Agile Incident Response: Operating through Ongoing Confrontation

Kevin Mandia

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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

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INVESTIGATING COMPUTER CRIME
Kevin Mandia & Chris Prosise
INCIDENT RESPONSE
SECOND EDITION
& COMPUTER FORENSICS
Kevin Mandia, Chris Prosise & Matt Pepe

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.

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ANTI-HACKER TOOL
REAL DIGITAL FORENSICS
Computer Security and Incident Response
KEITH J. JONES
RICHARD BEJTLICH
CURTIS W. ROSE

Agenda

- Incident Detection
- Case Studies
- Performing Agile Incident Response
- Operating through a Constant Aggressor

How Are Organizations Detecting Computer Security Incidents?

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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

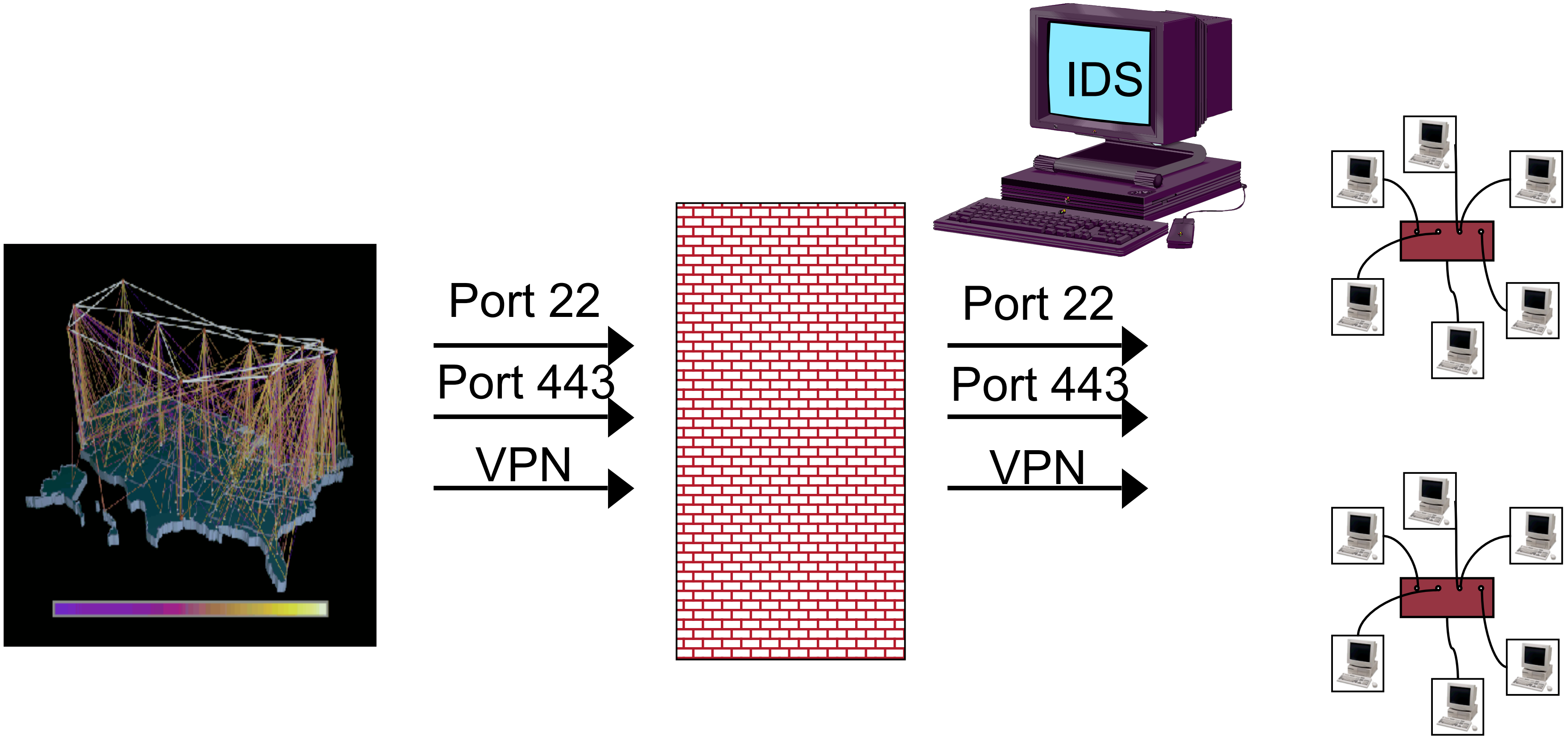
- The Review of 10 Malicious Executable Files Yielded:
  - 12/12 Files were NOT Publicly Available
  - 12/12 Files were NOT Detected by AV
  - 11/12 Files Reviewed were Packed via 2(5) Different Methods

It is Highly Unlikely AV will ever Trigger on Microsoft Tools or Sysinternal Tools.

2. How are Organization's Detecting Incidents?

- IDS Alerts?
  - Rare Detection Mechanism.

1



3. How are Organization’s Detecting Incidents?

6

- 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?

28

- 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

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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

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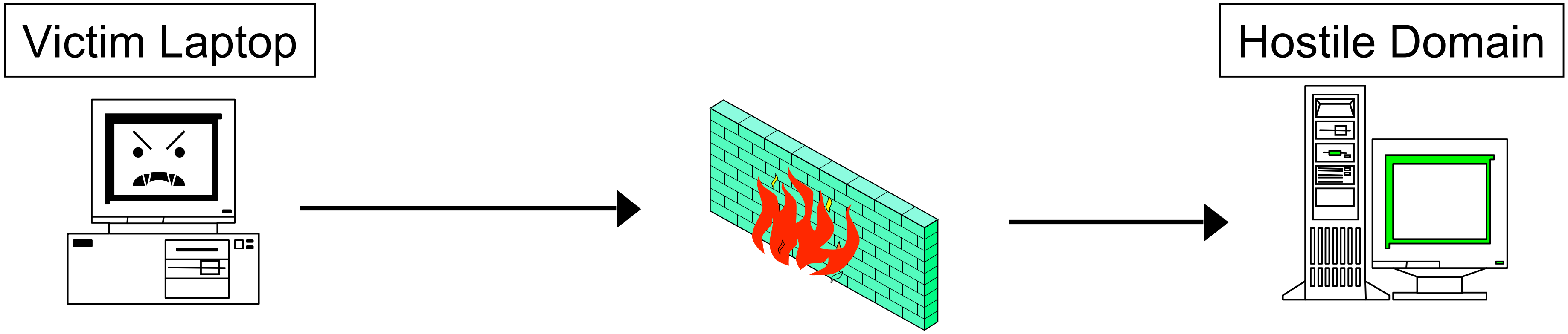
Incident Detected

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



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Demonstration

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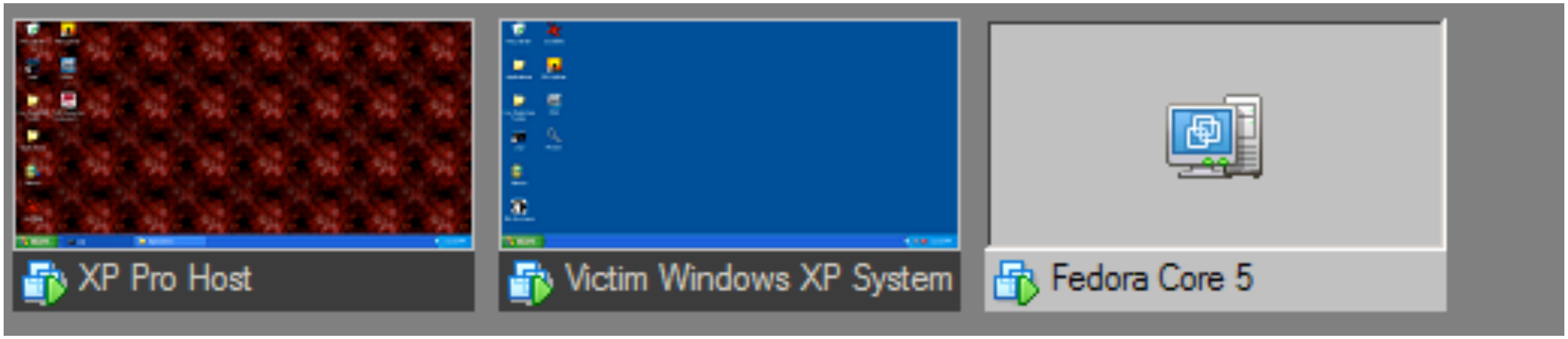
Demo 1

- Victim Receives "Innocuous Email"
  - Command Shell Backdoor sent to Drop Site



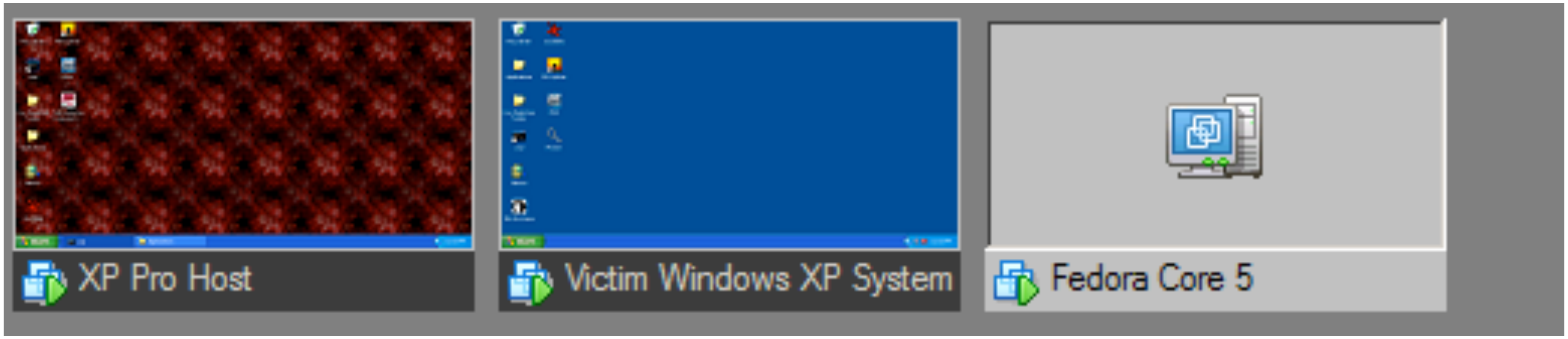
Attacker
66.92.146.247

Victim
66.92.146.248

Drop Site
66.92.146.1

Demo 2

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



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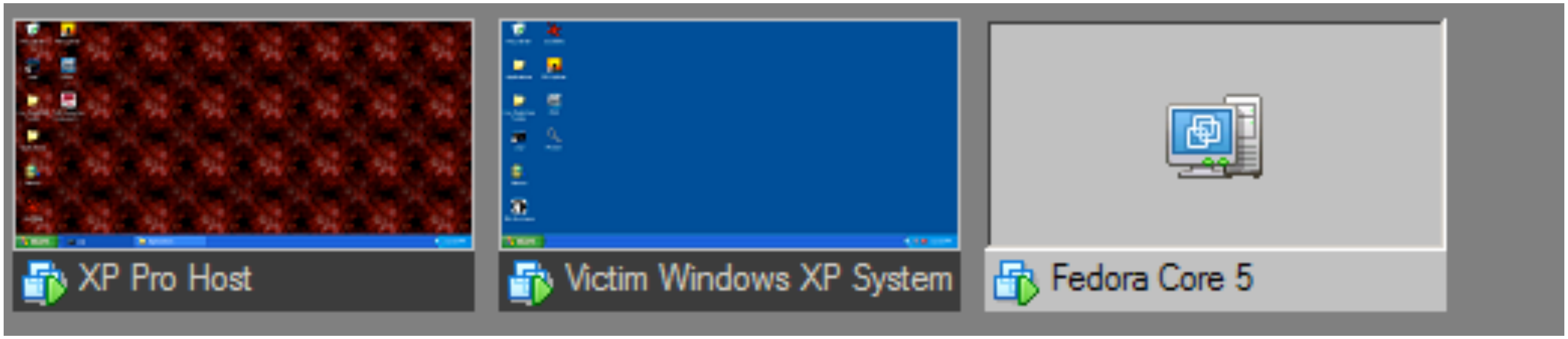
Demo 3

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



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Practicing Agile Incident Response

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Practicing Agile Incident Response

- 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

Technical

Business

Compliance

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

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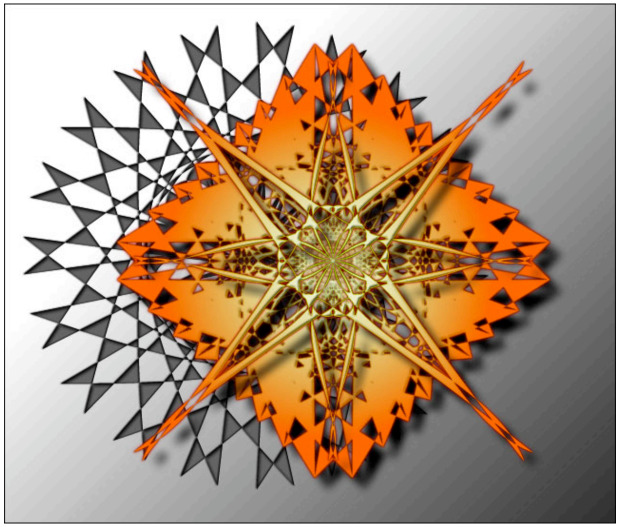
Performing Live Response

- 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



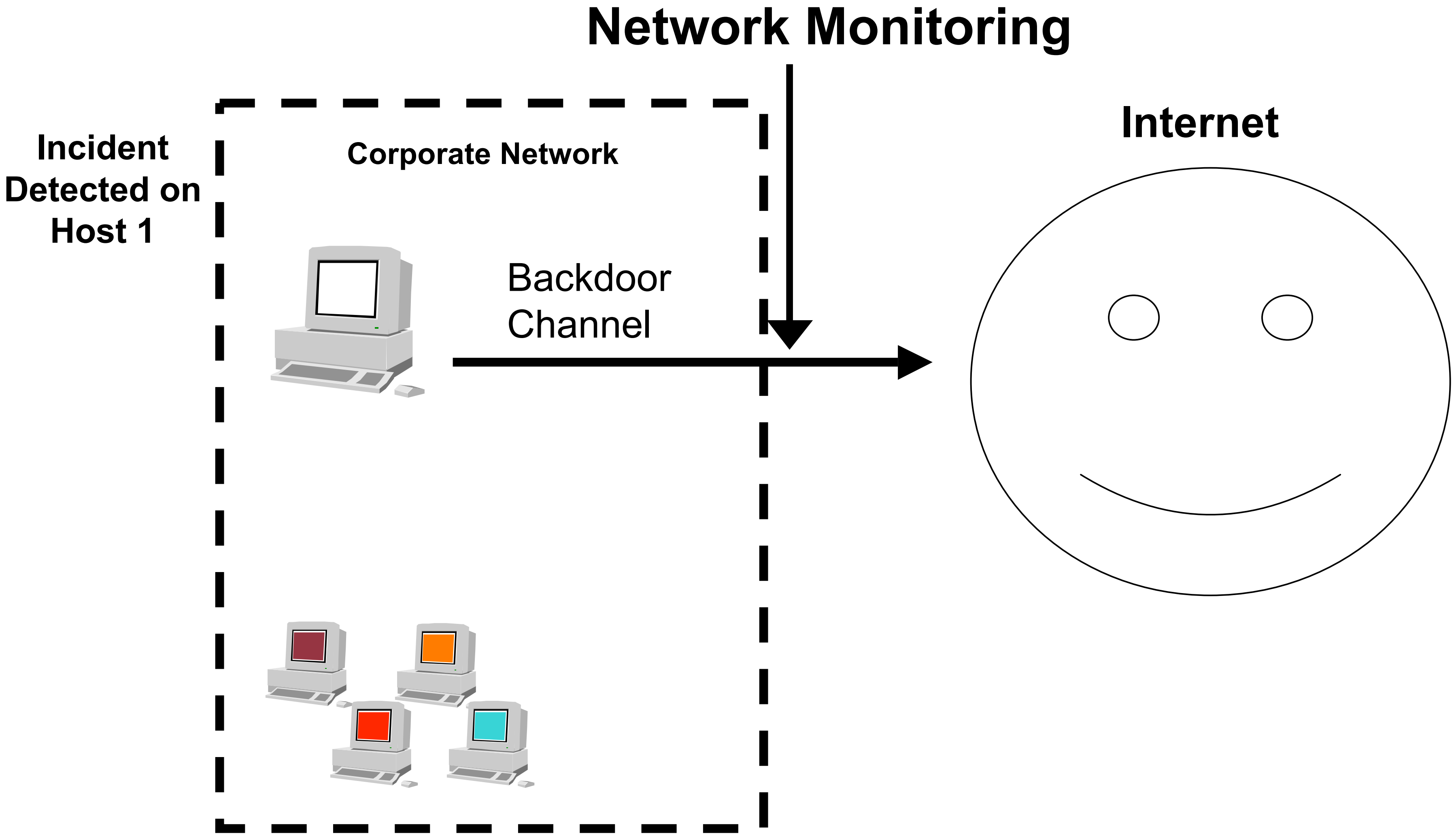
Volatile Data

- 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

Internet

Incident Detected on Host 1

Corporate Network

Backdoor Channel

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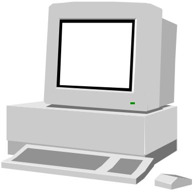
Performing Live Response

Incident
Detected on
Host 1



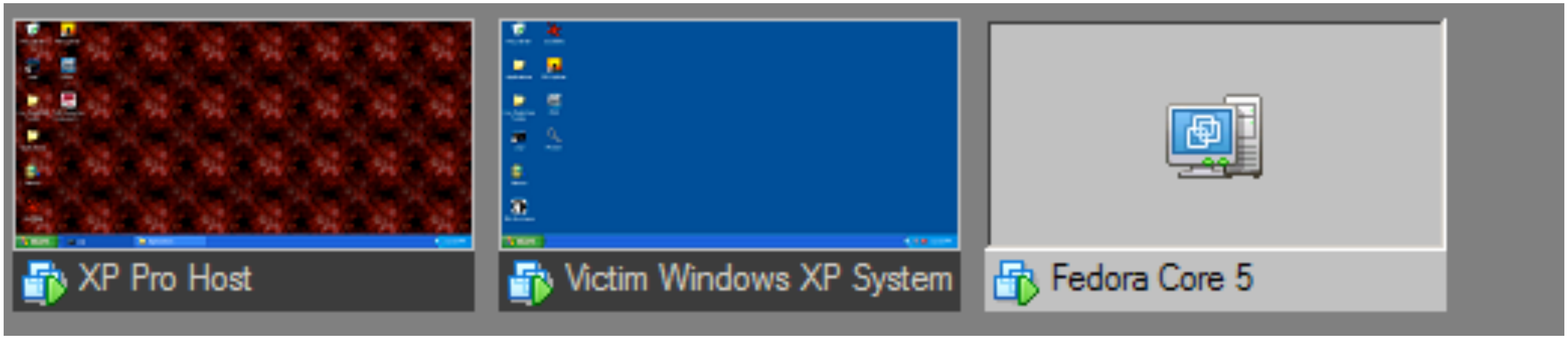
Respond
on Host 1

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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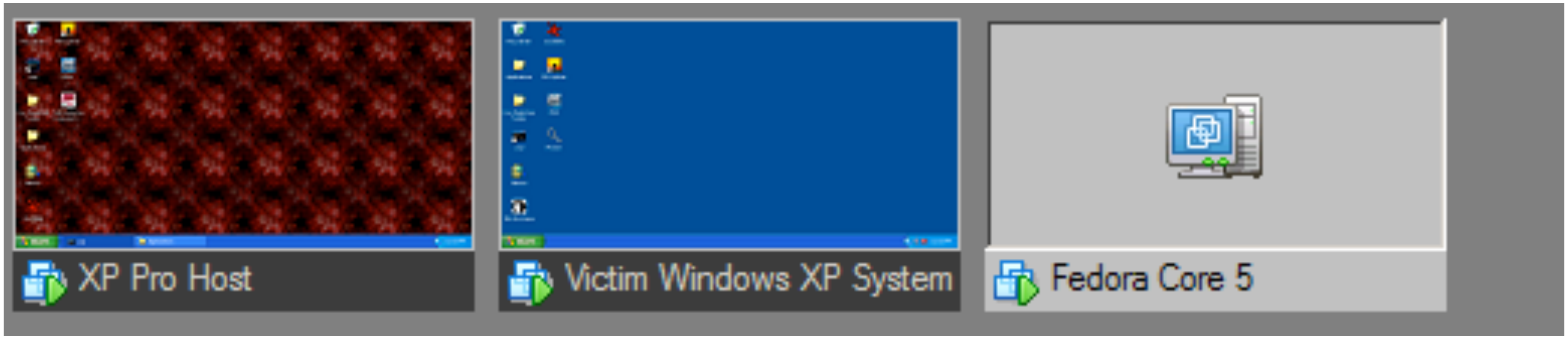
3. Rapid Data Analysis

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



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4. Focus: Countermeasures/Documentation

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Focus

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

APPLICATION PROGRAM INTERFACE (API)
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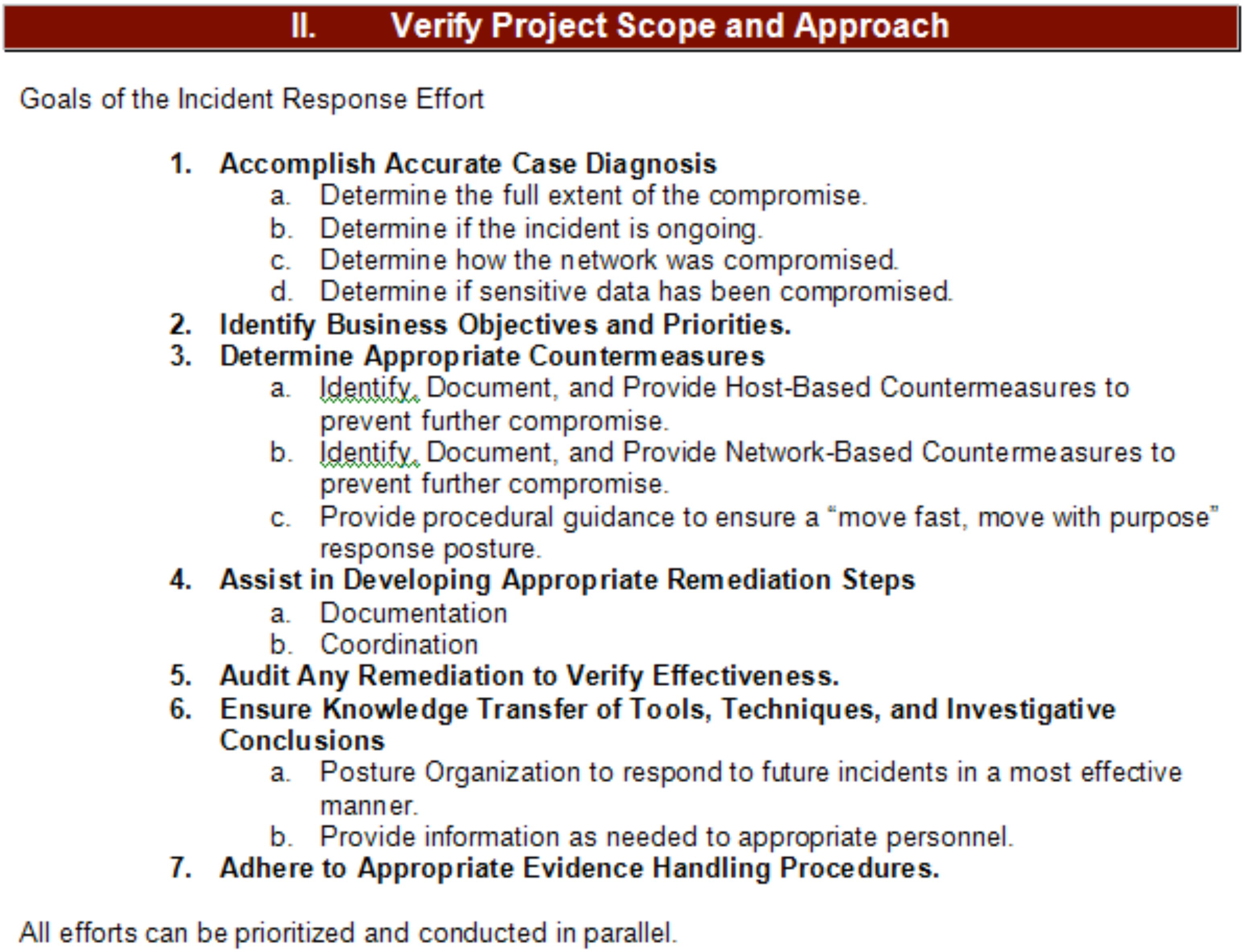
Know Your Goals



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

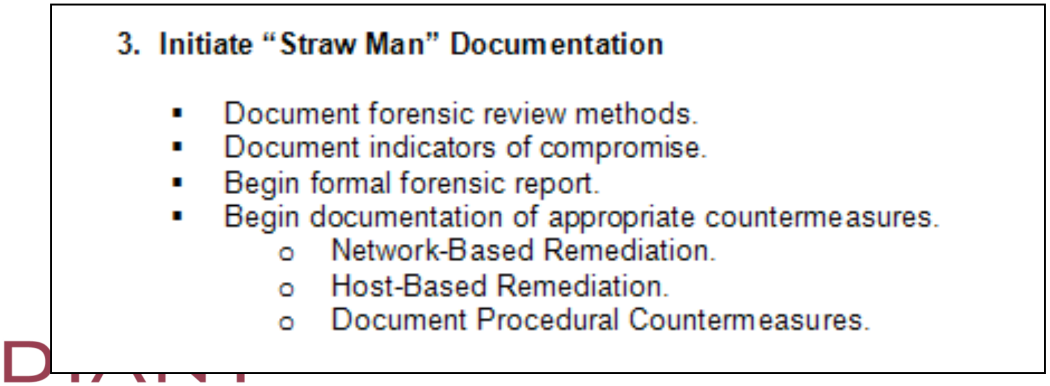
APPLICATION PROGRAM INTERFACE (API)
APPLICATION PROGRAM INTERFACE (API)

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

- Obtain High-Level Direction
- Know your Remediation Philosophy
- Identify the “Zone” You Are In
- Determine Remediation Plan
- Determine Readiness
- Execute

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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

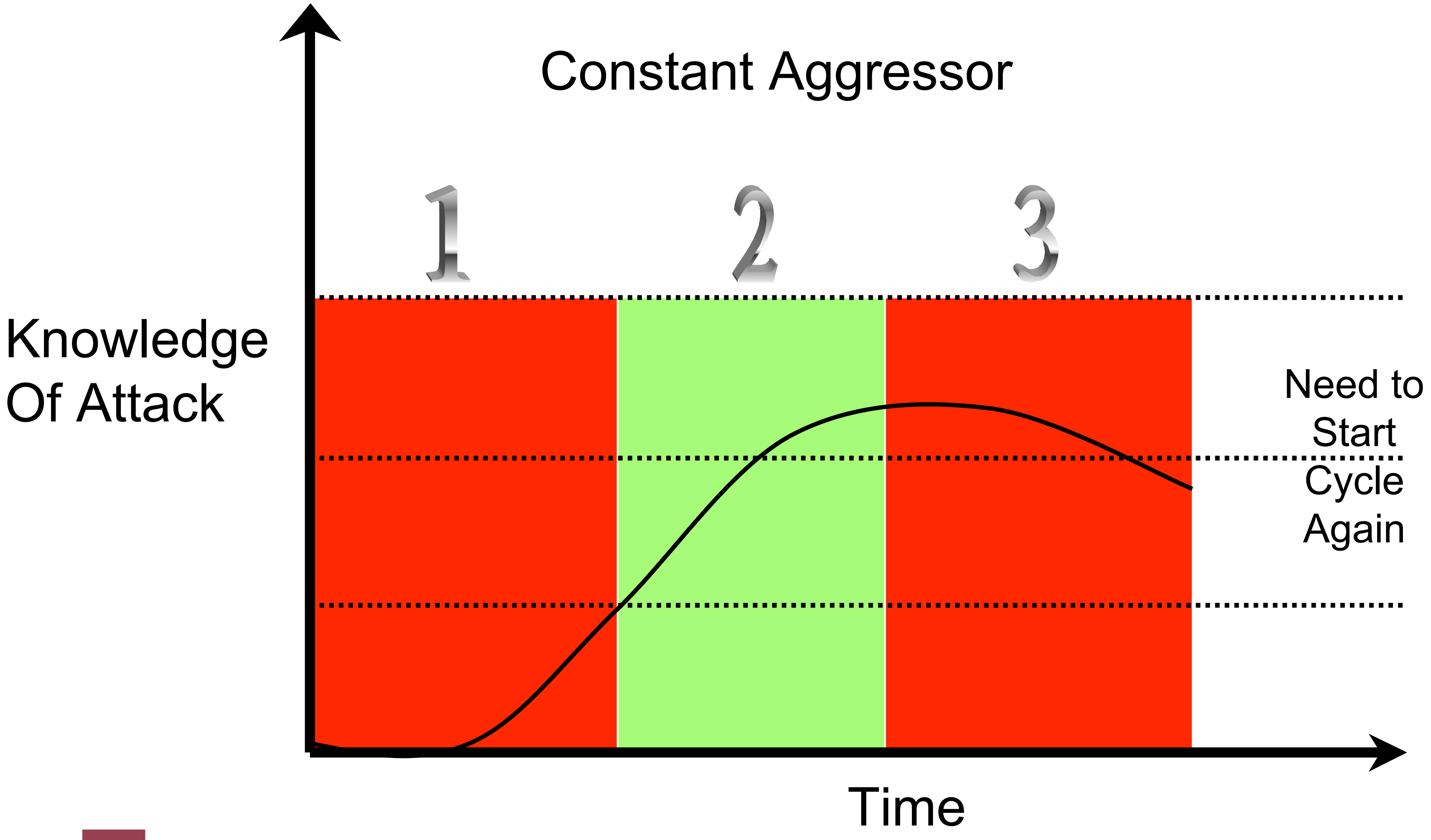
Aggressive Remediation

- 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 Seperate 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



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!

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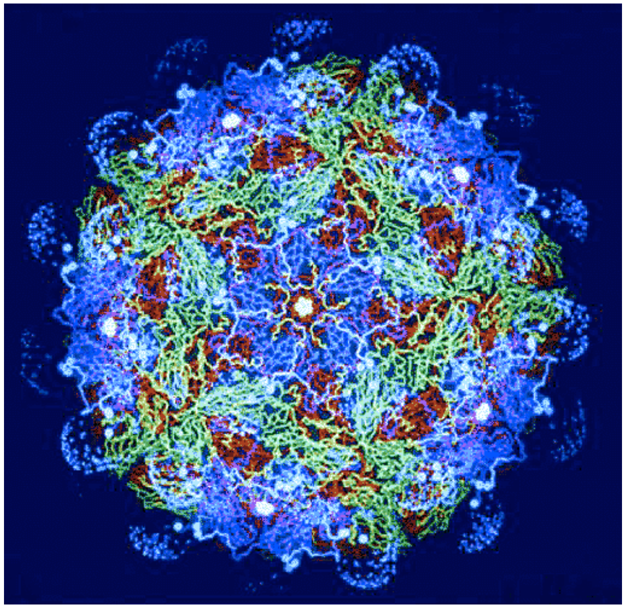
How Do You Miss Strike Zone?

- 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?