

Understanding Computer Investigations

Objectives

- Explain how to **prepare** a computer investigation
- Apply a **systematic approach** to an investigation
- Describe **procedures** for corporate high-tech investigations
- Explain **requirements** for data recovery workstations and software
- Describe how to **conduct** an investigation
- Explain how to **complete** and **critique** a case

Preparing a Computer Investigation

Preparing a Computer Investigation

- **Role** of computer forensics professional is to **gather evidence to prove** that a suspect committed a crime or violated a company policy
- Collect evidence that can be offered in court or at a corporate inquiry
 - Investigate the suspect's computer
 - Preserve the evidence on a different computer

Preparing a Computer Investigation (continued)

- Follow an accepted procedure to prepare a case
- Approaching each case **methodically**
 - **To evaluate** the evidence thoroughly
 - **To document** the chain of evidence
- **Chain of custody**
 - Route the evidence takes from the time you find it until the case is closed or goes to court

Preparing a Computer Investigation (continued)

- Two sample cases
 - one involving a computer crime
 - Drug dealer
 - Another involving a company policy violation
 - Running a company
- Each example describes the typical steps of a forensics investigation
 - gathering evidence
 - preparing a case
 - preserving the evidence

An Overview of a Computer Crime

- Computers can contain information that helps law enforcement determine:
 - Chain of events leading to a crime
 - Evidence that can lead to a conviction
- Law enforcement officers should **follow proper procedure** when acquiring the evidence
 - Digital evidence can be easily altered by an overeager investigator
- Information on hard disks might be **password protected**

An Overview of a Computer Crime

- **Example:**
- Police raided a suspected drug dealer's home and found a computer, several floppy disks and USB drives, a cell phone in a bedroom
- The computer was "bagged and tagged," - placed in evidence bags along with the storage media and then labeled with tags
- The acquisitions officer gives - documentation of items the investigating officers collected with the computer, including a list of other storage media, such as removable disks and CDs
- The acquisitions officer also notes that the computer is a Windows XP system, and the machine was running when it was discovered
- Before shutting down the computer, the acquisitions officer photographs all open windows on the Windows desktop, including one showing Windows Explorer, and gives you the photos
- Before shutting down the computer, a live acquisition should be done to capture RAM, too

An Overview of a Computer Crime

- Example:
 - Hard disk and storage media include intact files, such as e-mail messages, deleted files, and hidden files
 - Files on the disks you received are probably password protected
- **We need special software tools and experts**

Examining a Computer Crime



Figure 2-1 The crime scene

An Overview of a Company Policy Violation

- Personal tasks during work hours can waste company time
- Employees misusing resources can cost companies millions of dollars
- Misuse includes:
 - Surfing the Internet
 - Sending personal e-mails
 - Using company computers for personal tasks

An Overview of a Company Policy Violation

- Example:
- George has worked as a representative for several years
- He's been absent from work for two days but hasn't called in sick or told anyone why he wouldn't be at work
- Steve asks the IT Department to confiscate George's hard drive and all storage media in his work area
- He wants to know whether there's any information on George's computer and storage media that might offer a clue to George's whereabouts and job performance concerns
- **Need to take a systematic approach**

Taking a Systematic Approach

Assessing the Case

Planning your Investigation

Securing Your Evidence

Taking a Systematic Approach

- Steps for problem solving
 - Make an initial assessment about the type of case you are investigating
 - Determine a preliminary design or approach to the case
 - Create a detailed checklist
 - Determine the resources you need
 - Obtain and copy an evidence disk drive

Taking a Systematic Approach (continued)

- Steps for problem solving (continued)
 - Identify the risks
 - Mitigate or minimize the risks
 - Test the design
 - Analyze and recover the digital evidence
 - Investigate the data you recover
 - Complete the case report
 - Critique the case

Assessing the Case

- Systematically outline the case details
- **Situation**—Employee abuse case
- **Nature of the case** —Side business conducted on the employer's computer
- **Specifics of the case** —involves registering domain names for clients and setting up their Web sites at local ISPs
- **Type of evidence** —Small-capacity USB drive.
- **Operating system** —Microsoft Windows XP.
- **Known disk format** —FAT16.
- **Location of evidence** —One USB drive recovered from the employee's assigned computer

Assessing the Case (continued)

- Based on case details, you can determine the case requirements
 - Type of evidence
 - Computer forensics tools
 - Special operating systems

Planning Your Investigation

- A basic investigation plan should include the following activities:
 - Acquire the evidence
 - Complete an evidence form and establish a chain of custody
 - Transport the evidence to a computer forensics lab
 - Secure evidence in an **approved secure container**

Planning Your Investigation (continued)

- A basic investigation plan (continued):
 - Prepare a forensics workstation
 - Obtain the evidence from the secure container
 - Make a forensic copy of the evidence
 - Return the evidence to the secure container
 - Process the copied evidence with computer forensics tools

Planning Your Investigation (continued)

- An **evidence custody form** helps you document what has been done with the original evidence and its forensics copies
- Two types
 - **Single-evidence form**
 - Lists each piece of evidence on a separate page
 - **Multi-evidence form**

Planning Your Investigation (continued)

Corporation X Security Investigations This form is to be used for one to ten pieces of evidence			
Case No.:		Investigating Organization:	
Investigator:			
Nature of Case:			
Location where evidence was obtained:			
	Description of evidence:	Vendor Name	Model No./Serial No.
Item #1			
Item #2			
Item #3			
Item #4			
Item #5			
Item #6			
Item #7			
Item #8			
Item #9			
Item #10			
Evidence Recovered by:		Date & Time:	
Evidence Placed in Locker:		Date & Time:	
Item #	Evidence Processed by	Disposition of Evidence	Date/Time
			Page ___ of ___

Figure 2-2 A sample multi-evidence form used in a corporate environment

Planning Your Investigation (continued)

Metropolis Police Bureau High-tech Investigations Unit This form is to be used for only one piece of evidence. Fill out a separate form for each piece of evidence.			
Case No.:			Unit Number:
Investigator:			
Nature of Case:			
Location where evidence was obtained:			
Item # ID	Description of evidence:	Vendor Name	Model No./Serial No.
Evidence Recovered by:		Date & Time:	
Evidence Placed in Locker:		Date & Time:	
Evidence Processed by	Disposition of Evidence	Date/Time	
			Page ___ of ___

Figure 2-3 A single-evidence form

Securing Your Evidence

- Use **evidence bags** to secure and catalog the evidence
- Use computer safe products
 - Antistatic bags
 - Antistatic pads
- Use well padded containers
- Use evidence tape to seal all openings
 - Floppy disk or CD drives
 - Power supply electrical cord

Securing Your Evidence (continued)

- Write your initials on tape to prove that evidence has not been tampered with
- Consider computer specific temperature and humidity ranges

Procedures for Corporate High-Tech Investigations

Employee Termination Cases

Internet Abuse Investigations

E-mail Abuse Investigations

Attorney-Client Privilege Investigations

Media Leak Investigations

Industrial Espionage Investigations

Interviews and Interrogations in High-Tech Investigations

Procedures for Corporate High-Tech Investigations

- Develop formal procedures and informal checklists
 - To cover all issues important to high-tech investigations
- Procedures are necessary to ensure that correct techniques are used in an investigation
- Use informal checklists to be certain that all evidence is collected and processed properly

Employee Termination Cases

- Majority of investigative work for termination cases involves employee abuse of corporate assets
- Consulting with organization's general counsel and Human Resources Department for specific directions on how to handle these investigations is recommended
- Organization must have appropriate policies

Internet abuse investigations

- To conduct an investigation you need:
 - Organization's Internet proxy server logs
 - Suspect computer's IP address
 - Suspect computer's disk drive
 - Your preferred computer forensics analysis tool

Internet abuse investigations (continued)

– Recommended steps

- Use standard forensic analysis techniques and procedures
- Use appropriate tools to extract all Web page URL information
- Contact the network firewall administrator and request a proxy server log
- Compare the data recovered from forensic analysis to the proxy server log
- Continue analyzing the computer's disk drive data

E-mail abuse investigations

- To conduct an investigation you need:
 - An electronic copy of the offending e-mail that contains message header data
 - If available, e-mail server log records
 - For e-mail systems that store users' messages on a central server, access to the server
 - Access to the computer so that you can perform a forensic analysis on it
 - Your preferred computer forensics analysis tool

E-mail abuse investigations (continued)

- Recommended steps
 - Use the standard forensic analysis techniques
 - Obtain an electronic copy of the suspect's and victim's e-mail folder or data
 - For Web-based e-mail investigations, use tools such as FTK's Internet Keyword Search option to extract all related e-mail address information
 - Examine header data of all messages of interest to the investigation

Attorney-Client Privilege Investigations

- Under **attorney-client privilege (ACP)** rules for an attorney
 - You must keep all findings confidential
- Many attorneys like to have printouts of the data you have recovered
 - You need to persuade and educate many attorneys on how digital evidence can be viewed electronically
- You can also encounter problems if you find data in the form of binary files

Attorney-Client Privilege Investigations (continued)

- Steps for conducting an ACP case
 - Request a memorandum from the attorney directing you to start the investigation
 - Request a list of keywords of interest to the investigation
 - Initiate the investigation and analysis
 - For disk drive examinations, make two bit-stream images using different tools
 - Compare hash signatures on all files on the original and re-created disks

Attorney-Client Privilege Investigations (continued)

- Steps for conducting an ACP case (continued)
 - Methodically examine every portion of the disk drive and extract all data
 - Run keyword searches on allocated and unallocated disk space
 - For Windows OSs, use specialty tools to analyze and extract data from the Registry
 - AccessData Registry Viewer
 - For binary data files such as CAD drawings, locate the correct software product
 - For unallocated data recovery, use a tool that removes or replaces nonprintable data

Attorney-Client Privilege Investigations (continued)

- Steps for conducting an ACP case (continued)
 - Consolidate all recovered data from the evidence bit-stream image into folders and subfolders
- Other guidelines
 - Minimize written communications with the attorney
 - Any documentation written to the attorney must contain a header stating that it's "Privileged Legal Communication—Confidential Work Product"

Attorney-Client Privilege Investigations (continued)

- Other guidelines (continued)
 - Assist attorney and paralegal in analyzing the data
- If you have difficulty complying with the directions
 - Contact the attorney and explain the problem
- Always keep an open line of verbal communication
- If you're communicating via e-mail, use encryption

Media Leak Investigations

- In the corporate environment, controlling sensitive data can be difficult
- Consider the following for media leak investigations
 - Examine e-mail
 - Examine Internet message boards
 - Examine proxy server logs
 - Examine known suspects' workstations
 - Examine all company telephone records, looking for calls to the media

Media Leak Investigations (consider)

- Steps to take for media leaks
 - Interview management privately
 - To get a list of employees who have direct knowledge of the sensitive data
 - Identify media source that published the information
 - Review company phone records
 - Obtain a list of keywords related to the media leak
 - Perform keyword searches on proxy and e-mail servers

Media Leak Investigations (consider)

- Steps to take for media leaks (continued)
 - Discreetly conduct forensic disk acquisitions and analysis
 - From the forensic disk examinations, analyze all e-mail correspondence
 - And trace any sensitive messages to other people
 - Expand the discreet forensic disk acquisition and analysis
 - Consolidate and review your findings periodically
 - Routinely report findings to management

Industrial Espionage Investigations

- All suspected industrial espionage cases should be treated as criminal investigations
- Staff needed
 - Computing investigator who is responsible for disk forensic examinations
 - Technology specialist who is knowledgeable of the suspected compromised technical data
 - Network specialist who can perform log analysis and set up network sniffers
 - Threat assessment specialist (typically an attorney)

Industrial Espionage Investigations (continued)

- Guidelines
 - Determine whether this investigation involves a possible industrial espionage incident
 - Consult with corporate attorneys and upper management
 - Determine what information is needed to substantiate the allegation
 - Generate a list of keywords for disk forensics and sniffer monitoring
 - List and collect resources for the investigation

Industrial Espionage Investigations (continued)

- Guidelines (continued)
 - Determine goal and scope of the investigation
 - Initiate investigation after approval from management
- Planning considerations
 - Examine all e-mail of suspected employees
 - Search Internet newsgroups or message boards
 - Initiate physical surveillance
 - Examine facility physical access logs for sensitive areas

Industrial Espionage Investigations (continued)

- Planning considerations (continued)
 - Determine suspect location in relation to the vulnerable asset
 - Study the suspect's work habits
 - Collect all incoming and outgoing phone logs
- Steps
 - Gather all personnel assigned to the investigation and brief them on the plan
 - Gather resources to conduct the investigation

Industrial Espionage Investigations (continued)

- Steps (continued)
 - Place surveillance systems
 - Discreetly gather any additional evidence
 - Collect all log data from networks and e-mail servers
 - Report regularly to management and corporate attorneys
 - Review the investigation's scope with management and corporate attorneys

Interviews and Interrogations in High-Tech Investigations

- Becoming a skilled interviewer and interrogator can take many years of experience
- **Interview**
 - Usually conducted to collect information from a witness or suspect
 - About specific facts related to an investigation
- **Interrogation**
 - Trying to get a suspect to confess

Interviews and Interrogations in High-Tech Investigations (continued)

- Role as a computing investigator
 - To instruct the investigator conducting the interview on what questions to ask
 - And what the answers should be
- Ingredients for a successful interview or interrogation
 - Being patient throughout the session
 - Repeating or rephrasing questions to zero in on specific facts from a reluctant witness or suspect
 - Being tenacious

Understanding Data Recovery Workstations and Software

Understanding Data Recovery Workstations and Software

- Investigations are conducted on a computer forensics lab (or data-recovery lab)
- Computer forensics and data-recovery are related but different
- **Computer forensics workstation**
 - Specially configured personal computer
 - Loaded with additional bays and forensics software
- To avoid altering the evidence use:
 - Forensics boot floppy disk OR cd
 - Write-blocker devices

Write Blocker

- Connects a hard drive in trusted read-only mode
- There are also Linux boot CDs that mount all drives read-only, such as Helix and some Knoppix distributions



Setting Up your Computer for Computer Forensics

- Basic requirements
 - A workstation running Windows XP or Vista
 - A write-blocker device
 - Computer forensics acquisition tool
 - Like FTK Imager
 - Computer forensics analysis tool
 - Like FTK
 - Target drive to receive the source or suspect disk data
 - Spare PATA or SATA ports
 - USB ports

Setting Up your Computer for Computer Forensics (continued)

- Additional useful items
 - Network interface card (NIC)
 - Extra USB ports
 - FireWire 400/800 ports
 - SCSI card
 - Disk editor tool
 - Text editor tool
 - Graphics viewer program
 - Other specialized viewing tools

Conducting an Investigation

Conducting an Investigation

- Gather resources identified in investigation plan
- Items needed
 - Original storage media
 - Evidence custody form
 - Evidence container for the storage media
 - Bit-stream imaging tool
 - Forensic workstation to copy and examine your evidence
 - Securable evidence locker, cabinet, or safe

Gathering the Evidence

- Avoid damaging the evidence
- Steps
 - Meet the IT manager to interview him
 - Fill out the evidence form, have the IT manager sign
 - Place the evidence in a secure container
 - Complete the evidence custody form
 - Carry the evidence to the computer forensics lab
 - Create forensics copies (if possible)
 - Secure evidence by locking the container

Understanding Bit-Stream Copies

- **Bit-stream copy**
 - Bit-by-bit copy of the original storage medium
 - Exact copy of the original disk
 - Different from a simple backup copy
 - Backup software only copies known files (active data)
 - Backup software cannot copy deleted files, e-mail messages or recover file fragments
- **Bit-stream image**
 - File containing the bit-stream copy of all data on a disk or partition
 - Also known as **forensic copy**

Understanding Bit-stream Copies (continued)

- Copy image file to a target disk that matches the original disk's manufacturer, size and model

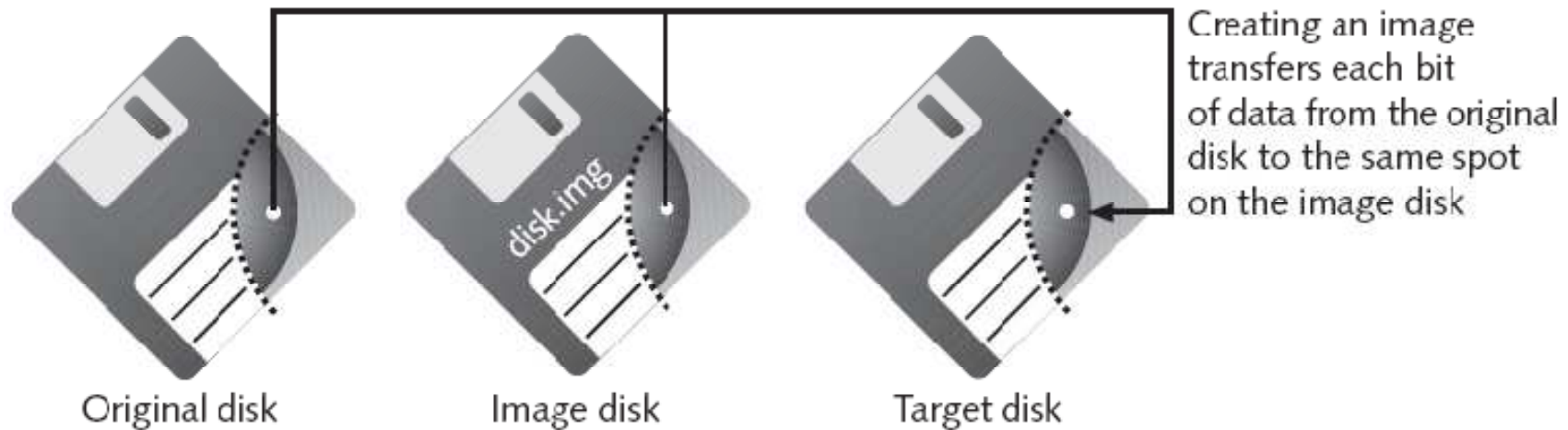


Figure 2-4 Transfer of data from original to image to target

Acquiring an Image of Evidence Media

- First rule of computer forensics
 - Preserve the original evidence
- Conduct your analysis only on a copy of the data

Completing the Case

Completing the Case

- You need to produce a final report
 - State what you did and what you found
- Include report generated by your forensic tool to document your work
- **Repeatable findings**
 - Repeat the steps and produce the same result, using different tools
- If required, use a report template
- Report should show conclusive evidence
 - Suspect did or did not commit a crime or violate a company policy

Critiquing the Case

- Ask yourself the following questions:
 - How could you improve your performance in the case?
 - Did you expect the results you found? Did the case develop in ways you did not expect?
 - Was the documentation as thorough as it could have been?
 - What feedback has been received from the requesting source?

Critiquing the Case (continued)

- Ask yourself the following questions (continued):
 - Did you discover any new problems? If so, what are they?
 - Did you use new techniques during the case or during research?