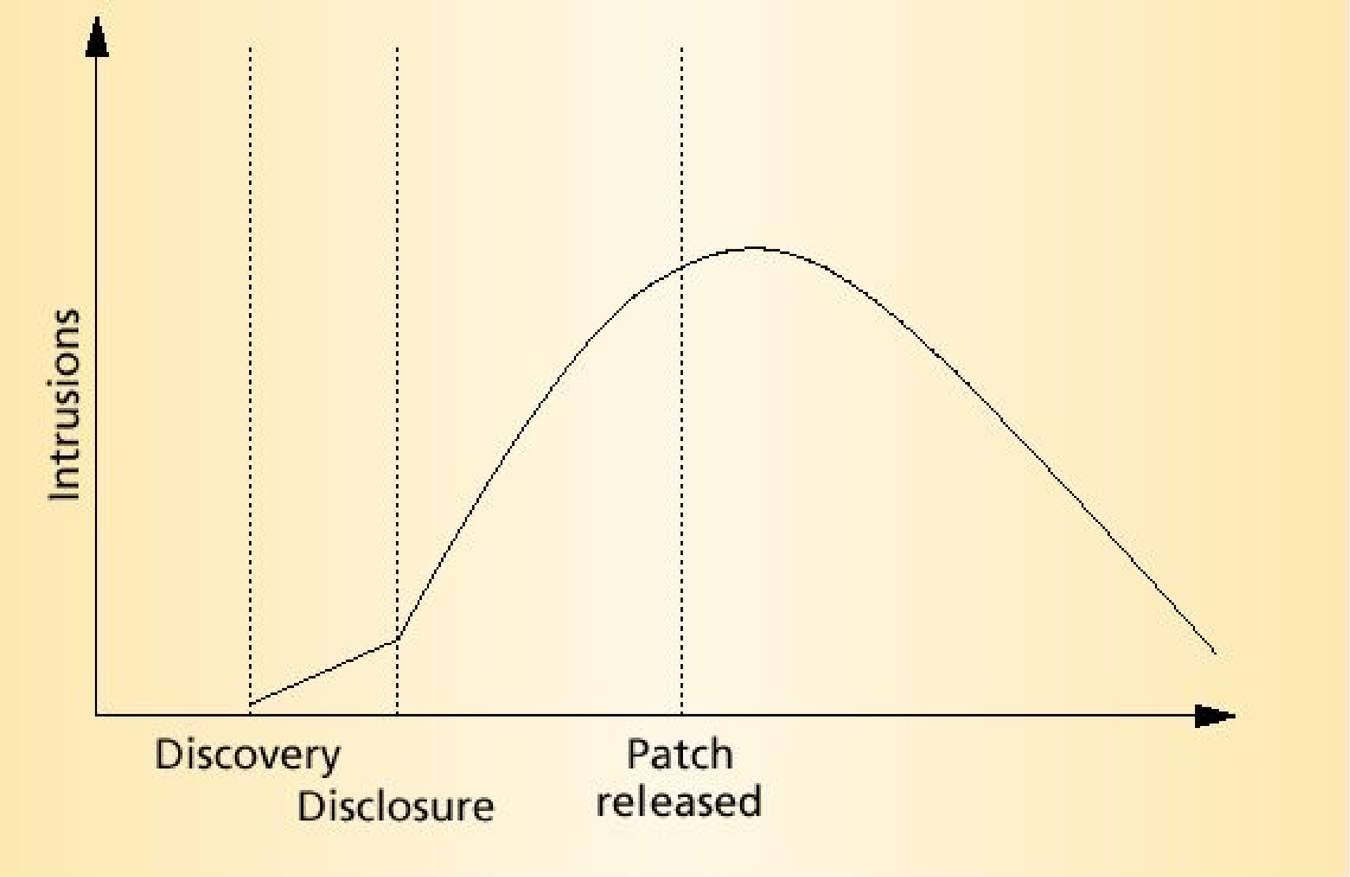
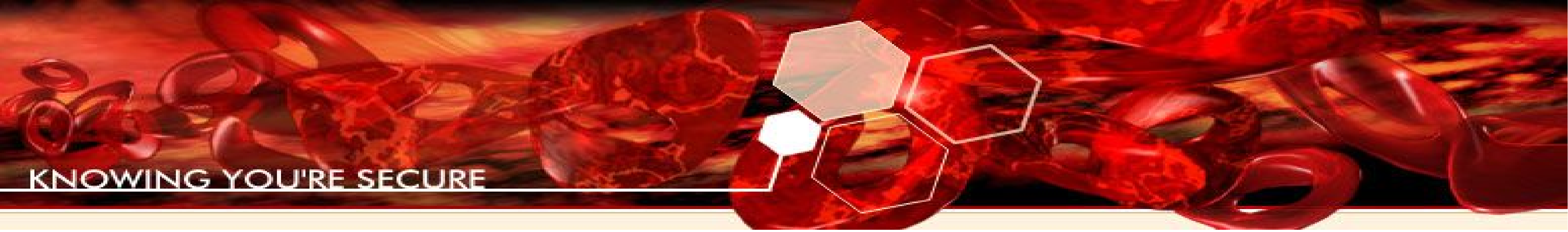


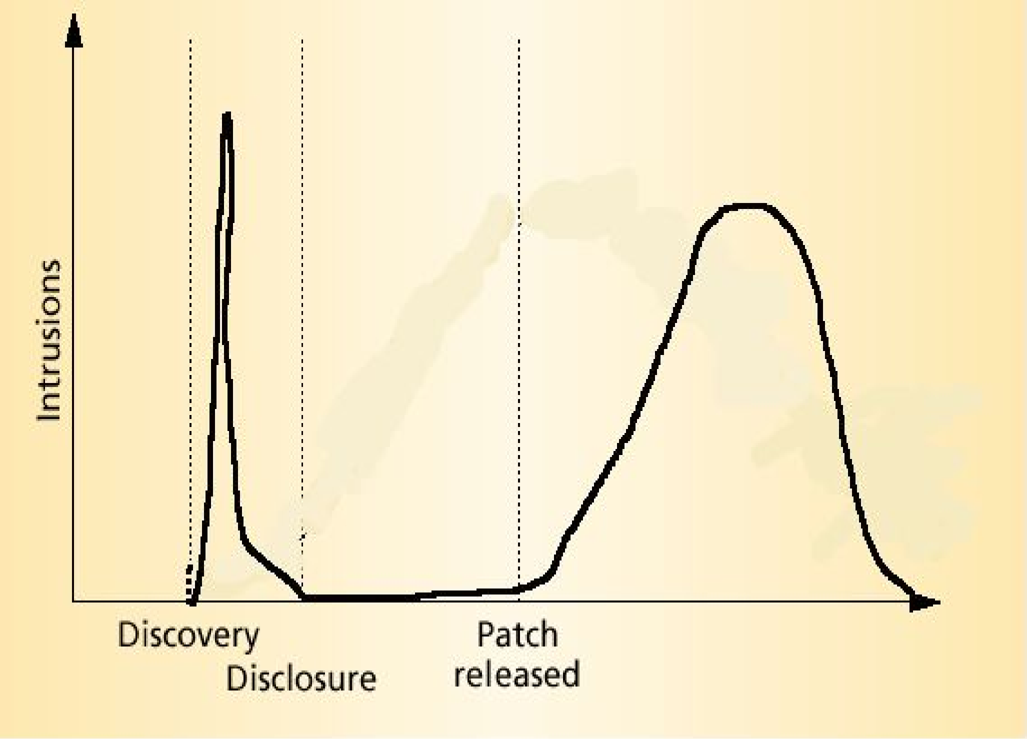
Figure 1. Intuitive life cycle of a system-security vulnerability. Intrusions increase once users discover a vulnerability, and the rate continues to increase until the system administrator releases a patch or workaround.



Hacking is not theoretical

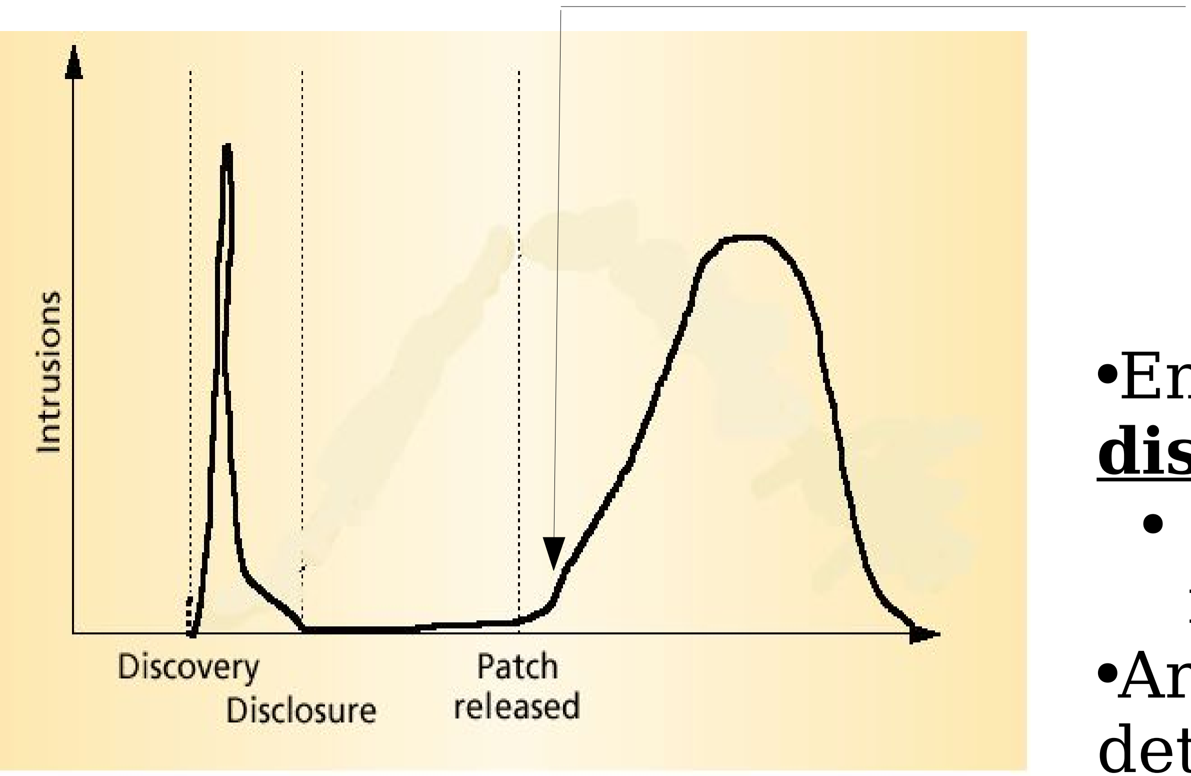
- Hackers do not own every machine that has a given vulnerability
  - that would be stupid
- Hackers own every important box that they do not already own
  - Generic and specific automation is as old as exploits
    - Admhack, etc.
- It is fair to say hackers have a generational lead on the industry

A closer curve



- Most interesting machines are owned shortly after discovery. Discovery rarely happens by “researchers” first.
- Patch information releases a lot of information about the vulnerability.
- Upon disclosure, real hacking stops.
- Hackers have access to a lot more “Internet” than the average public or a worm
  - Most vulnerable machines are on intra-nets

Why doesn't my IDS report this?

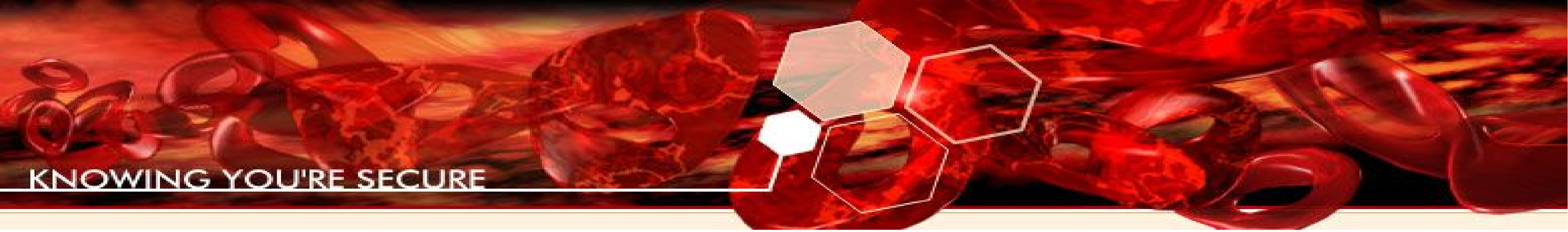


IDS becomes potentially effective here.

- Entire study is based on **<u>discovered</u>** intrusions!
  - (vs. attempted intrusions?)
- Are we measuring detections, rather than intrusions?

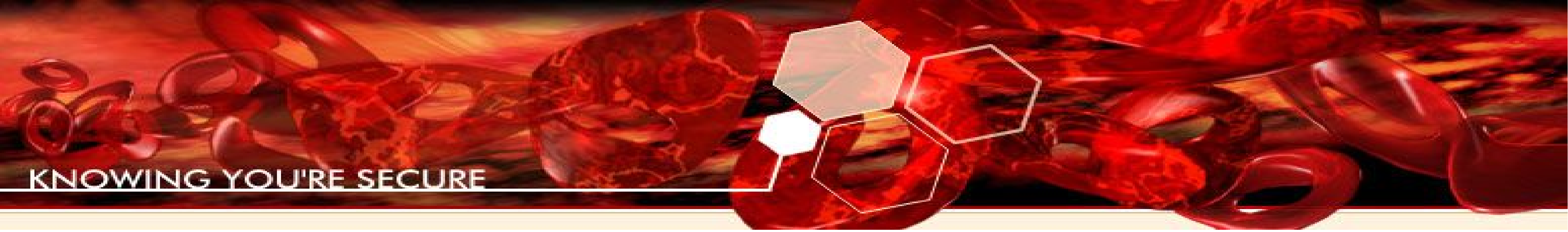
Passwords

- Are still the best way to protect information systems
  - great manageability interoperability, etc
- Are also the best way to hack into systems
  - known_hosts
  - password reuse is universal



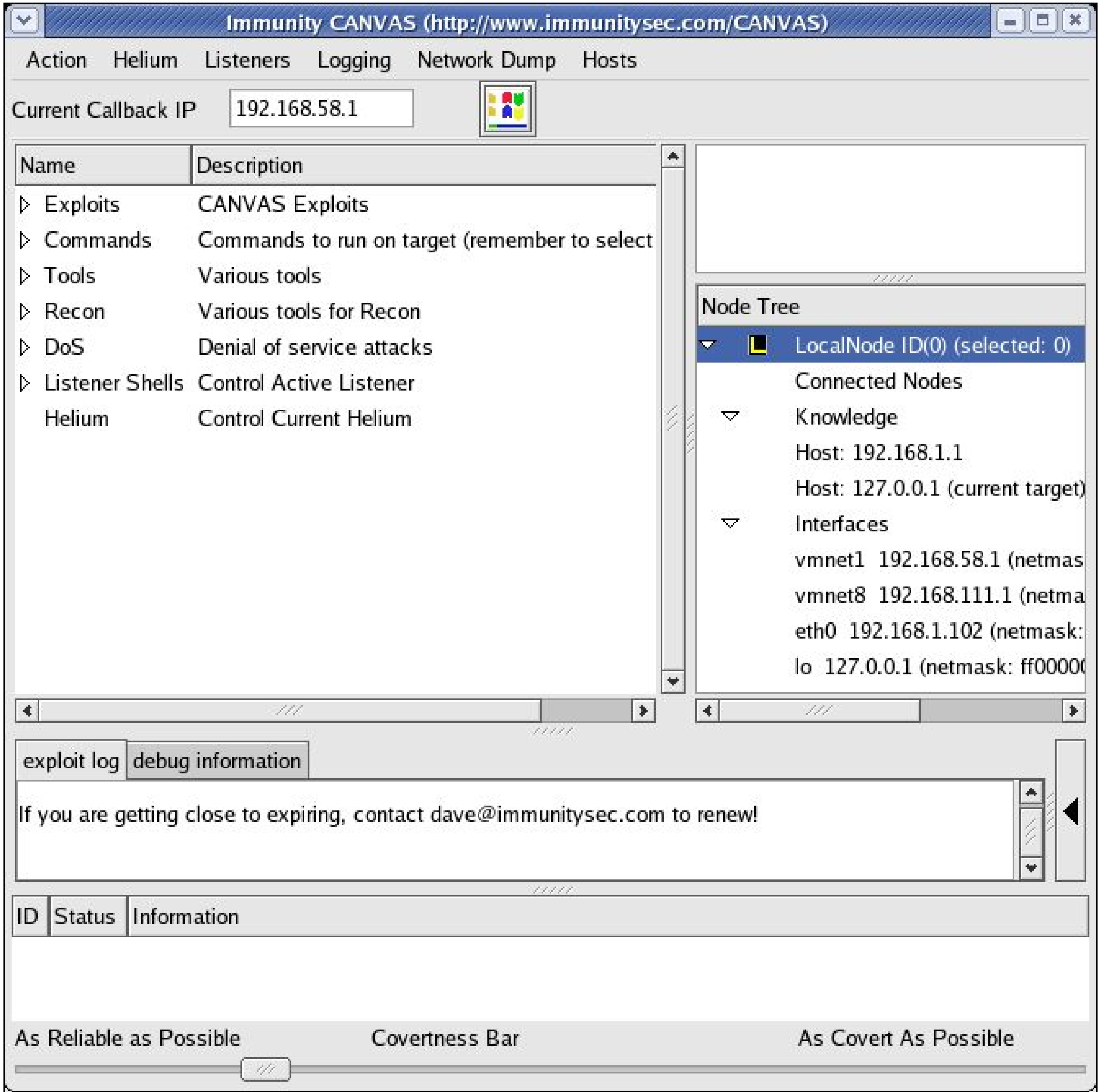
Hacker Network Targets

- Nervous systems are the primary target
  - Management networks
  - Intrusion detection networks
- Software companies add to this:
  - Security departments and QA systems
    - Predicted: A small bounce when vulnerabilities are reported



Looking towards the future of Attack

- More automated frameworks, public and private
- 0day and more 0day
- Customized worms



Current Callback IP 192.168.58.1

Name	Description
▷ Exploits	CANVAS Exploits
▷ Commands	Commands to run on target (remember to select
▷ Tools	Various tools
▷ Recon	Various tools for Recon
▷ DoS	Denial of service attacks
▷ Listener Shells	Control Active Listener
Helium	Control Current Helium

Node Tree

```
▽ LocalNode ID(0) (selected: 0)
    Connected Nodes
  ▽ Knowledge
    Host: 192.168.1.1
    Host: 127.0.0.1 (current target)
  ▽ Interfaces
    vmnet1  192.168.58.1 (netmas
    vmnet8  192.168.111.1 (netma
    eth0  192.168.1.102 (netmask:
    lo  127.0.0.1 (netmask: ff0000
```

If you are getting close to expiring, contact dave@immunitysec.com to renew!

ID	Status	Information

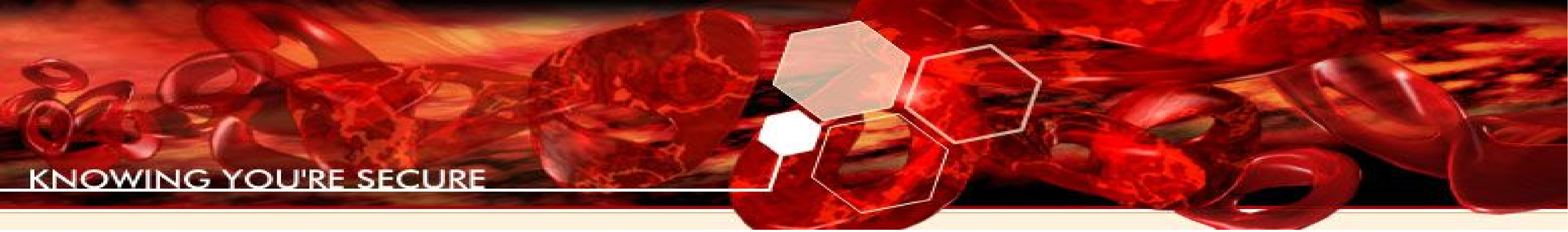
As Reliable as Possible   Covertness Bar   As Covert As Possible

Automated Attack Frameworks

Public, high quality rootkits

VMWare

Reduced vulnerability disclosure

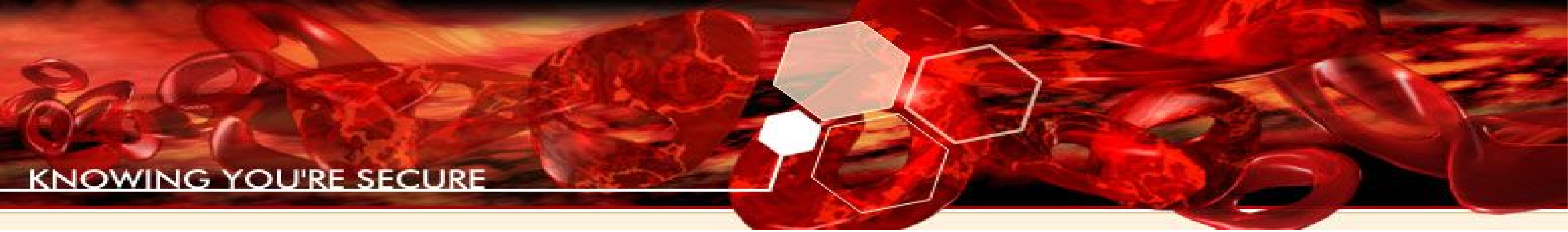


0day and more 0day

- As systems get more protected 0day becomes more valuable
- Survivability of even very popular 0day is measured in years, if not decades
  - Sadmind
  - VSC results
- Web application vulnerabilities are just the beginning

Customized Worms

- Custom worm generation languages
  - AdvancedOrdnance
  - Automated frameworks ARE worms (hydras)
- Worms are also useful for enterprises looking for distributed techniques
  - Think of them as distributed computing writ large
  - Write applications with worms as your platform

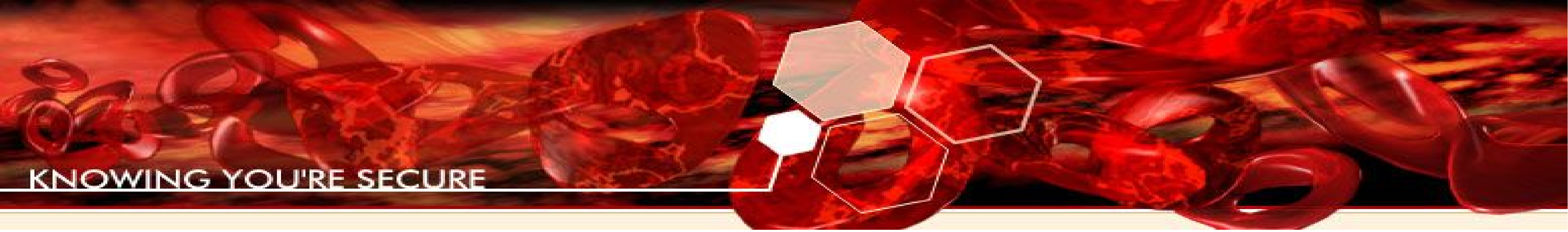


Looking towards the future of Defense

- The failure of patching
- Universal Configurations (automated patching)
- HIDS
- OS Protection

Patching is basically useless for security

- You must reinstall all vulnerable systems, reset all passwords for security
- This is an unattainable goal
- Patching quickly is extremely expensive
  - manpower, resources
  - mistakes are costly
  - still not winning race

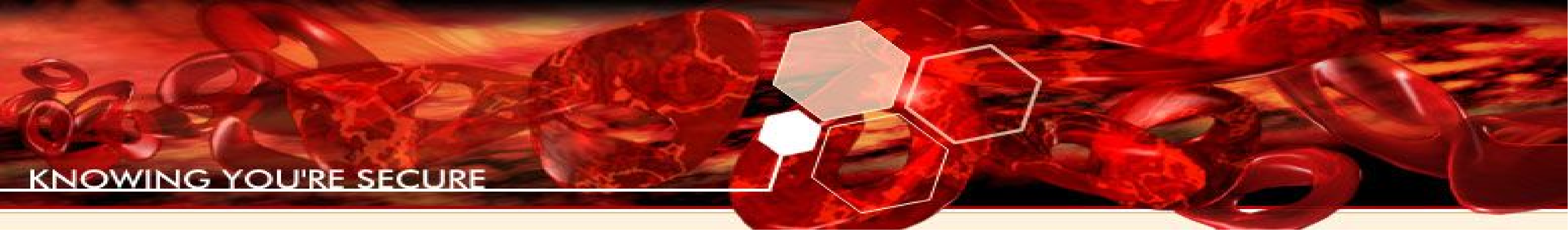


Universal Configurations

- Mono-cultures are a known evil
- Management software is typically weakly secured
  - Computer Associates cam.exe, Naimas32,etc
- Custom exploits are best against universal configurations
  - From custom exploits to custom worms

HIDS

- HIDS products receive little 3rd party testing
- Phrack 62 describes some widely known techniques for bypassing common HIDS technology
- You need a HIDS that prevents attacks, not shellcode
- HIDS are too expensive, by far



Network Intrusion Prevention Systems

- NIPS has a very very hard problem
  - Must model all types of systems and protocols
  - Must correctly detect attacks while in stream to target
  - Must know about all different variants on attacks
  - This is all exponentially expensive stuff
- Good against worms

OS protection

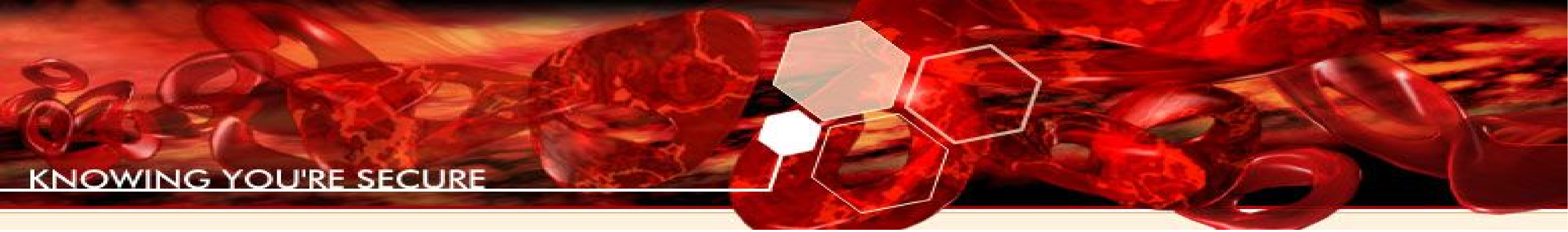
- Windows XP SP2
  - Should be required
  - Not perfect
    - Immunity has generic techniques to bypass it, so assume hackers do as well
  - IE is impossible to truly secure, ban it if possible
- Linux is much better (GRSecurity)
- Unix is much worse

Regulation

- No presentation is valid these days without a slide on Sarbanes-Oxley
  - This is that slide

Conclusion

- Use GRSecurity or HIDS
- Don't rely on patching as a security measure
- Get third party reviews of critical custom software
- Your intrusion response team is only really tested by 0days
- Stop purchasing junk software and then blaming other people for your problems



Questions?

- Did we answer more than we asked?