Guide to Computer Forensics and Investigations Fourth Edition

Chapter 2

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

Objectives (continued)

- 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

- 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
- **Chain of custody**
  - Route the evidence takes from the time you find it until the case is closed or goes to court

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**

Examining a Computer Crime

Figure 2-1 The crime scene

An Overview of a Company Policy Violation

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

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
  - Nature of the case
  - Specifics of the case
  - Type of evidence
  - Operating system
  - Known disk format
  - Location of evidence

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

- Develop formal procedures and informal checklists
  - To cover all issues important to high-tech investigations

Employee Termination Cases

- Majority of investigative work for termination cases involves employee abuse of corporate assets
- 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

Employee Termination Cases (continued)

- 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

Employee Termination Cases (continued)

- 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

Employee Termination Cases (continued)

- 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
  - 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

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

- 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
  - Write-blockers devices

Setting Up your Computer for Computer Forensics

- Basic requirements
  - A workstation running Windows XP or Vista
  - A write-blocker device
  - Computer forensics acquisition tool
  - Computer forensics analysis tool
  - 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

- 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 copy known files
    - 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

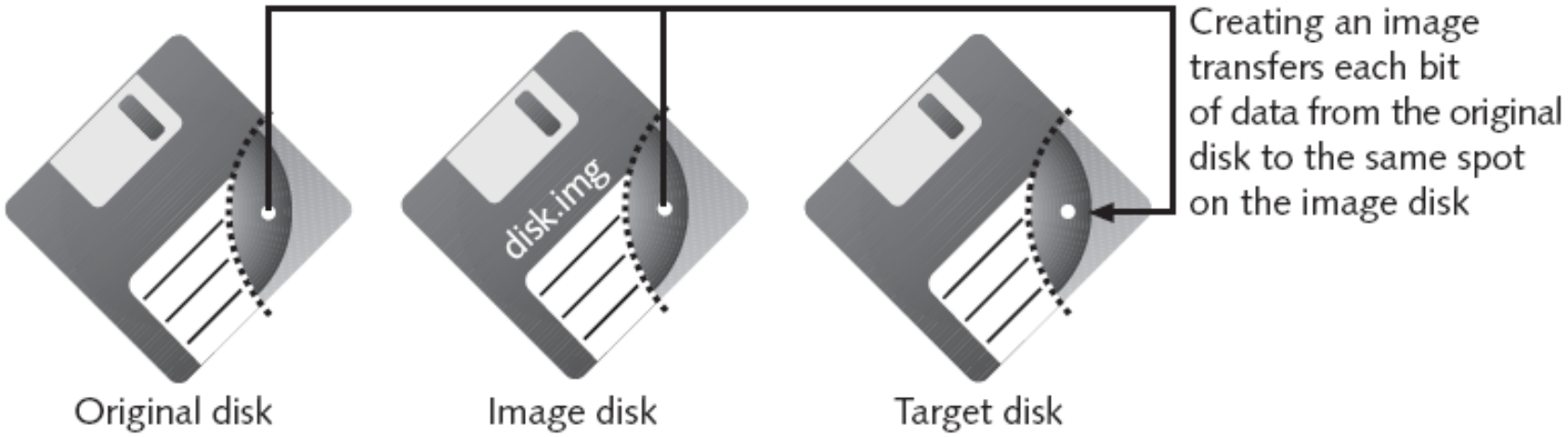

Figure 2-4 Transfer of data from original to image to target

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
- Using ProDiscover Basic to acquire a thumb drive
  - Create a work folder for data storage
  - Steps
    - On the thumb drive locate the write-protect switch and place the drive in write-protect mode
    - Start ProDiscover Basic

Acquiring an Image of Evidence Media (continued)

Figure 2-5 The main window in ProDiscover

Acquiring an Image of Evidence Media (continued)

- Using ProDiscover Basic to acquire a thumb drive (continued)
  - Steps (continued)
    - In the main window, click **Action**, **Capture Image** from the menu
    - Click the **Source Drive** drop-down list, and select the thumb drive
    - Click the **>>** button next to the Destination text box
    - Type your name in the Technician Name text box
    - ProDiscover Basic then acquires an image of the USB thumb drive
    - Click **OK** in the completion message box

Acquiring an Image of Evidence Media (continued)

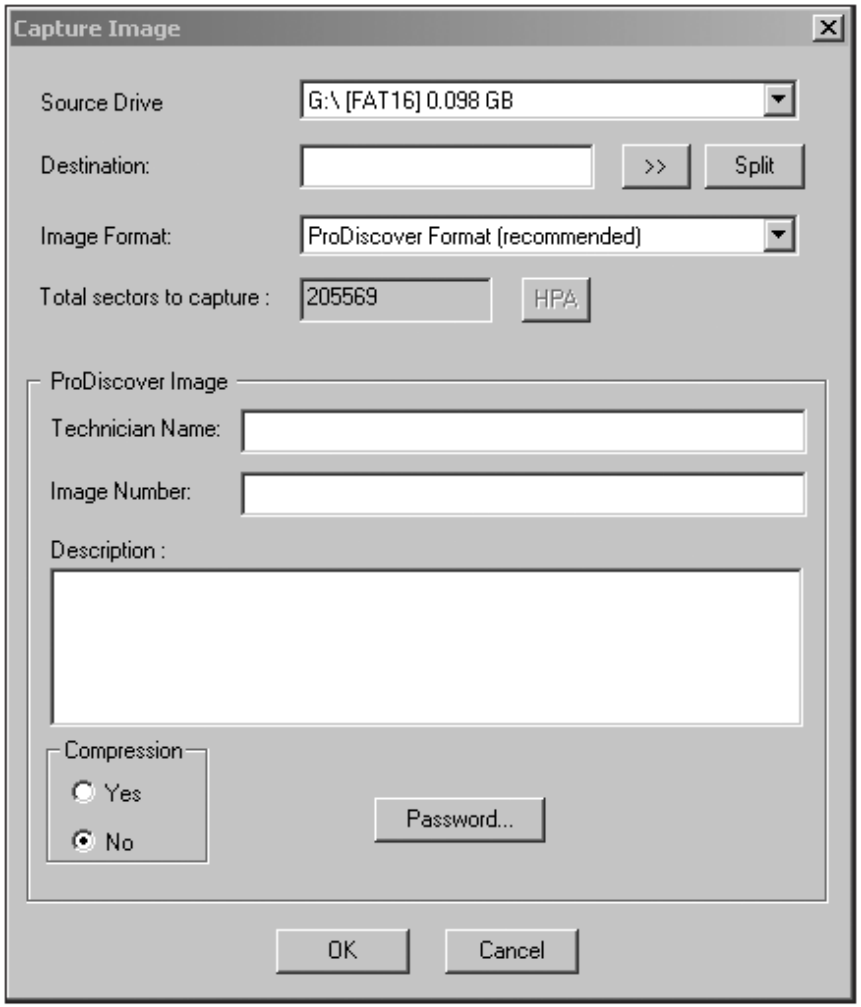

Figure 2-6 The Capture Image dialog box

Acquiring an Image of Evidence Media (continued)

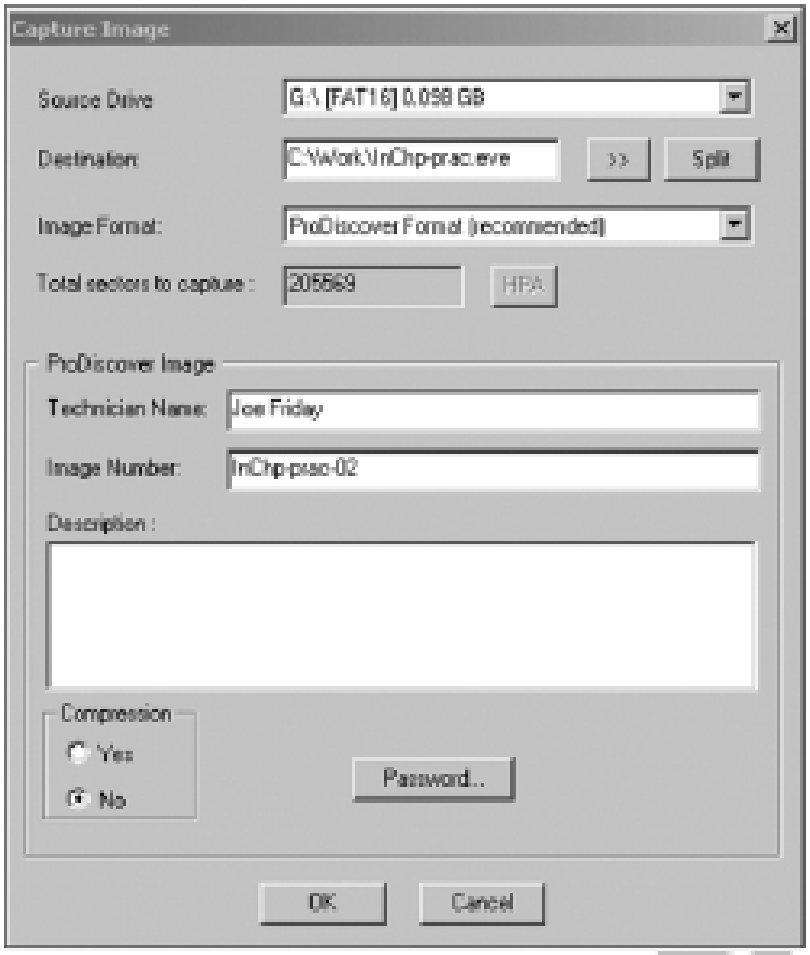

Figure 2-7 The completed Capture Image dialog box

Analyzing Your Digital Evidence

- Your job is to recover data from:
  - Deleted files
  - File fragments
  - Complete files
- Deleted files linger on the disk until new data is saved on the same physical location
- Tool
  - ProDiscover Basic

Analyzing Your Digital Evidence (continued)

- Steps
  - Start ProDiscover Basic
  - Create a new case
  - Type the project number
  - Add an **Image File**
- Steps to display the contents of the acquired data
  - Click to expand **Content View**
  - Click **All Files** under the image filename path

Analyzing Your Digital Evidence (continued)

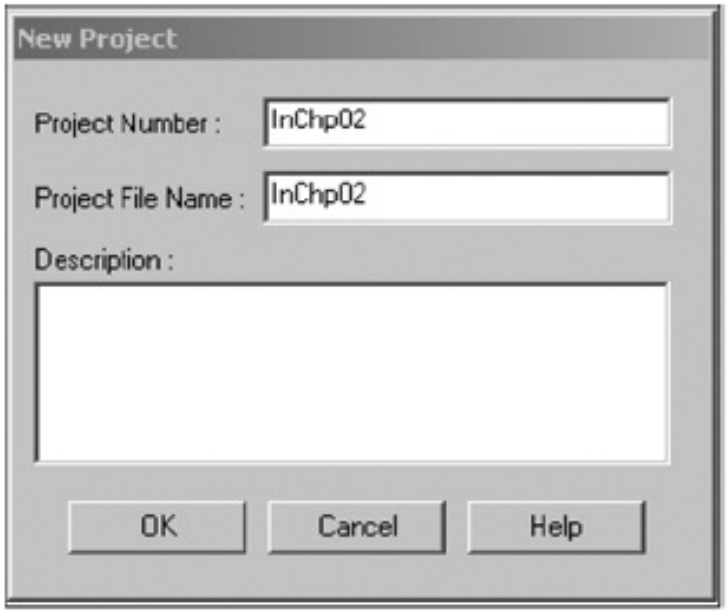

Figure 2-8 The New Project dialog box

Analyzing Your Digital Evidence (continued)

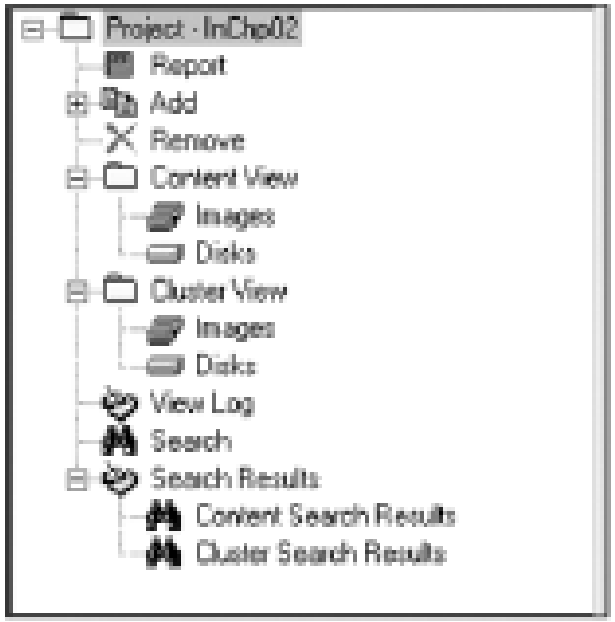

Figure 2-9 The tree view in ProDiscover

Analyzing Your Digital Evidence (continued)

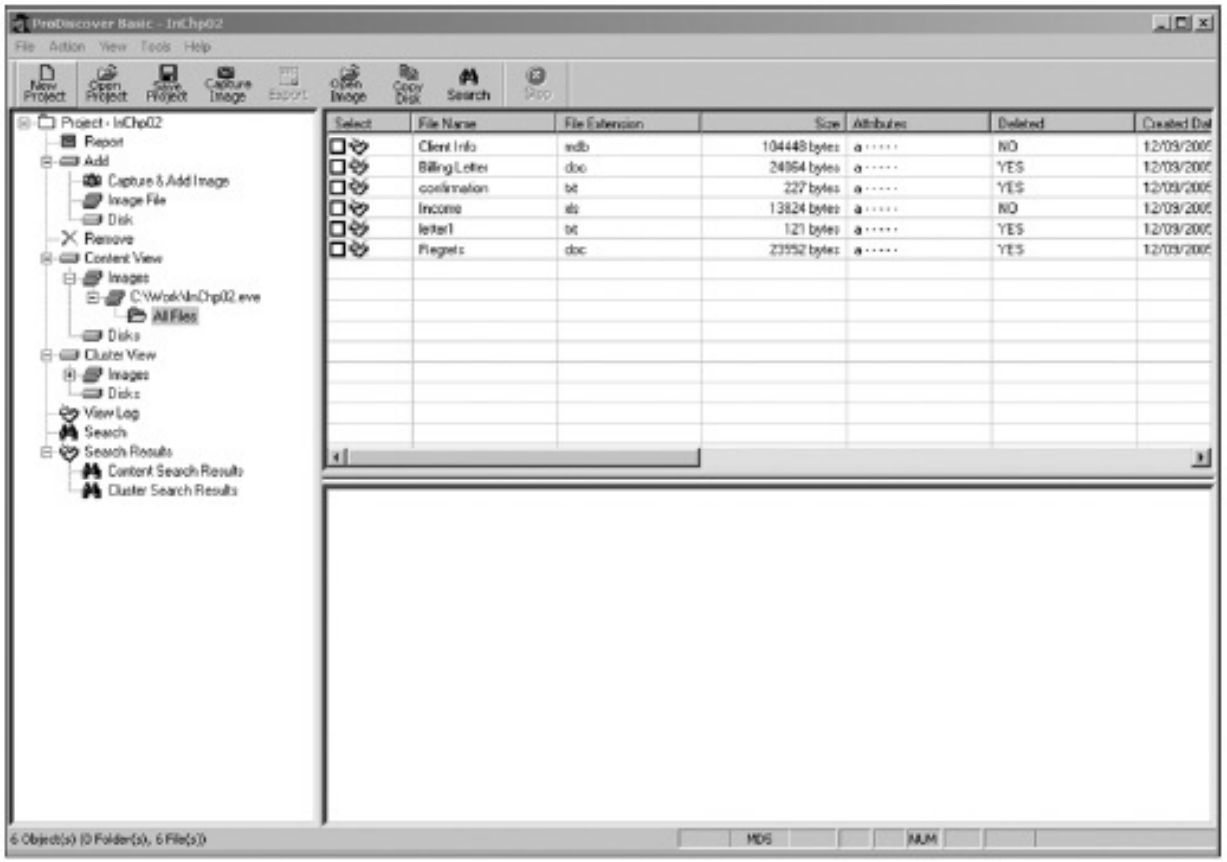

Figure 2-10 The loaded InChp02.eve file

Analyzing Your Digital Evidence (continued)

- Steps to display the contents of the acquired data (continued)
  - Click **letter1** to view its contents in the data area
  - In the data area, view contents of letter1
- Analyze the data
  - Search for information related to the complaint
- Data analysis can be most time-consuming task

Analyzing Your Digital Evidence (continued)

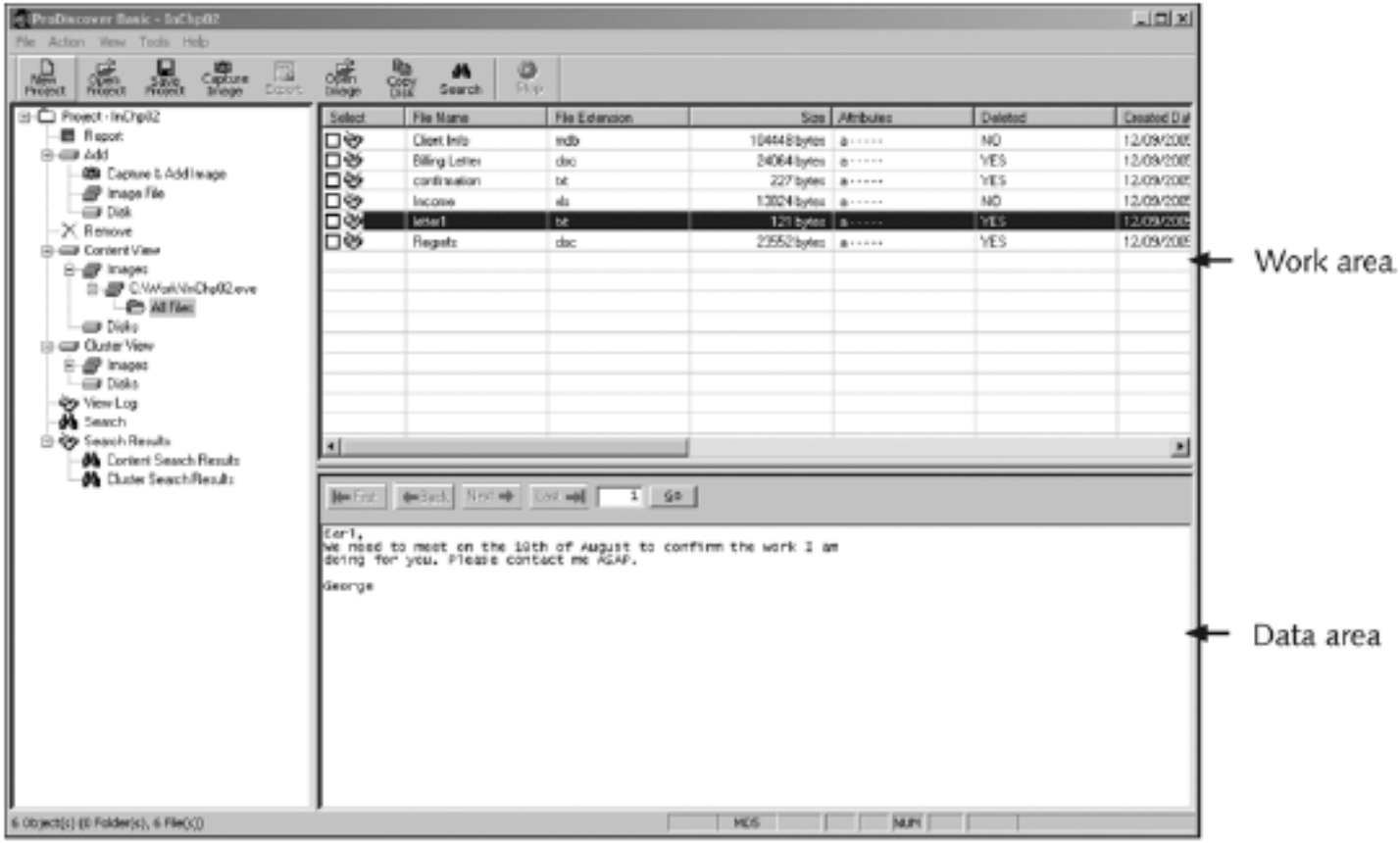

Figure 2-11 Selecting a file in the work area and viewing its contents in the data area

Analyzing Your Digital Evidence (continued)

- With ProDiscover Basic you can:
  - Search for keywords of interest in the case
  - Display the results in a search results window
  - Click each file in the search results window and examine its content in the data area
  - Export the data to a folder of your choice
  - Search for specific filenames
  - Generate a report of your activities

Analyzing Your Digital Evidence (continued)

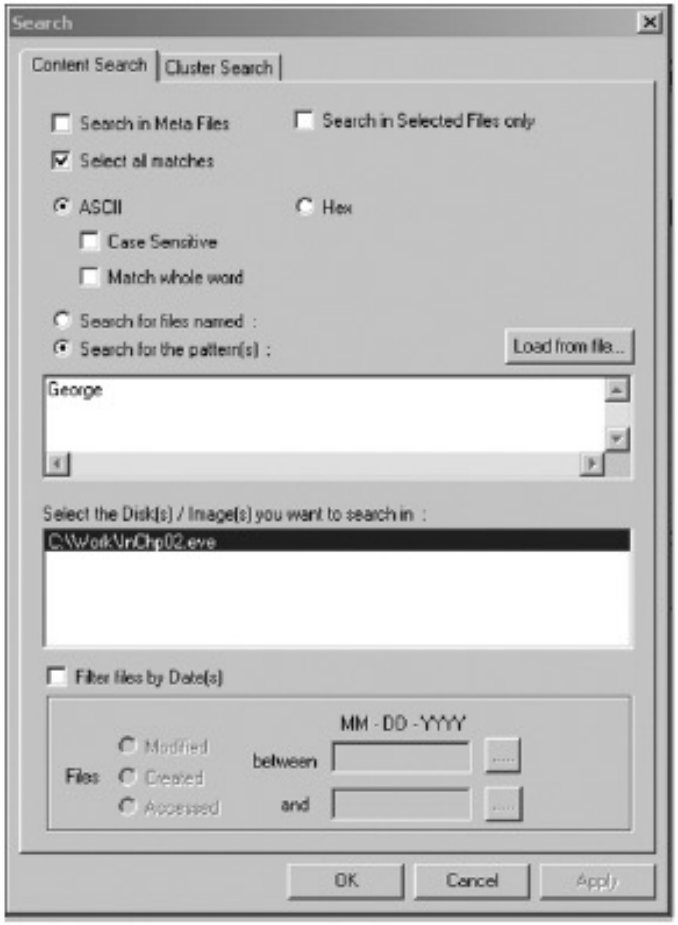

Figure 2-12 Entering a keyword in the Search dialog box

Analyzing Your Digital Evidence (continued)

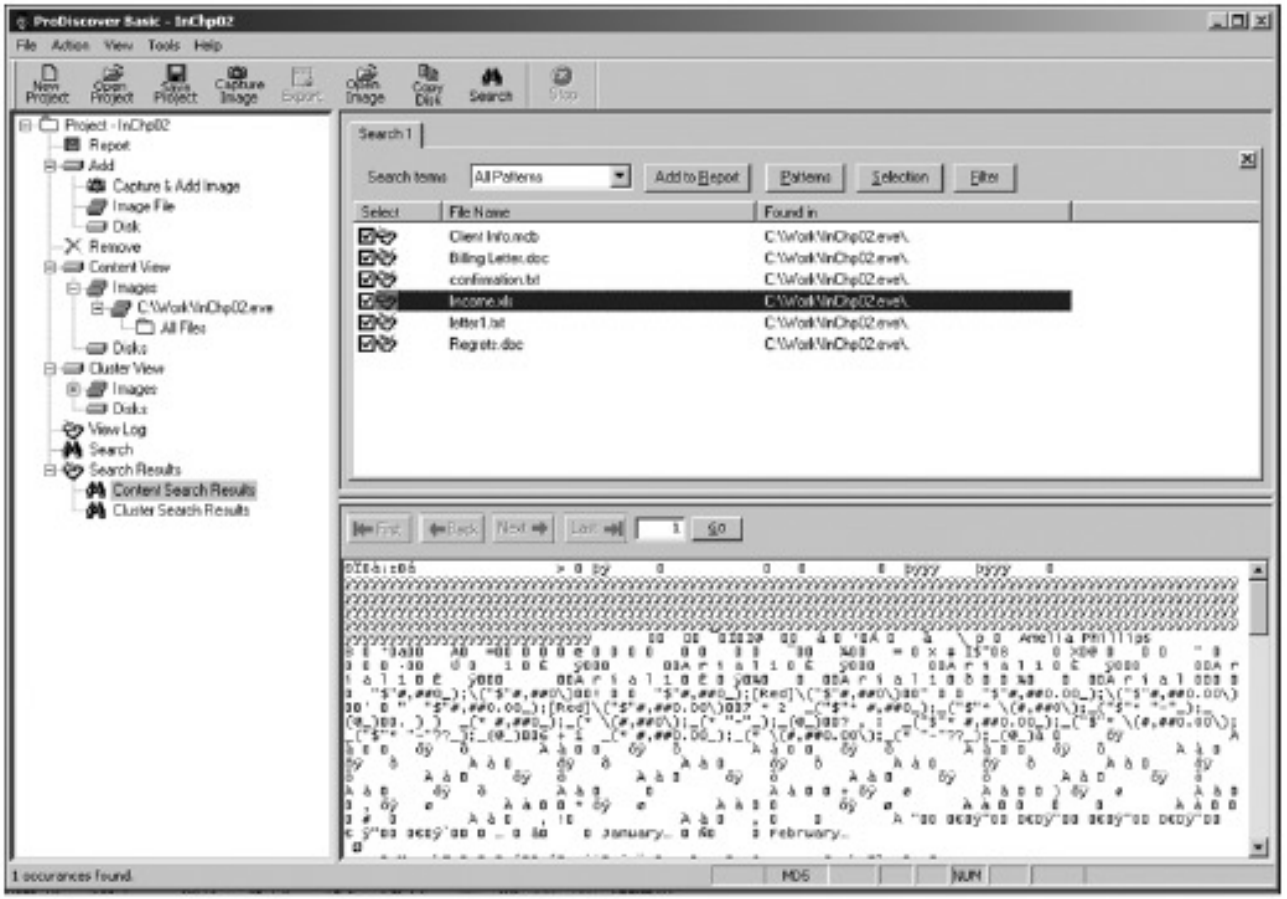

Figure 2-13 The search results pane

Analyzing Your Digital Evidence (continued)

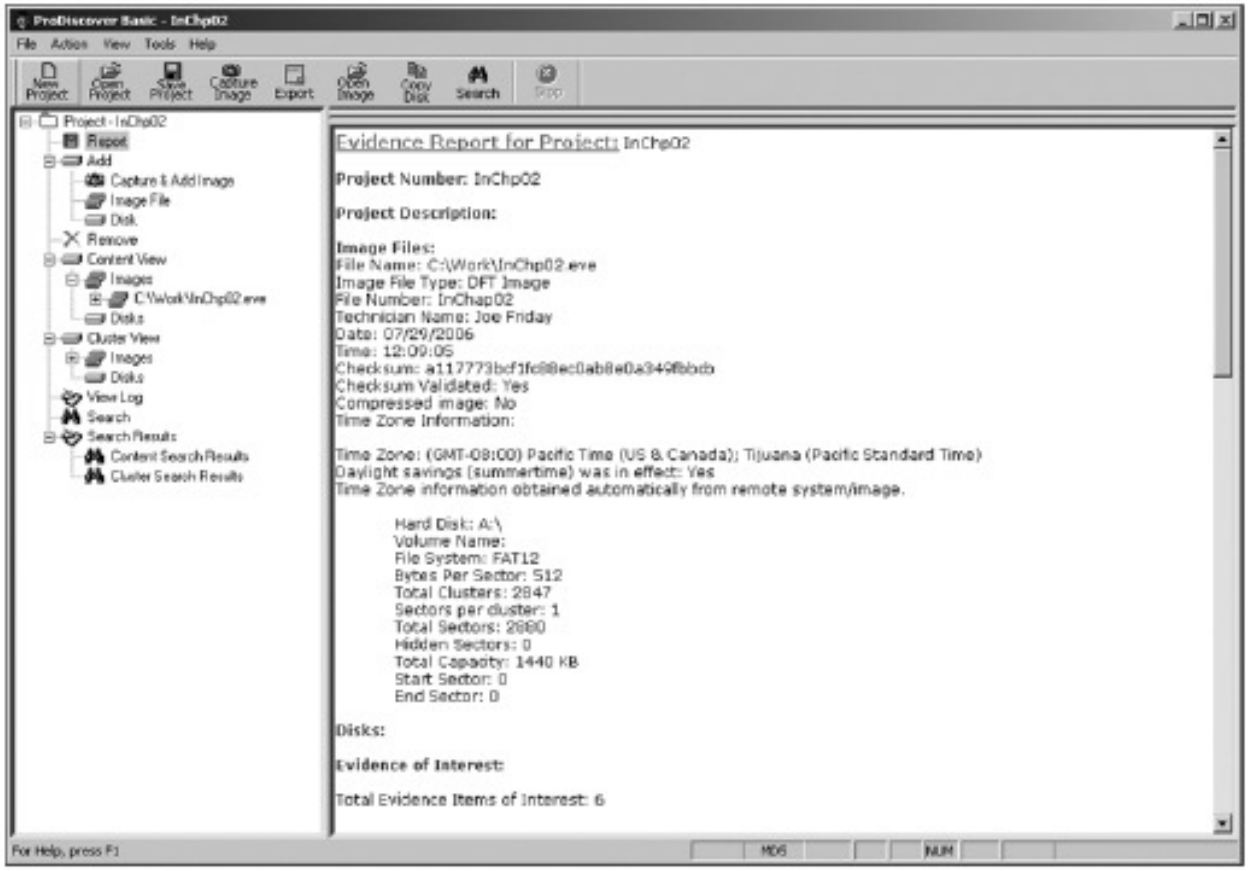

Figure 2-15 A ProDiscover report

Completing the Case

- You need to produce a final report
  - State what you did and what you found
- Include ProDiscover report to document your work
- **Repeatable findings**
  - Repeat the steps and produce the same result
- 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?

Summary

- Always use a systematic approach to your investigations
- Always plan a case taking into account the nature of the case, case requirements, and gathering evidence techniques
- Both criminal cases and corporate-policy violations can go to court
- Plan for contingencies for any problems you might encounter
- Keep track of the chain of custody of your evidence

Summary (continued)

- Internet and media leak investigations require examining server log data
- For attorney-client privilege cases, all written communication should remain confidential
- A bit-stream copy is a bit-by-bit duplicate of the original disk
- Always maintain a journal to keep notes on exactly what you did
- You should always critique your own work