Agile Incident Response: Operating through Ongoing Confrontation

Kevin Mandia
Who Am I?

- Professorial Lecturer
  - Carnegie Mellon University
    - 95-856 Incident Response
    - Master of Information System Management
  - The George Washington University
    - Computer Forensics III
    - Masters in Forensic Science
- Author for McGraw-Hill
- Honeynet Project
Who Am I?

- Last 3 Years
  - Responded to over 300 Potentially Compromised Systems.
  - Responded to Intrusions at Over 40 Organizations.
  - Created IR Programs at Several Fortune 500 Firms.
Agenda

- Incident Detection
- Case Studies
- Performing Agile Incident Response
- Operating through a Constant Aggressor
How Are Organizations Detecting Computer Security Incidents?
1. How are Organization’s Detecting Incidents?

- **Antivirus Alerts?**
  - Perhaps, but do not Count on It…
  - Alerts are Often Ignored – and Perhaps Value-less without an In-Depth Review of the System.
  - Quarantined Files Often Remain a Mystery

Anti-Virus Merely Alerts an Organization that Something Bad Might have Occurred. No Confirmation. Potential Loss of Critical Data
Findings – Ongoing Intrusion

- The Review of 10 Malicious Executable Files Yielded:
  - 12/12 Files were NOT Publicly Available
  - 12/12 Files were NOT Detected by AV
  - 11/12 Files Reviewed were Packed via 2(5) Different Methods

It is Highly Unlikely AV will ever Trigger on Microsoft Tools or Sysinternals Tools.
2. How are Organization’s Detecting Incidents?

- IDS Alerts?
  - Rare Detection Mechanism.
3. How are Organization’s Detecting Incidents?

- **Clients (Outside Company)**
  - More Often than Pro-Active Countermeasures.
  - Malicious Software Discovered on Compromised End-User Systems.
  - Recently (December 2005) Found a Keylogger Configuration File that Contained Approximately 1,157 Keyword Search Terms, and URL’s for Approximately 74 Online Banking Facilities.
4. How are Organization’s Detecting Incidents?

- **End Users (Internal)**
  - System Crashes (Blue Screens of Death)
  - Continual Termination of Antivirus Software.
  - Installing New Applications Simply Does Not Work.
  - Commonly Used Applications Do Not Run.
  - You Cannot “Save As”.
  - Task Manager Closes Immediately When You Execute It.
5. How Are Organization’s Detecting Incidents?

- Something Obvious …
6. How are Organizations Detecting Incidents?

- Notification from other Victims.
- Notification from Government Agencies.
Case Studies

The State of the Hack
The State of the Hack

- **End User Attacks**
  - Phishing
  - Spam / Rogue Attachments*
- **Web Application Compromises**
  - Custom App Vulnerabilities
- **Valid Credentials**
  - VPN Access
  - PSEXEC*
Case Study – Targeted Spamming
Incident Detected

- A Network Intrusion Detection System Observed Traffic Outbound to a Hostile / Uncommon Domain
- Traced IP Address Internally to a Laptop
Demo 1

- Victim Receives “Innocuous Email”
  - Command Shell Backdoor sent to Drop Site
Demo 2

- Victim Receives “Innocuous Email”
  - “Server” Sends Connection to Attacker

Attacker: 66.92.146.247
Victim: 66.92.146.248
Drop Site: 66.92.146.1
Demo 3

- Attacker Uses Valid Credentials and PSEXEC to Connect and Launch Evil Code on Victim System

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<tr>
<th>Attacker</th>
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Practicing Agile Incident Response
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- Agile Incident Response Requires
  - Understanding the Corporate/Organization Priorities
  - Rapid Data Collection Capability
  - Rapid Data Analysis
  - Focused Response:
    - Identify Host-Based Countermeasures
    - Identify Network-Based Countermeasures
    - Rapid/Concise Documentation
1. Understanding Corporate/Organization Priorities
Understanding Corporate Priorities

- Executive Concerns
- Legal Concerns
- Technical Concerns
Management Concerns (Board and CEO)

- What is the Incident’s Impact on Business?
- Do We have to Notify our Clients?
- Do We have to Notify our Regulators?
- Do We have to Notify our Stock Holders?
- What is Everyone Else Doing about this Sort of thing?
Legal Counsel Concerns

- What are the applicable regulations or statutes that impact our organization’s response to the security breach?
- Are there any contractual obligations that impact our incident response strategy?
- Are we required to notify our clients, consumers, or employees about the security breach?
- What constitutes a “reasonable belief” that protected information was compromised – the standard used in many states to determine whether notification is required?
Legal Counsel Concerns

- How might public knowledge of the compromise impact the organization?
- What is our liability if the compromised network hosted pirated software, music, or videos?
- Does notifying our customers increase the likelihood of a lawsuit?
- Is it permissible to monitor/intercept the intruder’s activities?
- How far can/should we go to identify the intruder?
- Should the organization notify our regulators? Law enforcement?
Technical Management (CIO)

- How long were we exposed?
- How many systems were affected?
- What data, if any, was compromised (i.e., viewed, downloaded, or copied)?
- Was any Personal Identifiable Information (PII) compromised?
- What countermeasures are we taking?
Technical Management (CIO)

- What are the chances that our countermeasures will succeed?
- Who else knows about the security breach?
- Is the incident ongoing? Preventable?
- Is there a risk of insider involvement?
2. Rapid Data Collection
Performing Live Response

- Cost-Effective Manner to Collect Information
- Collecting Information that is Lost When a Machine is Powered Off
- Collecting Windows/Unix Artifacts that Assist in the Investigation
Volatile Data

- The System Date and Time
- Current Network Connections
- Which Programs are Opening Network Connections (Listening)
- Users Currently Logged On
- Running Processes
- Running Services
- Memory Space of Active Processes
- Scheduled Jobs
- RAM
Windows Artifacts Collected from Live Systems

- File Lists
- The Windows Registry
- The Windows Event Logs
- Specific/Relevant Files
- The System Patch Level
- Certain Proprietary Log Files
Incident is Detected

Network Monitoring

Incident Detected on Host 1

Corporate Network

Backdoor Channel

Internet
Performing Live Response

Incident Detected on Host 1

1. Last Accessed Time of Files
2. Last Written Time of Files
3. Creation Time of Files
4. Volatile Information
5. Services Running
6. Event Logs
7. Registry Entries
8. Host Status (Uptime, Patch Level)
9. IIS and Other Application Logs

Live Data Collection Performed to Verify Incident and Determine Indicators / Signature of the Attack
Demo 4

- Live Response

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3. Rapid Data Analysis
Case 2 - Initial Detection

- Victim Organization Targeted - Ongoing Computer Intrusion
- Victim Organization Tweaked Proxy Server Logs to Review all Outbound Connects to Hostile Domains
- Caught a Bleep on the Radar from a Host
- Performs a Remote Live Response Using First Response
Demo 5

- Rapid Analysis

Attacker
66.92.146.247

Victim
66.92.146.248

Drop Site
66.92.146.1
4. Focus: Countermeasures/Documentation
Focus

- Focus = Defined and Established
  - Goals
  - Roles
  - Expectations
    - Speed
    - Communication
    - Documentation
Know Your Goals

II. Verify Project Scope and Approach

Goals of the Incident Response Effort

1. Accomplish Accurate Case Diagnosis
   a. Determine the full extent of the compromise.
   b. Determine if the incident is ongoing.
   c. Determine how the network was compromised.
   d. Determine if sensitive data has been compromised.

2. Identify Business Objectives and Priorities.

3. Determine Appropriate Countermeasures
   a. Identify, Document, and Provide Host-Based Countermeasures to prevent further compromise.
   b. Identify, Document, and Provide Network-Based Countermeasures to prevent further compromise.
   c. Provide procedural guidance to ensure a “move fast, move with purpose” response posture.

4. Assist in Developing Appropriate Remediation Steps
   a. Documentation
   b. Coordination

5. Audit Any Remediation to Verify Effectiveness.

6. Ensure Knowledge Transfer of Tools, Techniques, and Investigative Conclusions
   a. Posture Organization to respond to future incidents in a most effective manner.
   b. Provide information as needed to appropriate personnel.

7. Adhere to Appropriate Evidence Handling Procedures.

All efforts can be prioritized and conducted in parallel.
Know Roles

- Data Collection
- Data Analysis
- Malware Analysis
- Network Traffic Analysis
- Host-Based Detection
- Documentation
Speed

- Incident Response – Fast and Steady
- Fast Enough to Get Reliable Answers
- Fast Enough to Provide Simple but Adequate Documentation
- We Strongly Dissuade Briefing Anything that has not been Written.
Documentation

- Establish Champions Responsible for the Necessary Documents:
  - Status Reports
  - Live Response Investigative Steps
  - Hot IPs
  - Host-Based Indicators of Compromise
  - Network-Based Indicators of Compromise
  - Remedial Steps

3. Initiate “Straw Man” Documentation
   - Document forensic review methods.
   - Document indicators of compromise.
   - Begin formal forensic report.
   - Begin documentation of appropriate countermeasures.
     - Network-Based Remediation.
     - Host-Based Remediation.
     - Document Procedural Countermeasures.
Operating through an Attack
Operating through an Attack

1. Obtain High-Level Direction
2. Know your Remediation Philosophy
3. Identify the “Zone” You Are In
4. Determine Remediation Plan
5. Determine Readiness
6. Execute
1. Obtaining High-Level Direction

- The Most Difficult and Confusing Aspect of Remediation Planning
- Impacts All Aspects of your Remediation Plan
  - What is Your Leadership’s Tolerance of the Status Quo?
  - How Good Does Your Incident Response Need to Be?
  - How Much are You Willing to Spend?
  - What is the Risk?
    - Do you have to Tell Shareholders?
    - Do you have to tell Clients?
2. Know your Remediation Philosophy

- Battle Plan
  - Aggressive Remediation
  - Moderate Remediation
  - No Execution of Remediation
Aggressive Remediation

- IR Roles and Responsibilities Are Clearly Defined
- Team Capability Exists
  - Host Based Detection / Countermeasures
  - Network Based Detection / Countermeasures
- Remediation is
  - Planned
  - Coordinated
  - Organization-Wide
  - Executed in Strike Zone
  - Clear Cut Status (Where You Are)
- Ongoing Remedial Activities are DELIBERATE
Moderate Remediation

- IR Roles and Responsibilities are Ad Hoc
- Moderate Team Capability To Execute:
  - Host Based Detection / Countermeasures
  - Network Based Detection / Countermeasures
- Remediation
  - Executed in Bursts
  - Not Coordinated Well Among Separate Business Units
  - Different BLs Have Different Posture
  - Current Status Sometimes Confusing
- Few Significant Remedial Efforts
- Reliance on Small, DISPARATE Efforts.
3. Determine the Zone you are In

- **Constant Aggressor**
- **Knowledge Of Attack**

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Need to Start Cycle Again
Zone 1 Symptoms

- Host Based Indicators are Unknown
- Network Based Indicators are Unknown or Transaction Based
- New Compromised Hosts are Still Being Detected at a High Rate (more than 1 per day)
- There Seems to be No Established Pattern to Assist your Organization in Anticipating the Next Compromised Host
- There is Little Coordination between Business Lines (Staff) Concerning Remediation

Remediation will Likely FAIL!
Zone 2 – “Strike Zone”

- Host Based Indicators are Stable
- Network Based Indicators are Stable
- The Delta to Detect New Compromised Hosts is Shrinking Consistently
- Your Organization can Anticipate which Systems may be Compromised Next
- Your Organization is Postured to Actively Anticipate and Address the “Next Generation” of Attacks
- There is Active Communication and Coordination between Business Lines (Staff) Concerning Remediation
Zone 3 Symptoms

- Host Based Indicators are Becoming Less Reliable
- Network Based Indicators are Becoming Less Reliable
- No New Compromises have been Detected
- Staff Motivation and Concern has Waned Considerably
- Remedial Activities have Evolved from Corporate-Wide Efforts to Independent “Splinter Cells”

Remediation will Likely FAIL!
How Do You Miss Strike Zone?

- Assets Impacted are Too Important
- Analysis Paralysis / Indecision
  - Too Much Consider of ‘What if”
- Lack of High-Level Buy-In
  - Remediation and Business Objectives Diverge
- Too Much Consensus Building
- Common Goal Not Established or Understood
- Remediation Not Feasible
  - Lack of Resources
4. Assess Your Remediation Plan

- Criteria:
  - Documented
  - Coordinated
  - Feasible

- Can it be Implemented?
  - Appropriate Skills
  - Appropriate Coordination

- Can it Meet Organization’s Objectives?
5. Assess your Readiness

- Do you have a Move Fast, Think Fast Diagnosis Team?
- Can They Collect the Data the Need Fast Enough?
- Can you Deploy Rapid Network-Based Countermeasures for
  - Incident Detection?
  - Incident Prevention?
- Can you Deploy Rapid Host-Based Countermeasures for
  - Incident Detection?
  - Incident Prevention?
5. Assess your Readiness

- Have you Coordinated Amongst the Appropriate Service Lines?
- Have you Documented the Remediation Plan?
- If the Aggressor “ups the ante”, will your Improvement for Next Iteration of Attacks be Fast Enough?
Questions?