

Guide to Computer Forensics and Investigations Fourth Edition

Chapter 12 E-mail Investigations

Objectives

- Explain the role of e-mail in investigations
- Describe client and server roles in e-mail
- Describe tasks in investigating e-mail crimes and violations
- Explain the use of e-mail server logs
- Describe some available e-mail computer forensics tools

Exploring the Role of E-mail in Investigations

Exploring the Role of E-mail in Investigations

- With the increase in e-mail scams and fraud attempts with phishing or spoofing
 - Investigators need to know how to examine and interpret the unique content of e-mail messages
- **Phishing** e-mails are in HTML format
 - Which allows creating links to text on a Web page
- One of the most noteworthy e-mail scams was 419, or the Nigerian Scam
- **Spoofing** e-mail can be used to commit fraud

Munshani v. Signal Lake Venture Fund

- Munshani received an email and altered it
- But he failed to alter the ESMTP numbers which uniquely identify each message an SMTP server transmits
- Comparing ESMTP numbers from the server and the spoofed email revealed the fraud
 - Link Ch 12a

Exploring the Roles of the Client and Server in E-mail

Exploring the Roles of the Client and Server in E-mail

- Send and receive e-mail in two environments
 - Internet
 - Controlled LAN, MAN, or WAN
- **Client/server architecture**
 - Server OS and e-mail software differs from those on the client side
- Protected accounts
 - Require usernames and passwords

Exploring the Roles of the Client and Server in E-mail (continued)

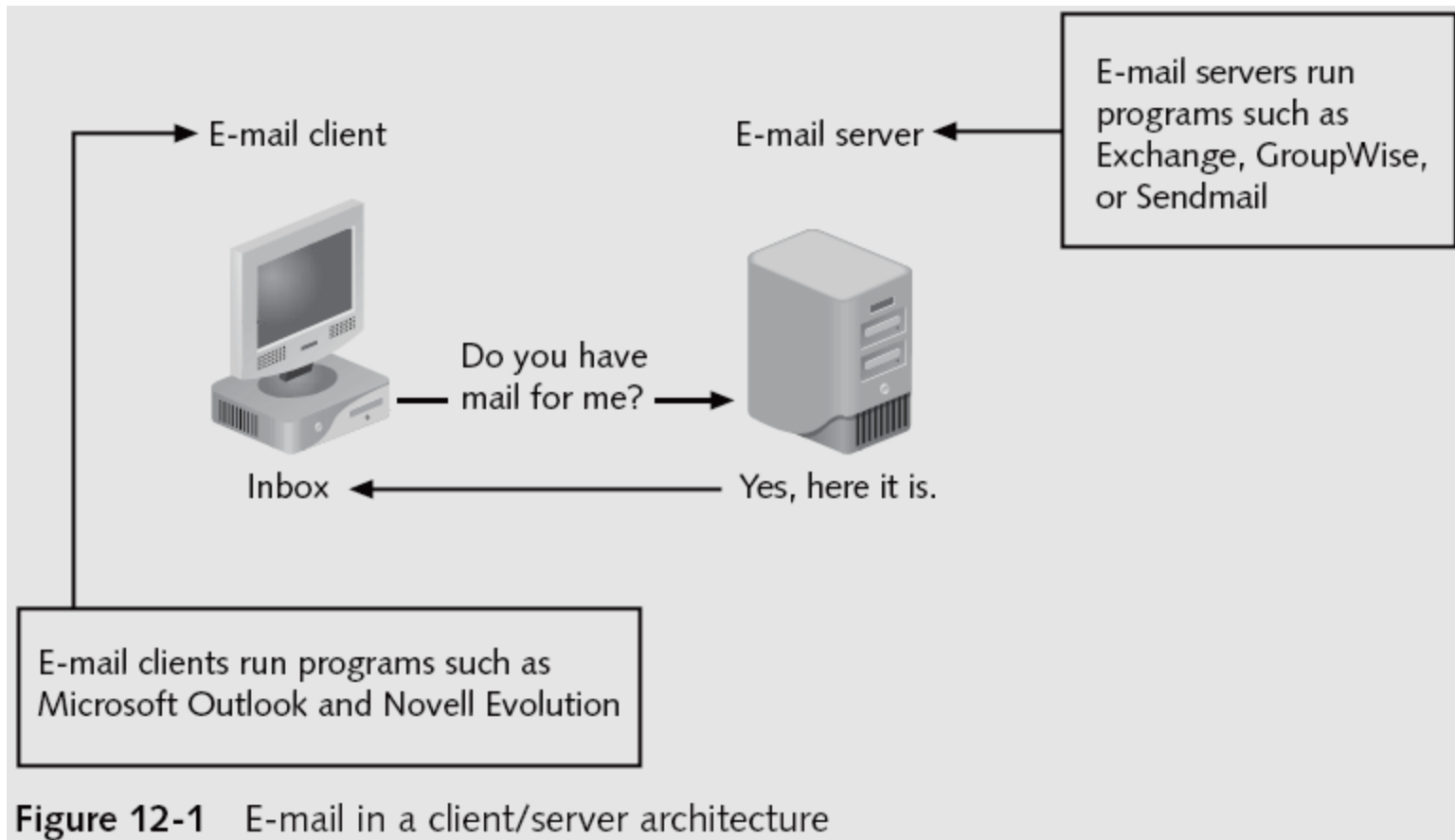


Figure 12-1 E-mail in a client/server architecture

Exploring the Roles of the Client and Server in E-mail (continued)

- Name conventions
 - Corporate: john.smith@somecompany.com
 - Public: whatever@hotmail.com
 - Everything after @ belongs to the domain name
- Tracing corporate e-mails is easier
 - Because accounts use standard names the administrator establishes

Investigating E-mail Crimes and Violations

Investigating E-mail Crimes and Violations

- Similar to other types of investigations
- Goals
 - Find who is behind the crime
 - Collect the evidence
 - Present your findings
 - Build a case

Investigating E-mail Crimes and Violations (continued)

- Depend on the city, state, or country
 - Example: spam
 - Always consult with an attorney
- Becoming commonplace
- Examples of crimes involving e-mails
 - Narcotics trafficking
 - Extortion
 - Sexual harassment
 - Child abductions and pornography

Examining E-mail Messages

- Access victim's computer to recover the evidence
- Using the victim's e-mail client
 - Find and copy evidence in the e-mail
 - Access protected or encrypted material
 - Print e-mails
- Guide victim on the phone
 - Open and copy e-mail including headers
- Sometimes you will deal with deleted e-mails

Examining E-mail Messages (continued)

- Copying an e-mail message
 - Before you start an e-mail investigation
 - You need to copy and print the e-mail involved in the crime or policy violation
 - You might also want to forward the message as an attachment to another e-mail address
- With many GUI e-mail programs, you can copy an e-mail by dragging it to a storage medium
 - Or by saving it in a different location

Examining E-mail Messages (continued)

Messages in the selected folder are displayed here

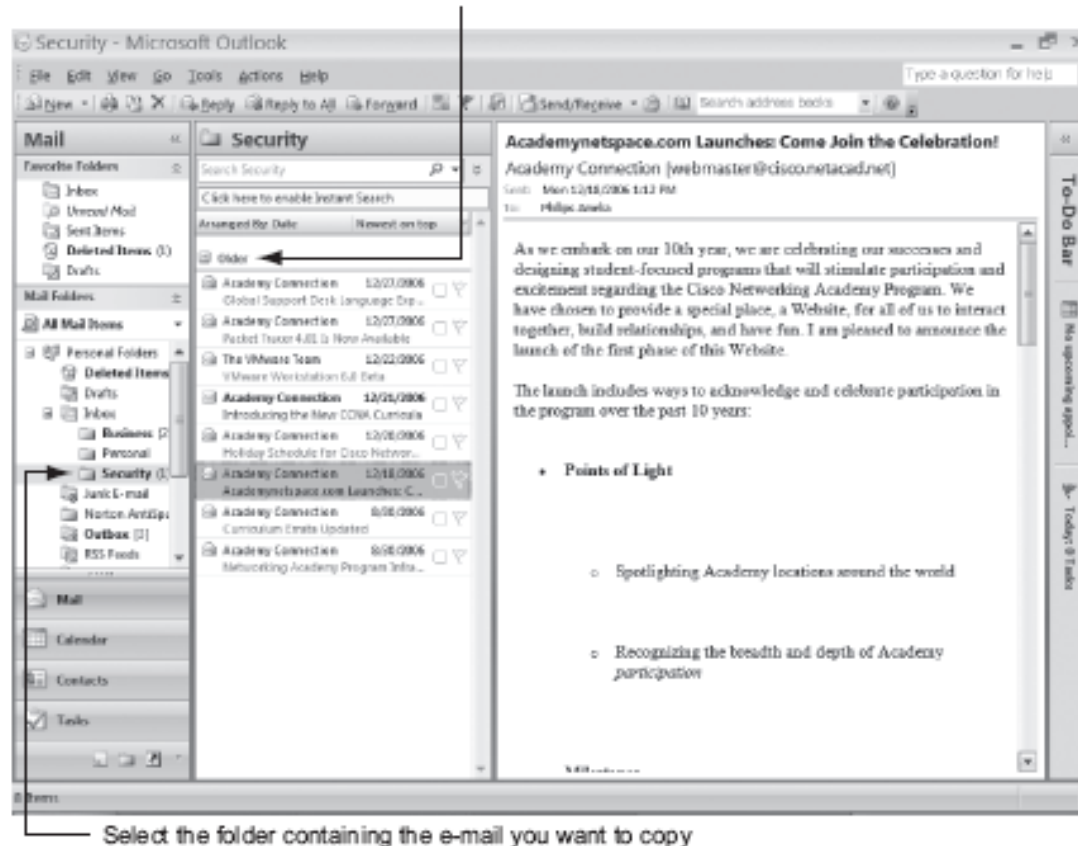


Figure 12-2 Selecting an e-mail to copy

Viewing E-mail Headers

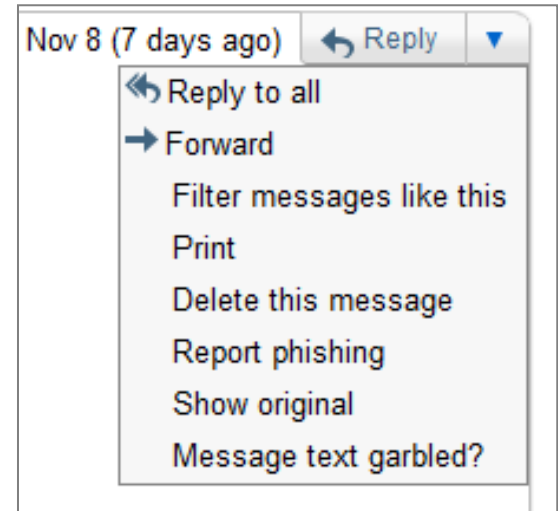
- Learn how to find e-mail headers
 - GUI clients
 - Command-line clients
 - Web-based clients
- After you open e-mail headers, copy and paste them into a text document
 - So that you can read them with a text editor
- Headers contain useful information
 - Unique identifying numbers, IP address of sending server, and sending time

Viewing E-mail Headers (continued)

- Outlook
 - Open the Message Options dialog box
 - Copy headers
 - Paste them to any text editor
- Outlook Express
 - Open the message Properties dialog box
 - Select Message Source
 - Copy and paste the headers to any text editor

Email Headers in Gmail

- Click “Reply” drop-down arrow, “Show original”



```
Delivered-To: sam.bowne@gmail.com
Received: by 10.220.199.195 with SMTP id et3cs9078vcb;
      Mon, 8 Nov 2010 17:50:42 -0800 (PST)
Return-Path: <ccsf_hackers+bncCmRI05G0FxDn0eLmBBoEmBaGPQ@googlegroups.com>
Received-SPF: pass (google.com: domain of ccsf_hackers+bncCmRI05G0FxDn0eLmBBoEmBaGPQ@
10.142.149.8 as permitted sender) client-ip=10.142.149.8;
Authentication-Results: mr.google.com; spf=pass (google.com: domain of
ccsf_hackers+bncCmRI05G0FxDn0eLmBBoEmBaGPQ@googlegroups.com designates 10.142.149.8 a
smtp.mail=ccsf_hackers+bncCmRI05G0FxDn0eLmBBoEmBaGPQ@googlegroups.com; dkim=pass
header.i=ccsf_hackers+bncCmRI05G0FxDn0eLmBBoEmBaGPQ@googlegroups.com
Received: from mr.google.com ([10.142.149.8])
      by 10.142.149.8 with SMTP id w8mr1776030wfd.45.1289267441901 (num_hops = 1);
      Mon, 08 Nov 2010 17:50:41 -0800 (PST)
DKIM-Signature: v=1; a=rsa-sha256; c=relaxed/relaxed;
```

Viewing E-mail Headers (continued)

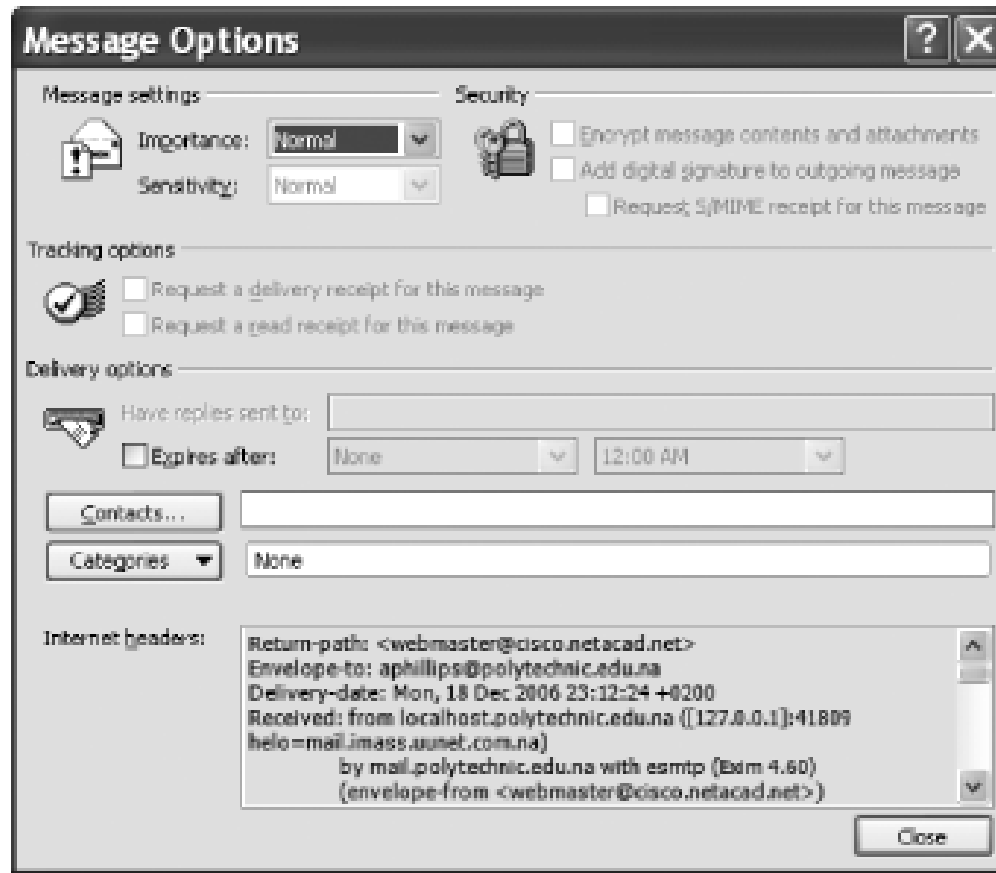


Figure 12-3 An Outlook e-mail header

Examining E-mail Headers

- Gather supporting evidence and track suspect
 - Return path
 - Recipient's e-mail address
 - Type of sending e-mail service
 - IP address of sending server
 - Name of the e-mail server
 - Unique message number
 - Date and time e-mail was sent
 - Attachment files information
 - See link Ch 12b for an example—tracing the source of spam

Examining Additional E-mail Files

- E-mail messages are saved on the client side or left at the server
- Microsoft Outlook uses .pst and .ost files
- Most e-mail programs also include an electronic address book
- In Web-based e-mail
 - Messages are displayed and saved as Web pages in the browser's cache folders
 - Many Web-based e-mail providers also offer instant messaging (IM) services

Tracing an E-mail Message

- Contact the administrator responsible for the sending server
- Finding domain name's point of contact
 - www.arin.net
 - www.internic.com
 - www.freeality.com
 - www.google.com
- Find suspect's contact information
- Verify your findings by checking network e-mail logs against e-mail addresses

Using Network E-mail Logs

- Router logs
 - Record all incoming and outgoing traffic
 - Have rules to allow or disallow traffic
 - You can resolve the path a transmitted e-mail has taken
- Firewall logs
 - Filter e-mail traffic
 - Verify whether the e-mail passed through
- You can use any text editor or specialized tools

Using Network E-mail Logs (continued)

E:\Program Files\WatchGuard\logs\10.0.1.2-2003-02-10-19-51-43.log - LogViewer

File Edit View Help

Destination	S. Port	D. Port	Details
deny out eth1	218	smtp	20 128 169.254.19.156 169.254.255.255 138 138
deny out eth1	96	smtp	20 128 169.254.19.156 169.254.255.255 137 137
deny out eth1	96	smtp	20 128 169.254.19.156 169.254.255.255 137 137
deny out eth1	96	smtp	20 128 169.254.19.156 169.254.255.255 137 137
deny out eth1	96	smtp	20 128 169.254.19.156 169.254.255.255 137 137
deny out eth1	96	smtp	20 128 169.254.19.156 169.254.255.255 137 137
deny out eth1	96	smtp	20 128 169.254.19.156 169.254.255.255 137 137
deny out eth1	96	smtp	20 128 169.254.19.156 169.254.255.255 137 137
deny out eth1	96	smtp	20 128 169.254.19.156 169.254.255.255 137 137
deny out eth1	206	smtp	20 128 169.254.19.156 169.254.255.255 138 138
deny out eth1	206	smtp	20 128 169.254.19.156 169.254.255.255 138 138
deny out eth1	236	smtp	20 128 169.254.19.156 169.254.255.255 138 138
deny out eth1	78	smtp	20 128 169.254.19.156 169.254.255.255 137 137
deny out eth1	78	smtp	20 128 169.254.19.156 169.254.255.255 137 137
deny out eth1	78	smtp	20 128 169.254.19.156 169.254.255.255 137 137
deny out eth1	78	smtp	20 128 169.254.19.156 169.254.255.255 137 137

Log file is loaded. Total Lines: 83 At entry 56: 67% into file.

Figure 12-13 A firewall log

Understanding E-mail Servers

Understanding E-mail Servers

- Computer loaded with software that uses e-mail protocols for its services
 - And maintains logs you can examine and use in your investigation
- E-mail storage
 - Database
 - Flat file
- Logs
 - Default or manual
 - Continuous and circular

Understanding E-mail Servers (continued)

- Log information
 - E-mail content
 - Sending IP address
 - Receiving and reading date and time
 - System-specific information
- Contact suspect's network e-mail administrator as soon as possible
- Servers can recover deleted e-mails
 - Similar to deletion of files on a hard drive

Understanding E-mail Servers (continued)

```
Administrator@superiorbicycles.biz -2010-10-16 09:44:22 GMT
10.0.1.205 pegasus.superiorbicycles.biz PEGASUS 10.0.1.205

Jim.hu@superiorbicycles.biz 1019
5.2.0.9.0.20101016072308.00a543|44@pegasus.superiorbicycles.biz 0
487 1 2010-10-16 09:44:22 GMT
```

Figure 12-14 An e-mail server log file

Examining UNIX E-mail Server Logs

- /etc/sendmail.cf
 - Configuration information for Sendmail
- /etc/syslog.conf
 - Specifies how and which events Sendmail logs
- /var/log/maillog
 - **SMTP** and **POP3** communications
 - IP address and time stamp
- Check UNIX man pages for more information

Examining UNIX E-mail Server Logs (continued)

```
# The following line will send all mail logs to the /var/log/maillog
directory
mail.* /var/log/maillog
# Log all emergency messages in the same place
*.emerg *
*.emerg @superiorbicycles.biz
# This line will put all news and e-mail encoded with uuwp with
Critical errors in the #/var/log/spooler
uuwp, news.crit
```

Figure 12-15 A typical syslog.conf file

Examining UNIX E-mail Server Logs (continued)

```
May 21 10:10:32 poser sendmail[5365]: NOQUEUE: "wir" command from  
[10.0.1.1] (10.0.1.1)  
May 21 10:10:32 poser sendmail[5365]: NOQUEUE: "debug" command from  
[10.0.1.1] (10.0.1.1)
```

Figure 12-16 A maillog file with SMTP information

```
May 21 10:12:44 poser ?pop3d[5373]: port 110 service init from 10.0.1.1  
May 21 10:12:44 poser ?pop3d[5373]: Login failure user=rich  
host=[10.0.1.1]
```

Figure 12-17 A maillog file with POP3 information

Examining Microsoft E-mail Server Logs

- Microsoft Exchange Server (Exchange)
 - Uses a database
 - Based on Microsoft Extensible Storage Engine
- Messaging Application Programming Interface (MAPI)
 - A Microsoft system that enables different e- mail applications to work together

Examining Microsoft E-mail Server Logs

- The “Information Store” is made of two files
 - Database files *.edb
 - Responsible for MAPI information
 - Database files *.stm
 - Responsible for non-MAPI information

Examining Microsoft E-mail Server Logs (continued)

- Administrators can recover lost or deleted emails from these files:
 - Transaction log
 - Keep track of e-mail databases
 - Checkpoints
 - Marks the place in the transaction log where the last backup was made

Examining Microsoft E-mail Server Logs (continued)

- Other useful files
 - Temporary files
 - E-mail communication logs
 - res#.log
 - Tracking.log
 - Tracks messages

Examining Microsoft E-mail Server Logs (continued)



```
20021216.log - Notepad
File Edit Format Help
# Message Tracking Log File# Exchange System Attendant Version
6.0.4417.00# Date      Time      client-ip      client-hostname
Partner-Name      server-hostname server-ip      recipient-address
Event-ID      MSGID      Priority      Recipient-Report-Status
Total-bytes      Number-recipients      origination-time
Encryption      service-version Linked-MSGID      Message-Subject
Sender-Address0002005-12-16 17:8:30 GMT - - -
PEGASUS - /O=ZOIKES/OU=FIRST ADMINISTRATIVE
GROUP/CN=RECIPIENTS/CN=Janedoe 1027
11A0DC98C6BC774BA0B32AE932D5B3E02E49@pegasus.mycompany.com 0
Q 1320 1 2005-12-16 17:8:30 GMT 0 -
c-us;a= ;p=ZOIKES;l=PEGASUS-0212161708282-1 One for the books
EX:/O=ZOIKES/OU=FIRST ADMINISTRATIVE
GROUP/CN=RECIPIENTS/CN=ADMINISTRATOR -002005-12-16 17:8:31 GMT
- - - PEGASUS - /O=ZOIKES/OU=FIRST
ADMINISTRATIVE GROUP/CN=RECIPIENTS/CN=Janedoe 1019
11A0DC98C6BC774BA0B32AE932D5B3E02E49@pegasus.mycompany.com 0
O 1320 1 2005-12-16 17:8:30 GMT 0 -
One for the books - -002005-12-16 17:8:31 GMT -
- - PEGASUS - /O=ZOIKES/OU=FIRST ADMINISTRATIVE
GROUP/CN=RECIPIENTS/CN=Janedoe 1025
11A0DC98C6BC774BA0B32AE932D5B3E02E49@pegasus.mycompany.com 0
O 1320 1 2005-12-16 17:8:30 GMT 0 -
One for the books - -002005-12-16 17:8:31 GMT -
- - PEGASUS - /O=ZOIKES/OU=FIRST ADMINISTRATIVE
GROUP/CN=RECIPIENTS/CN=Janedoe 1024
11A0DC98C6BC774BA0B32AE932D5B3E02E49@pegasus.mycompany.com 0
```

Figure 12-18 A message tracking log in verbose mode

Examining Microsoft E-mail Server Logs (continued)

- Troubleshooting or diagnostic log
 - Logs events
 - Use Windows Event Viewer
 - Open the Event Properties dialog box for more details about an event

Examining Microsoft E-mail Server Logs (continued)

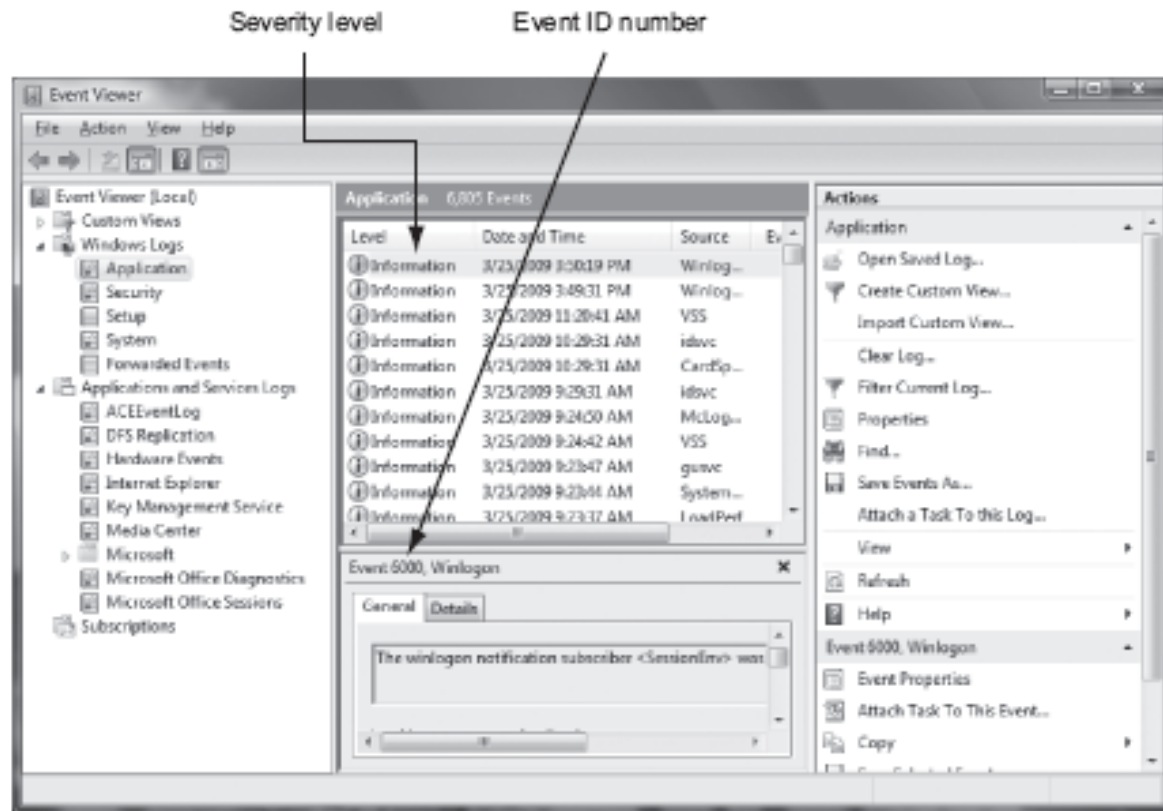


Figure 12-19 Viewing a log in Event Viewer

Examining Microsoft E-mail Server Logs (continued)

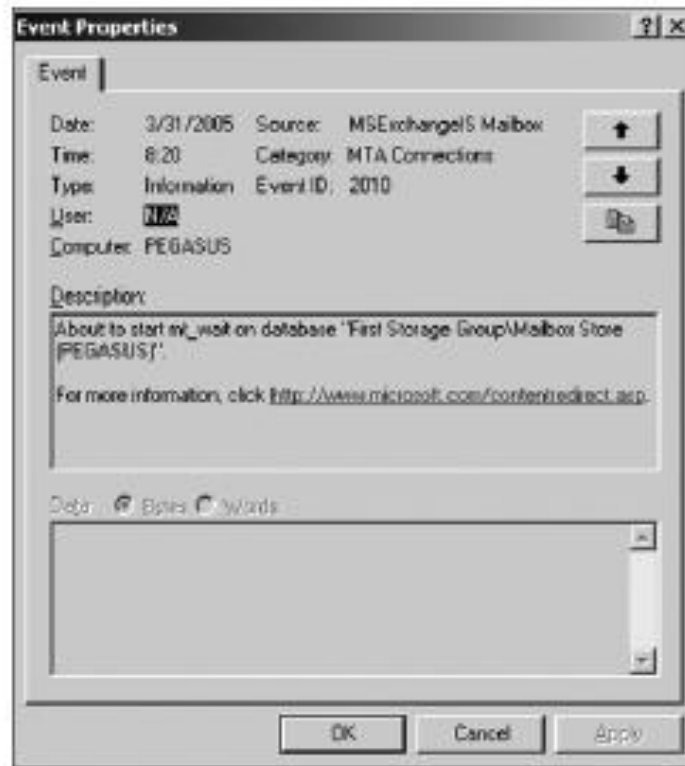


Figure 12-20 The Event Properties dialog box

Examining Novell GroupWise E-mail Logs

- Up to 25 databases for e-mail users
 - Stored on the Ofuser directory object
 - Referenced by a username, an unique identifier, and .db extension
- Shares resources with e-mail server databases
- Mailboxes organizations
 - Permanent index files
 - QuickFinder

Examining Novell GroupWise E-mail Logs (continued)

- Folder and file structure can be complex
 - It uses Novell directory structure
- Guardian
 - Directory of every database
 - Tracks changes in the GroupWise environment
 - Considered a single point of failure
- Log files
 - GroupWise generates log files (.log extension) maintained in a standard log format in GroupWise folders

Using Specialized E-mail Forensics Tools

Using Specialized E-mail Forensics Tools

- Tools include:
 - AccessData's Forensic Toolkit (FTK)
 - ProDiscover Basic
 - FINALeMAIL
 - Sawmill-GroupWise
 - DBXtract
 - Fookes Aid4Mail and MailBag Assistant
 - Paraben E-Mail Examiner
 - Ontrack Easy Recovery EmailRepair
 - R-Tools R-Mail

Using Specialized E-mail Forensics Tools (continued)

- Tools allow you to find:
 - E-mail database files
 - Personal e-mail files
 - Offline storage files
 - Log files
- Advantage
 - Do not need to know how e-mail servers and clients work

Using Specialized E-mail Forensics Tools (continued)

- FINALeMAIL
 - Scans e-mail database files
 - Recovers deleted e-mails
 - Searches computer for other files associated with e-mail

Using Specialized E-mail Forensics Tools (continued)

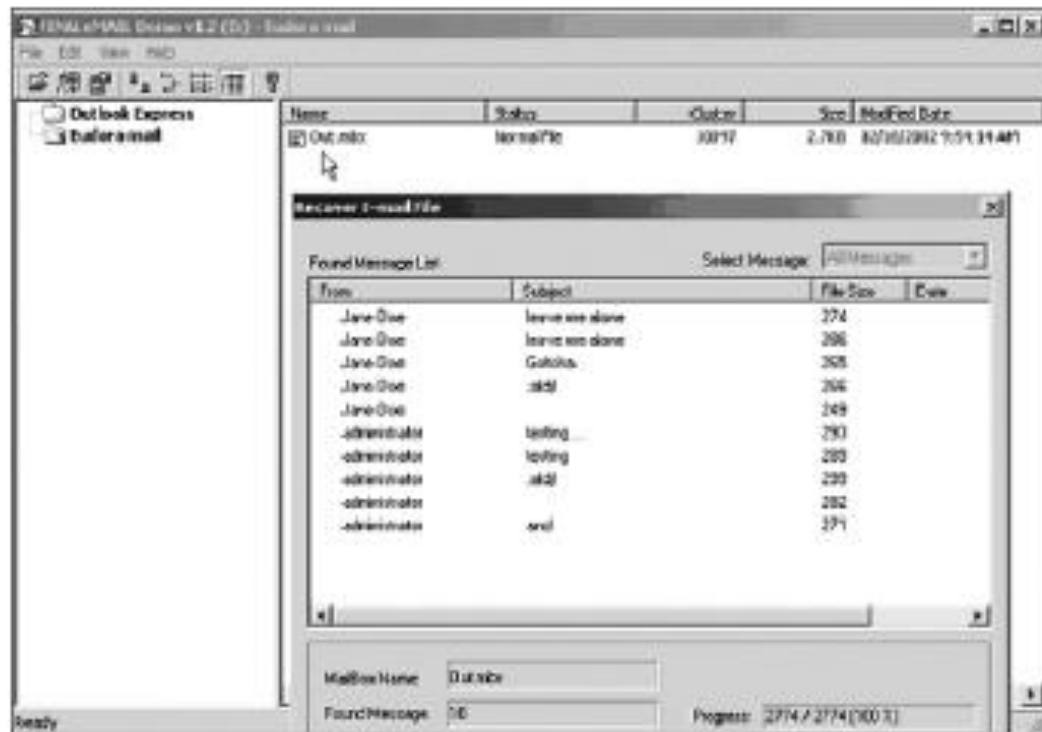


Figure 12-21 E-mail search results in FINALEMAIL

Using Specialized E-mail Forensics Tools (continued)

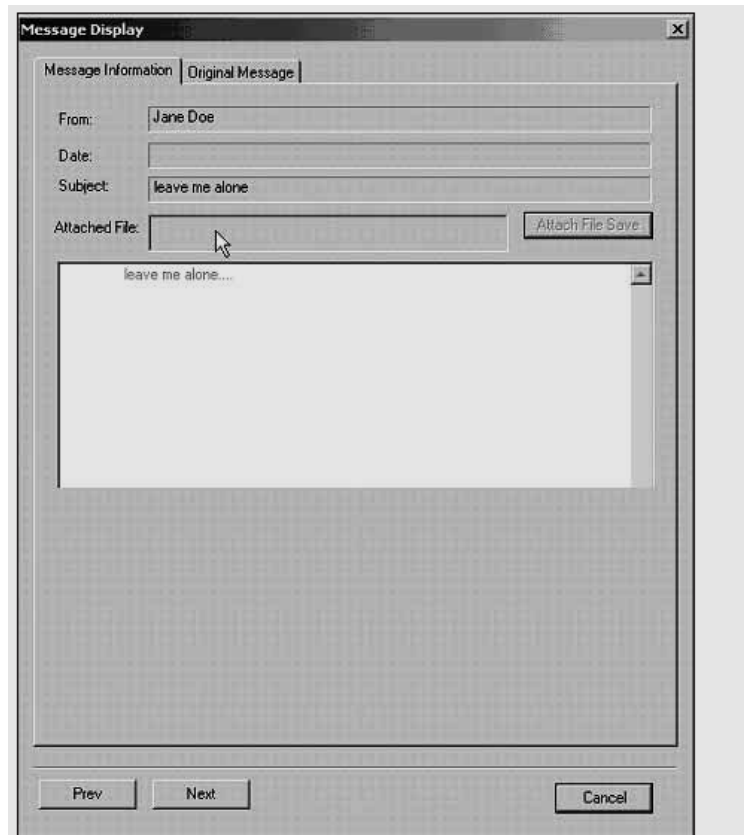


Figure 12-23 Viewing message contents in FINALEMAIL

Using AccessData FTK to Recover E-mail

- FTK
 - Can index data on a disk image or an entire drive for faster data retrieval
 - Filters and finds files specific to e-mail clients and servers
- To recover e-mail from Outlook and Outlook Express
 - AccessData integrated dtSearch
 - dtSearch builds a b-tree index of all text data in a drive, an image file, or a group of files

Using AccessData FTK to Recover E-mail (continued)

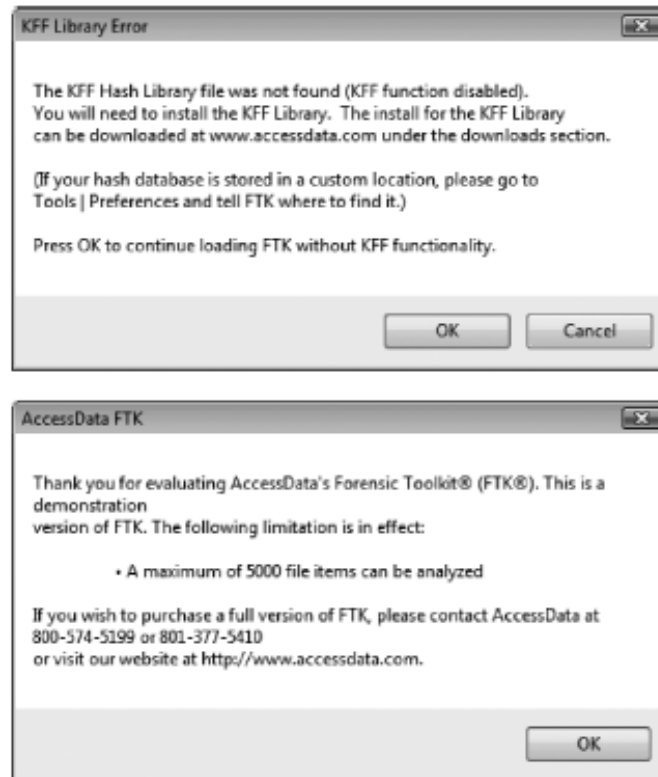


Figure 12-24 KFF warning and AccessData's evaluation notice

Using AccessData FTK to Recover E-mail (continued)

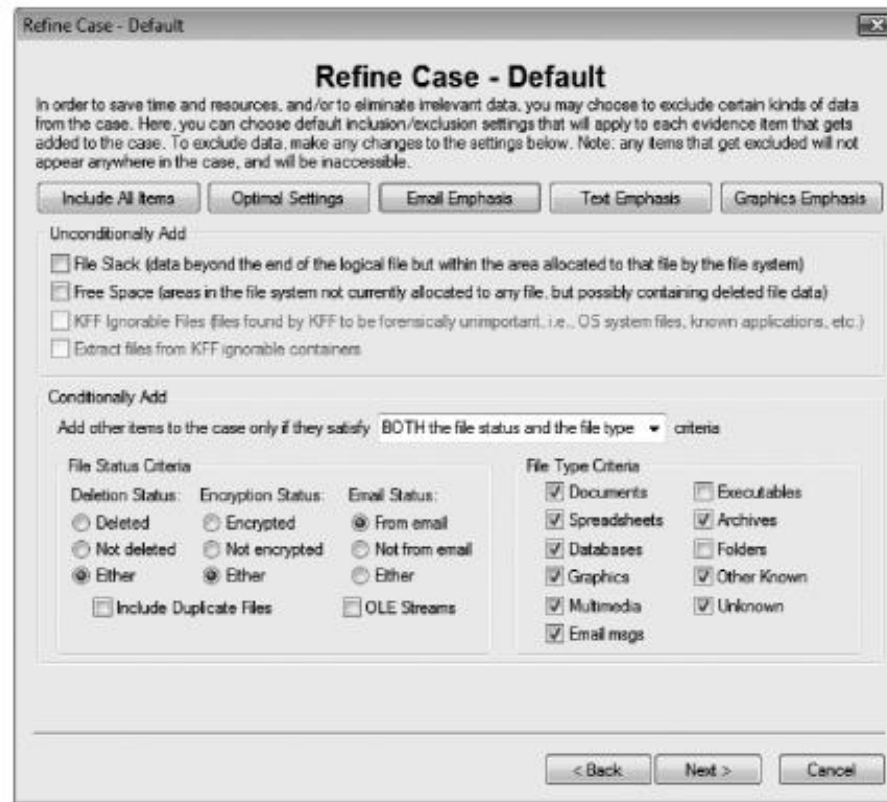


Figure 12-25 The Refine Case - Default dialog box

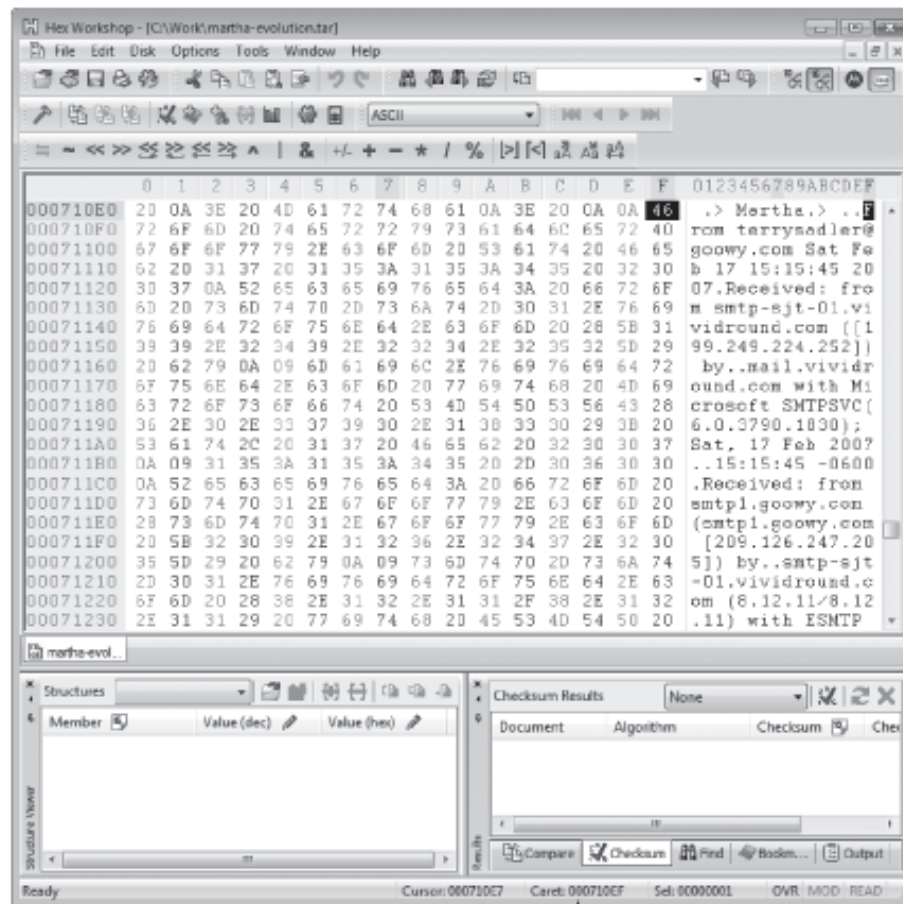
Using AccessData FTK to Recover E-mail (continued)



Figure 12-28 The E-Mail tab showing all messages

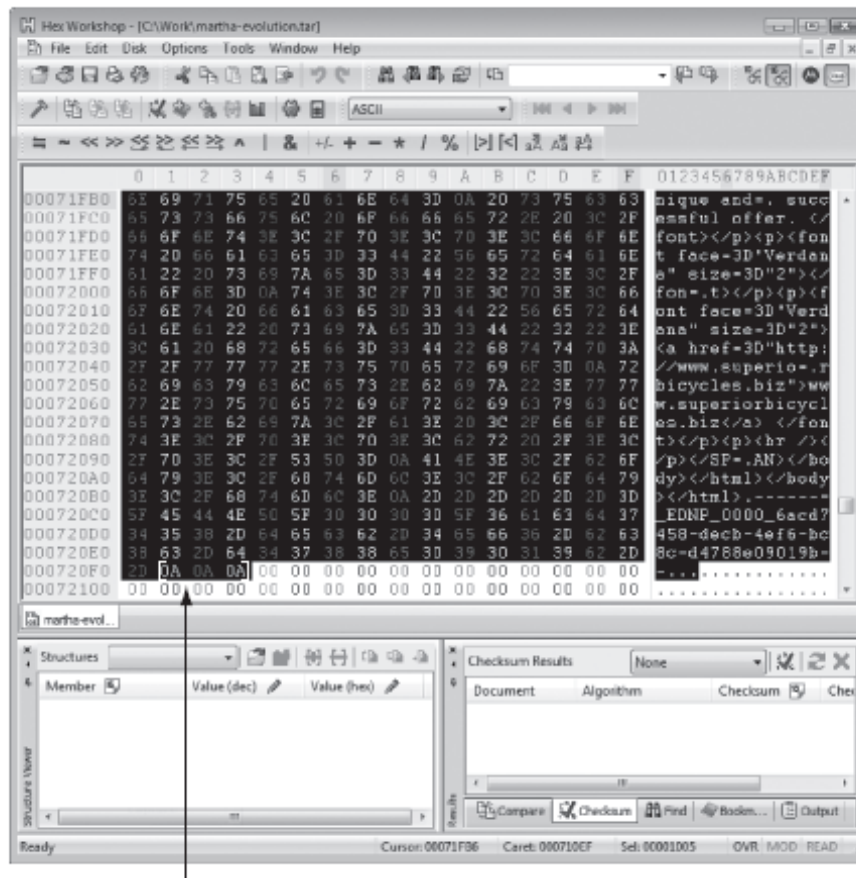
Using a Hexadecimal Editor to Carve E-mail Messages

- Very few vendors have products for analyzing e-mail in systems other than Microsoft
- **mbox** format
 - Stores e-mails in flat plaintext files
- **Multipurpose Internet Mail Extensions (MIME)** format
 - Used by vendor-unique e-mail file systems, such as Microsoft .pst or .ost
- Example: carve e-mail messages from Evolution



Offset byte count from beginning of file

Figure 12-29 Hex Workshop displaying the beginning of the e-mail from Terry Sadler



Ending position for this message

Figure 12-30 Hex Workshop displaying the ending position of the e-mail from Terry Sadler

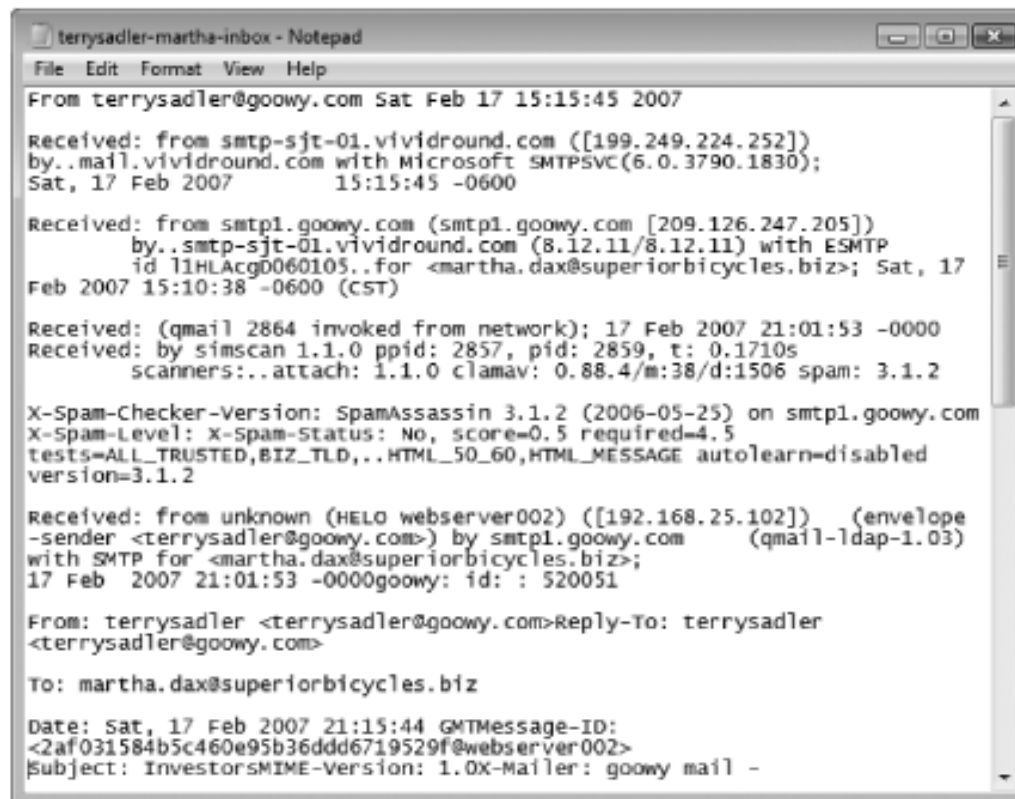
Using a Hexadecimal Editor to Carve E-mail Messages (continued)



```
terradsler-martha-inbox - Notepad
File Edit Format View Help
From terradsler@goowy.com Sat Feb 17 15:15:45 2007Received: from smtp-
s1t-01.vividround.com ([199.249.224.252]) by mail.vividround.com with
Microsoft SMTPSVC(6.0.3790.1830); Sat, 17 Feb 2007 15:15:45 -0600
Received: from smtp1.goowy.com (smtp1.goowy.com [209.126.247.205]) by
smtp-s1t-01.vividround.com (8.12.11/8.12.11) with ESMTP id 11HLACgp060105
for <martha.dax@superiorbicycles.biz>; Sat, 17 Feb 2007 15:10:38 -0600
(CST)Received: (qmail 2864 invoked from network); 17 Feb 2007 21:01:53 -
0000Received: by simscan 1.1.0 ppid: 2857, pid: 2859, t: 0.1710s
scanners: attach: 1.1.0 clamav: 0.88.4/m:38/d:1506 spam: 3.1.2X-
Spam-Checker-Version: SpamAssassin 3.1.2 (2006-05-25) on smtp1.goowy.com
X-Spam-Level: X-Spam-Status: No, score=0.5 required=4.5
tests=ALL_TRUSTED,BIZ_TLD, HTML_50_60,HTML_MESSAGE
autolearn-disabled version=3.1.2Received: from unknown (HELO
webserver002) ([192.168.25.102]) (envelope-sender
<terradsler@goowy.com>) by smtp1.goowy.com (qmail-ladap-1.03) with
SMTP for <martha.dax@superiorbicycles.biz>; 17 Feb 2007 21:01:53 -
0000goowy: id: : 520051From: terradsler <terradsler@goowy.com>Reply-To:
terradsler <terradsler@goowy.com>To: martha.dax@superiorbicycles.biz
Date: Sat, 17 Feb 2007 21:15:44 GMTMessage-ID:
<2af031584b5c460e95b36ddd6719529f@webserver002>Subject: InvestorsSMIME-
version: 1.0X-Mailer: goowy mail - http://www.goowy.comPriority: Normalx
-Priority: 3Content-Type: multipart/alternative; boundary="-----
=_EDNP_0000_6acd7458-decb-4ef6-bc8c-d4788e09019b"x-ePrism-Trap: Default
TrapX-eGuard-Score: () 0.6 BIZ_TLD,HTML_50_60,HTML_MESSAGEX-Scanned-By:
ePrism email filtering appliance on 199.249.224.252Return-Path:
terradsler@goowy.comX-OriginalArrivalTime: 17 Feb 2007 21:15:45.0640
(UTC) FILETIME=[C90BFE80:01C752D8]X-Evolution-Source:
pop://martha.dax@mail.superiorbicycles.biz/X-Evolution: 0000001a-0010This
is a multi-part message in MIME format.-----=_EDNP_0000_6acd7458-decb-
4ef6-bc8c-d4788e09019bContent-Type: text/plain; charset="iso-8859-1"
Content-Transfer-Encoding: quoted-printable-0Ahello, -0A-0Aare you
looking for investors for your company? we speci-alize in small to medium
size companies that have a proven track record- for making quality
```

Figure 12-31 Carved e-mail message in Notepad

Using a Hexadecimal Editor to Carve E-mail Messages (continued)

A screenshot of a Notepad window titled "terradsler-martha-inbox - Notepad". The window contains a text-based email message. The message header includes "From terradsler@goowy.com Sat Feb 17 15:15:45 2007". The body of the message contains several lines of technical information, including "Received: from smtp-sjt-01.vividround.com", "Received: from smtp1.goowy.com", "Received: (qmail 2864 invoked from network)", "Received: by simscan 1.1.0", "X-Spam-Checker-Version: SpamAssassin 3.1.2", "Received: from unknown (HELO webserver002)", "From: terradsler <terradsler@goowy.com>Reply-To: terradsler <terradsler@goowy.com>", "To: martha.dax@superiorbicycles.biz", "Date: Sat, 17 Feb 2007 21:15:44 GMT", "Message-ID: <2af031584b5c460e95b36ddd6719529f@webserver002>", and "Subject: InvestorsMIME-Version: 1.0X-Mailer: goowy mail -".

```
terradsler-martha-inbox - Notepad
File Edit Format View Help
From terradsler@goowy.com Sat Feb 17 15:15:45 2007
Received: from smtp-sjt-01.vividround.com ([199.249.224.252])
by..mail.vividround.com with Microsoft SMTPSVC(6.0.3790.1830);
Sat, 17 Feb 2007 15:15:45 -0600
Received: from smtp1.goowy.com (smtp1.goowy.com [209.126.247.205])
by..smtp-sjt-01.vividround.com (8.12.11/8.12.11) with ESMT
id 11HLAcgD060105..for <martha.dax@superiorbicycles.biz>; Sat, 17
Feb 2007 15:10:38 -0600 (CST)
Received: (qmail 2864 invoked from network); 17 Feb 2007 21:01:53 -0000
Received: by simscan 1.1.0 ppid: 2857, pid: 2859, t: 0.1710s
scanners:..attach: 1.1.0 clamav: 0.88.4/m:38/d:1506 spam: 3.1.2
X-Spam-Checker-Version: SpamAssassin 3.1.2 (2006-05-25) on smtp1.goowy.com
X-Spam-Level: X-Spam-Status: No, score=0.5 required=4.5
tests=ALL_TRUSTED,BIZ_TLD,..HTML_50_60,HTML_MESSAGE autolearn=disabled
version=3.1.2
Received: from unknown (HELO webserver002) ([192.168.25.102]) (envelope
-sender <terradsler@goowy.com>) by smtp1.goowy.com (qmail-ldap-1.03)
with SMTP for <martha.dax@superiorbicycles.biz>;
17 Feb 2007 21:01:53 -0000goowy: id: : 520051
From: terradsler <terradsler@goowy.com>Reply-To: terradsler
<terradsler@goowy.com>
To: martha.dax@superiorbicycles.biz
Date: Sat, 17 Feb 2007 21:15:44 GMTMessage-ID:
<2af031584b5c460e95b36ddd6719529f@webserver002>
Subject: InvestorsMIME-Version: 1.0X-Mailer: goowy mail -
```

Figure 12-32 After formatting the e-mail message in Notepad

Recovering Deleted Outlook Files

- Microsoft's Inbox Repair Tool (scanpst)
 - <http://office.microsoft.com/en-001/outlook-help/repair-outlook-data-files-pst-and-ost-HA010075831.aspx>
 - www.outlook-tips.net/beginner/scanpst.htm
 - www.slipstick.com/outlook/config/recover-deleted-messages-pst-files/

Recovering Deleted Outlook Files

- EnCase
 - <http://encase-forensic-blog.guidancesoftware.com/2014/04/systools-outlook-exporter-for-encase-no.html>
- Advanced Outlook Repair from DataNumen, Inc.
 - www.datanumen.com/outlook-repair