US006070244A

United States Patent [19]

Orchier et al.

[11] **Patent Number: 6,070,244**

[45] **Date of Patent: May 30, 2000**

[54] **COMPUTER NETWORK SECURITY MANAGEMENT SYSTEM**

[75] Inventors: **Jonathan Orchier**; **Raymond Soriano**; **Louis Salvaterra**; **Dario Ardito**; **Anil Byreddy**, all of Brooklyn, N.Y.

[73] Assignee: **The Chase Manhattan Bank**, New York, N.Y.

[21] Appl. No.: **08/966,902**

[22] Filed: **Nov. 10, 1997**

[51] **Int. Cl.^{7}** **G06F 15/16**

[52] **U.S. Cl.** **713/201**; 713/200; 713/201; 709/223; 709/224; 709/225

[58] **Field of Search** 713/200, 201; 709/220, 223, 224, 225, 250, 227, 229; 395/500.44, 500.47, 500.48

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,442,791	8/1995	Wrabetz	709/104
5,566,346	10/1996	Andert	710/8
5,623,667	4/1997	Golshani	395/705
5,655,081	8/1997	Bonnell	709/202
5,675,782	10/1997	Montague	713/201
5,761,669	6/1998	Montague	707/103
5,872,970	2/1999	Pickett	709/101
5,881,232	3/1999	Cheng	709/217
5,966,707	10/1999	Van Huben	707/10

OTHER PUBLICATIONS

Network Briefing "Memco Software tries again with its automated Single Sign–On" May, 28, 1997 n285 Dialog Abstract.

www.bmc.com. Accessed Sep. 30, 1999.

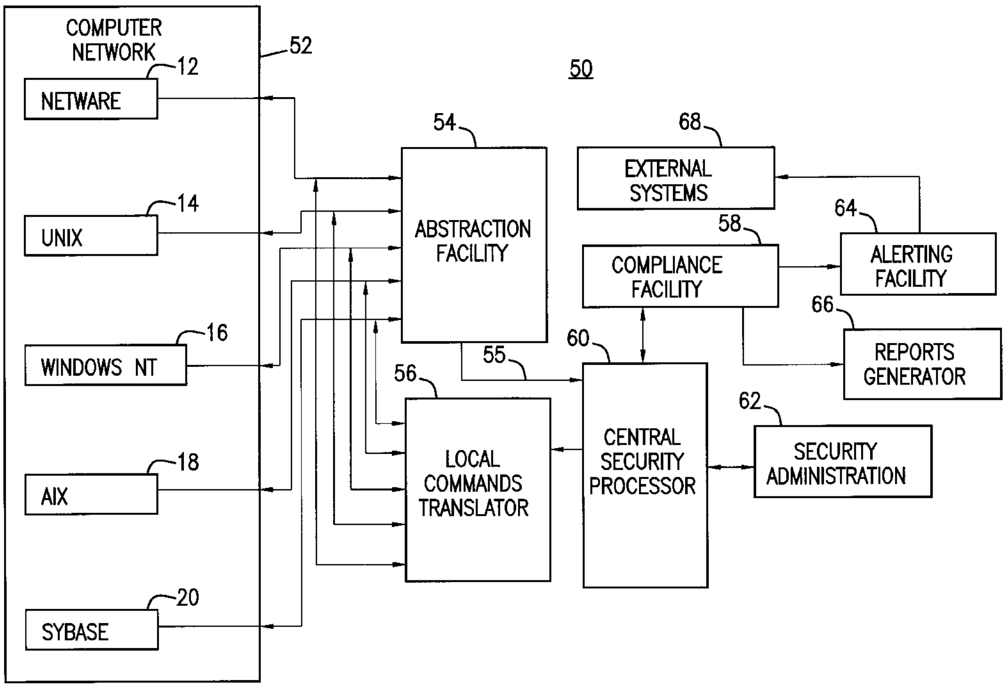
"Internet: Memco Software tries again with its automated Signle Sign–On" Network Briefing, n285, May 28, 1997.

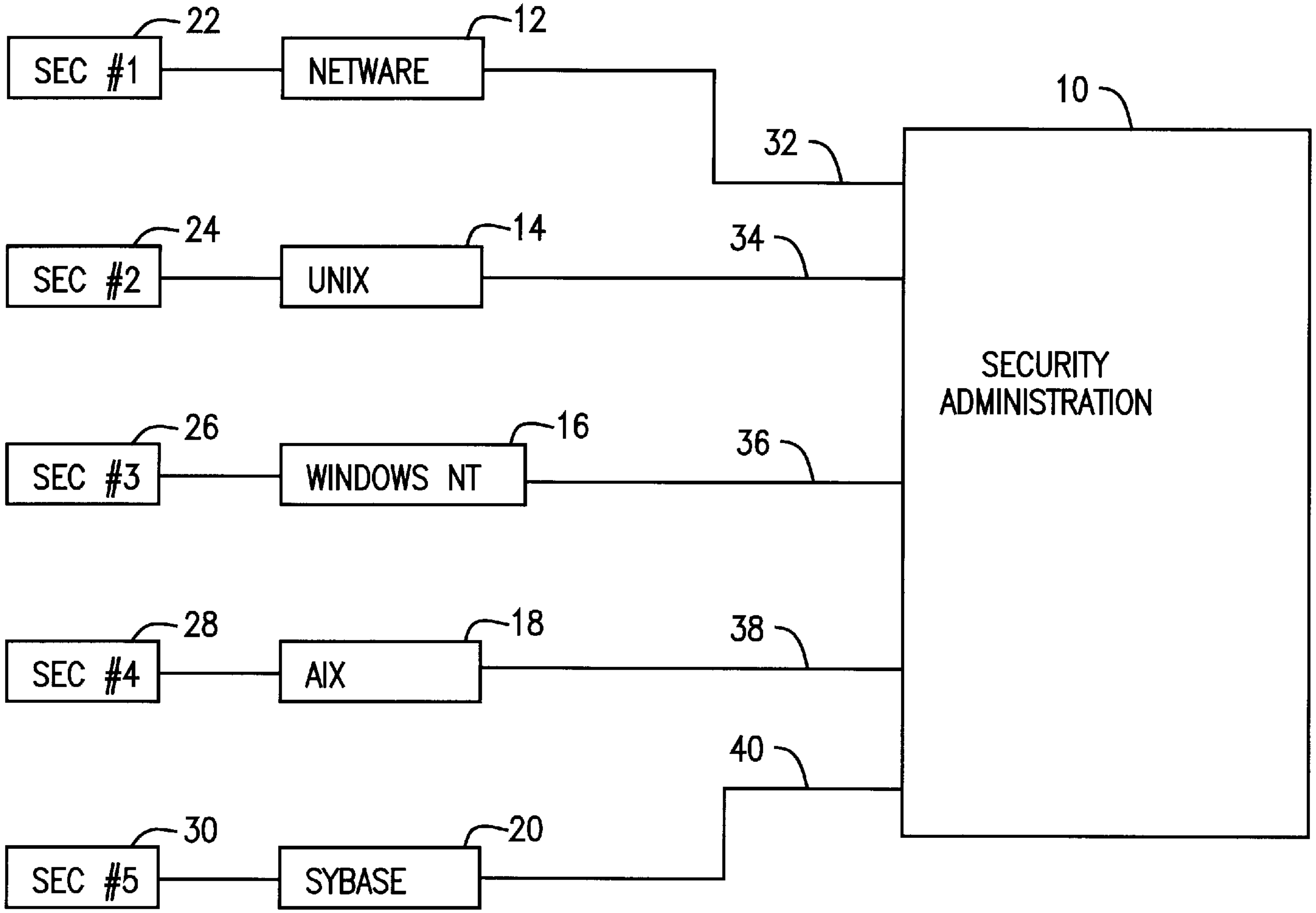
Primary Examiner—Robert W. Beausoliel, Jr.
Assistant Examiner—Bryce P. Bonzo
Attorney, Agent, or Firm—Ostrolenk, Faber, Gerb & Soffen, LLP

[57] **ABSTRACT**

A method and system for controlling computer security. The system is a centralized, computer-network security management tool capable of handling many different kinds of equipment in a standardized format despite differences in the computer security features among the diverse range of computer equipment in the computer network. The invention uses a layered software architecture, including a technology specific layer and a technology independent layer. The technology specific layer serves to extract and maintain security data on target platforms and for converting data to and from a common data model used by the technology independent layer. The technology independent layer handles the main functionality of the system such as locating and removing certain present and former employees from computer access lists, auditing system user data, monitoring security events (e.g. failed login attempts), automatically initiating corrective action, interfacing with the system users, reporting, querying and storing of collected data.

34 Claims, 36 Drawing Sheets





(PRIOR ART)

FIG. 1

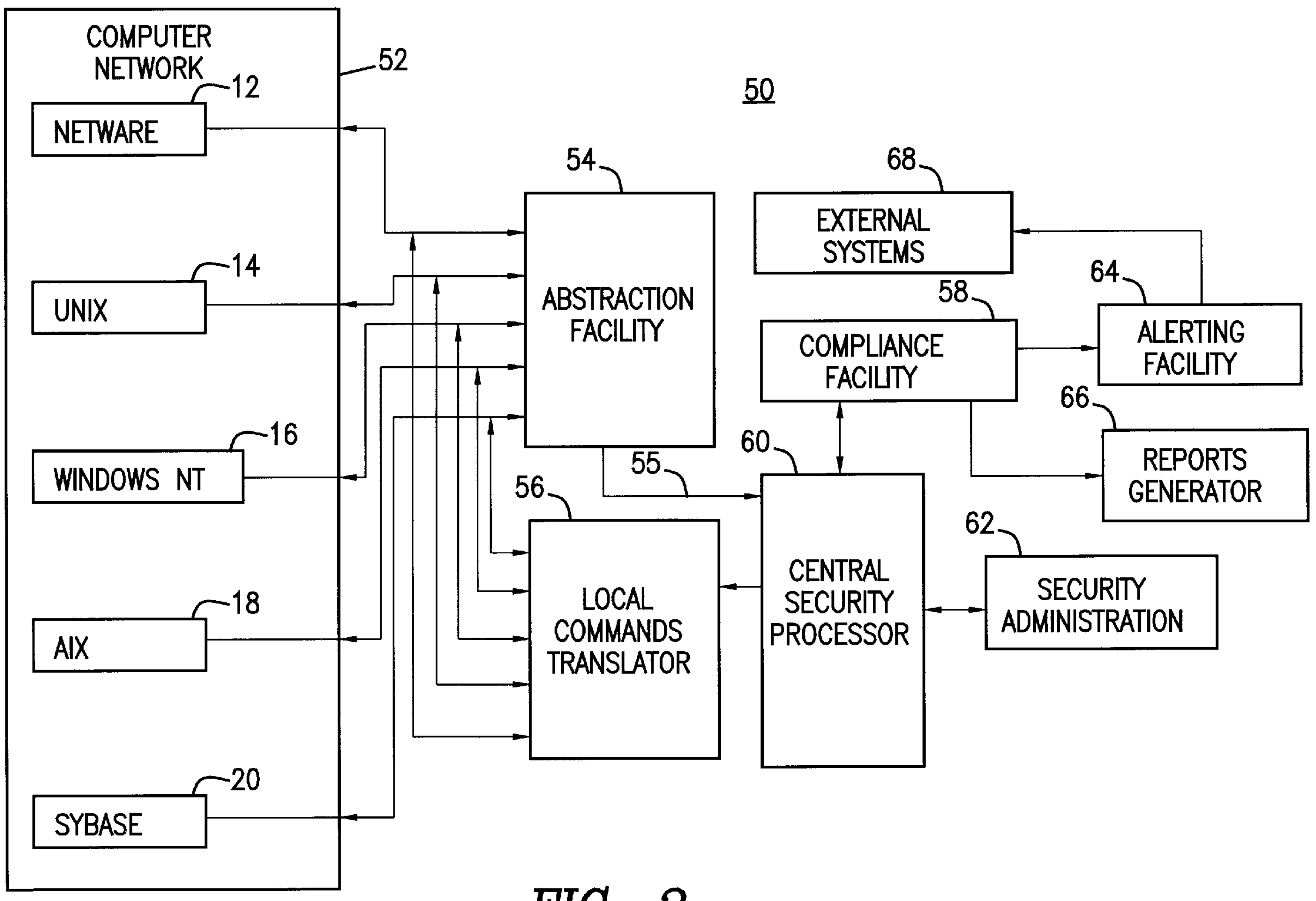

COMPUTER NETWORK
52
50
12
NETWARE
14
UNIX
16
WINDOWS NT
18
AIX
20
SYBASE
54
ABSTRACTION FACILITY
55
56
LOCAL COMMANDS TRANSLATOR
60
CENTRAL SECURITY PROCESSOR
68
EXTERNAL SYSTEMS
58
COMPLIANCE FACILITY
64
ALERTING FACILITY
66
REPORTS GENERATOR
62
SECURITY ADMINISTRATION

FIG. 2

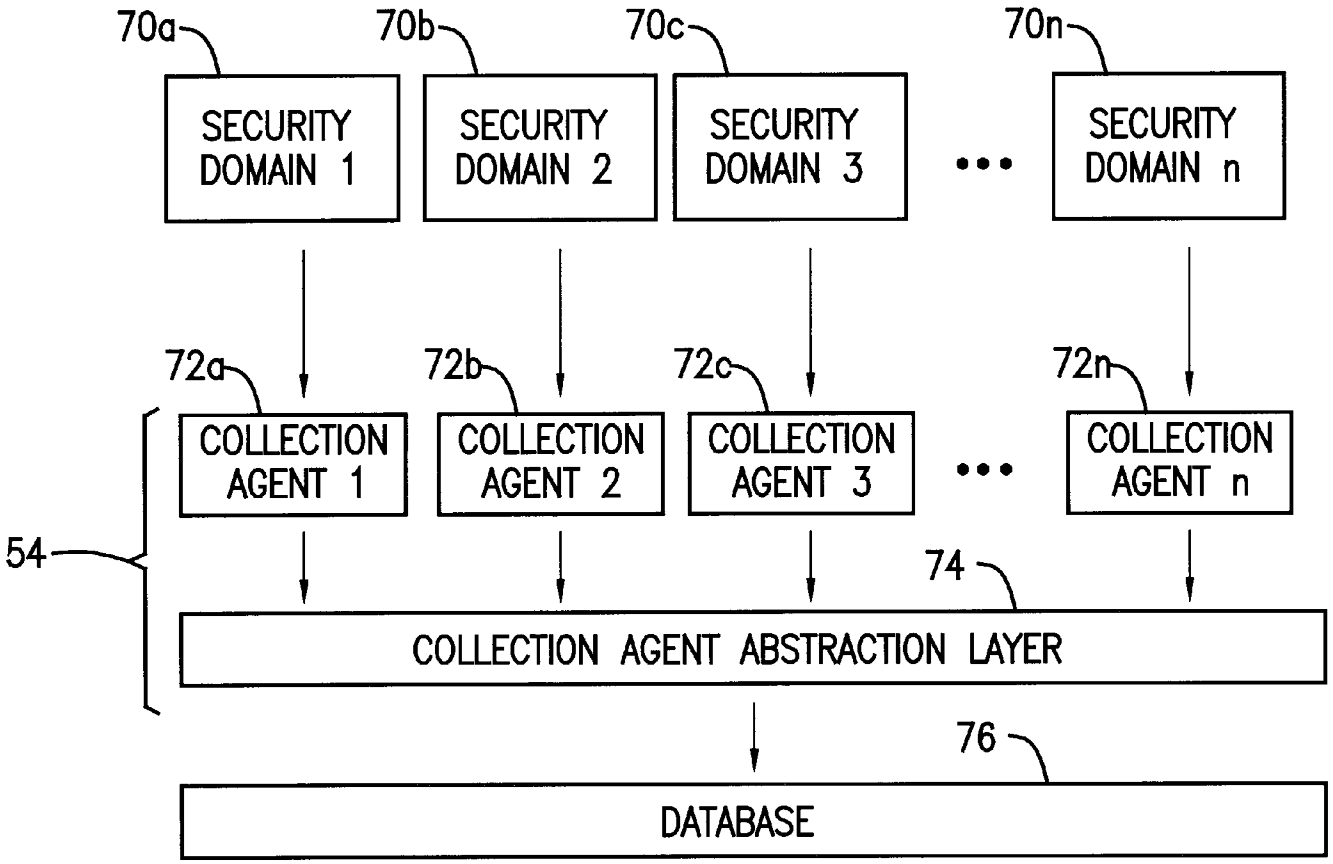

70a
70b
70c
70n
SECURITY DOMAIN 1
SECURITY DOMAIN 2
SECURITY DOMAIN 3
SECURITY DOMAIN n
72a
72b
72c
72n
COLLECTION AGENT 1
COLLECTION AGENT 2
COLLECTION AGENT 3
COLLECTION AGENT n
54
74
COLLECTION AGENT ABSTRACTION LAYER
76
DATABASE

FIG. 3a

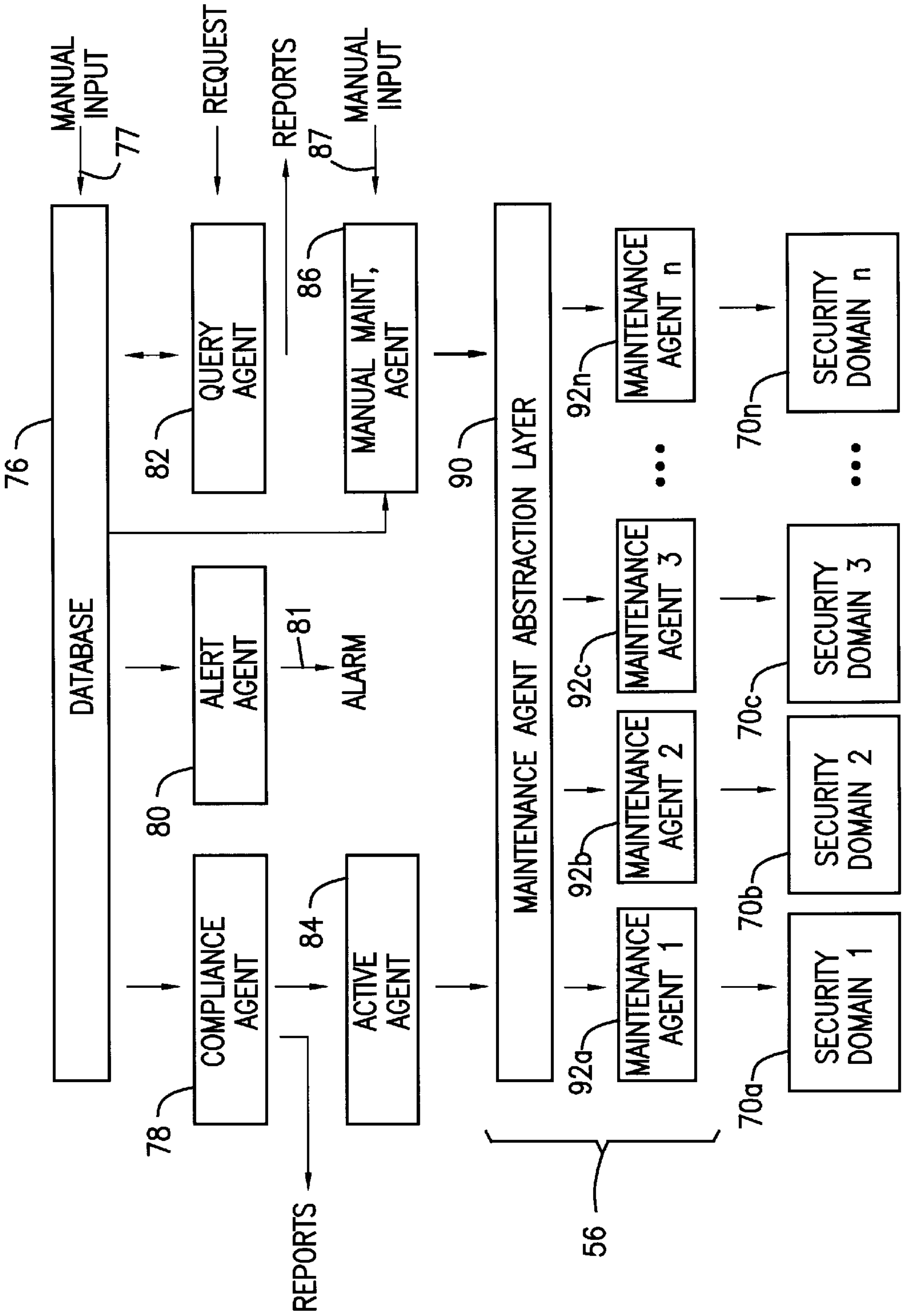

MANUAL INPUT
77
DATABASE
76
REQUEST
QUERY AGENT
82
REPORTS
87
MANUAL INPUT
MANUAL MAINT, AGENT
86
ALERT AGENT
80
81
ALARM
COMPLIANCE AGENT
78
REPORTS
ACTIVE AGENT
84
MAINTENANCE AGENT ABSTRACTION LAYER
90
MAINTENANCE AGENT 1
92a
MAINTENANCE AGENT 2
92b
MAINTENANCE AGENT 3
92c
MAINTENANCE AGENT n
92n
SECURITY DOMAIN 1
70a
SECURITY DOMAIN 2
70b
SECURITY DOMAIN 3
70c
SECURITY DOMAIN n
70n
56

FIG. 3b

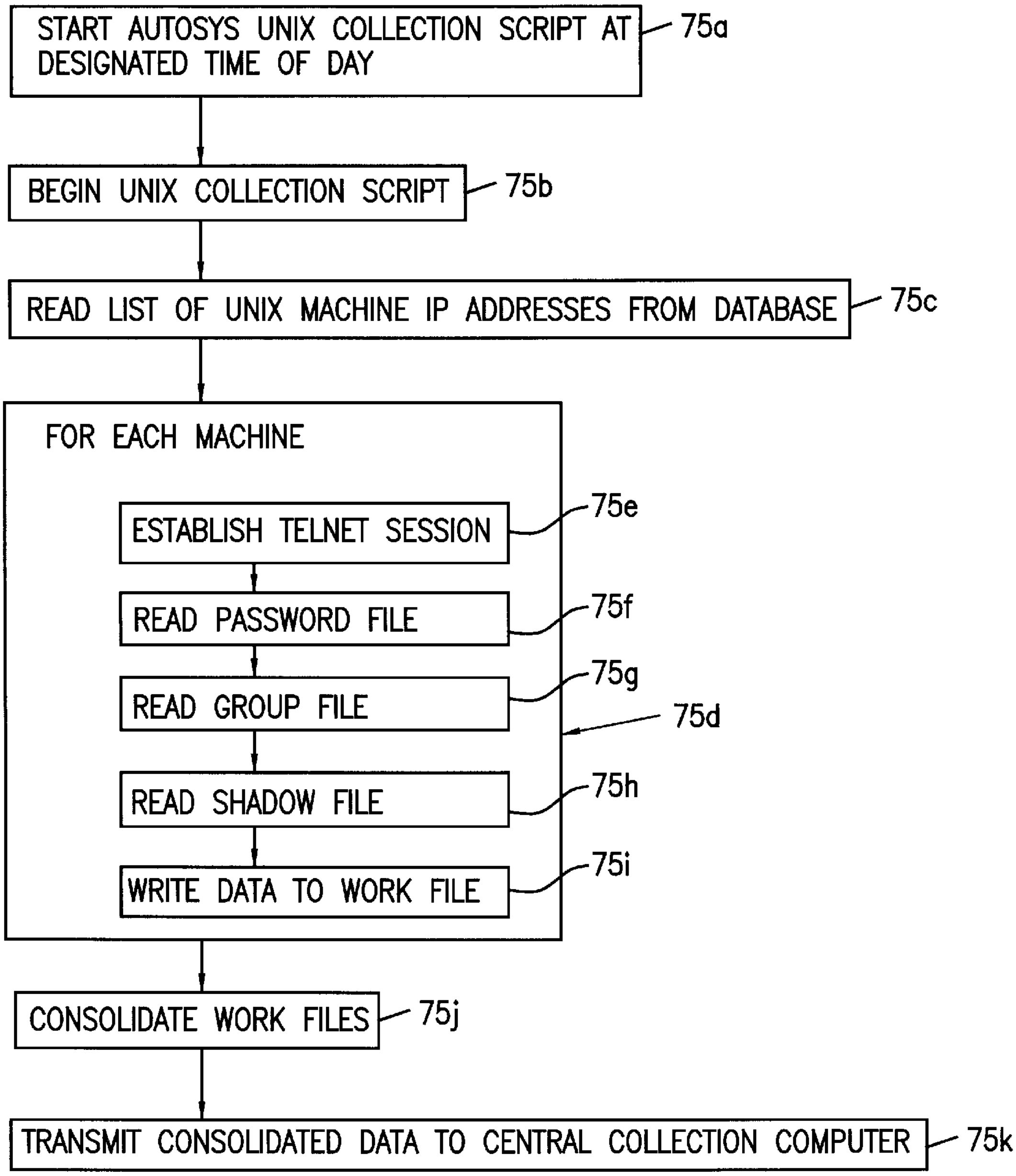

START AUTOSYS UNIX COLLECTION SCRIPT AT DESIGNATED TIME OF DAY
75a
BEGIN UNIX COLLECTION SCRIPT
75b
READ LIST OF UNIX MACHINE IP ADDRESSES FROM DATABASE
75c
FOR EACH MACHINE
ESTABLISH TELNET SESSION
75e
READ PASSWORD FILE
75f
READ GROUP FILE
75g
75d
READ SHADOW FILE
75h
WRITE DATA TO WORK FILE
75i
CONSOLIDATE WORK FILES
75j
TRANSMIT CONSOLIDATED DATA TO CENTRAL COLLECTION COMPUTER
75k

FIG. 4a

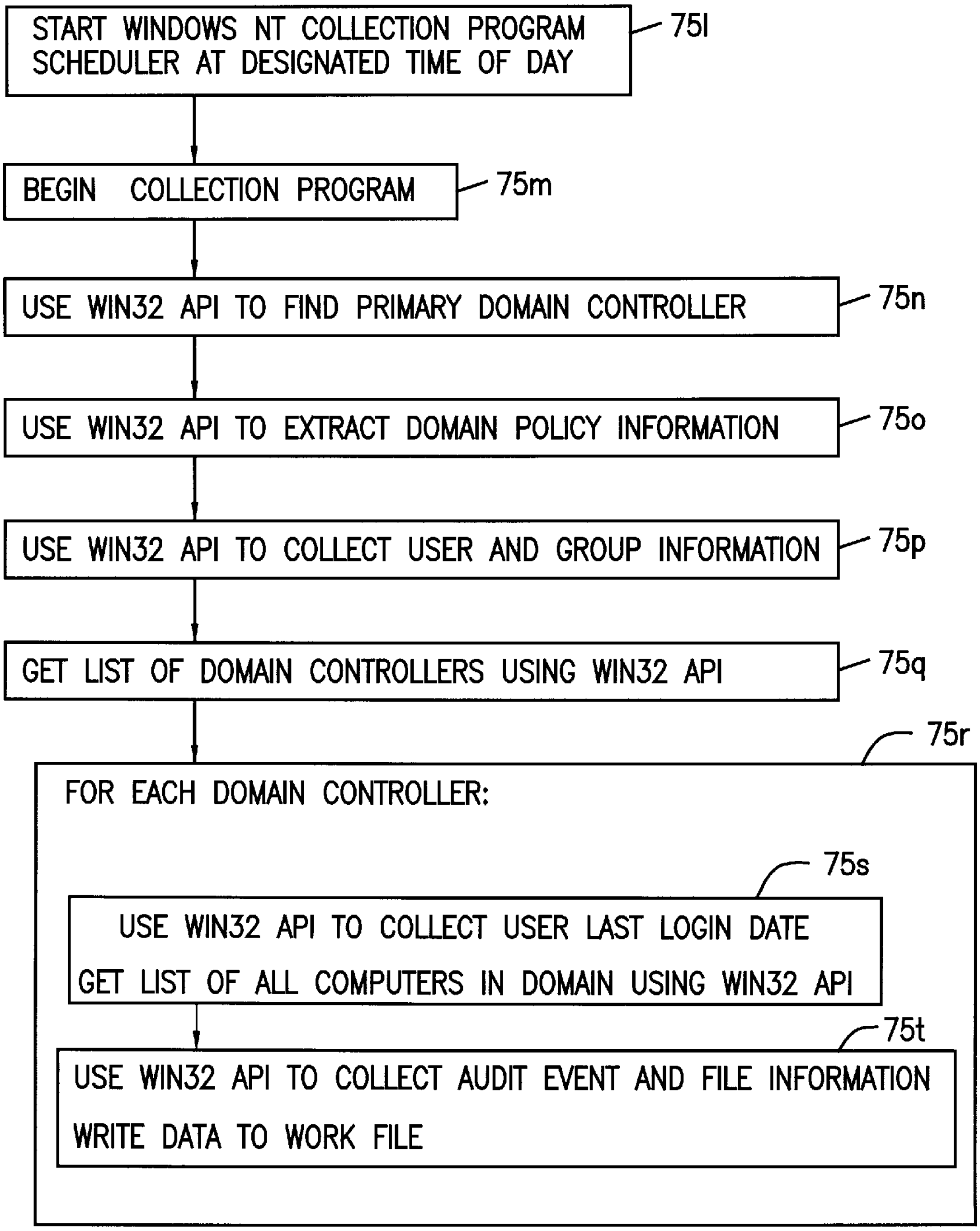

START WINDOWS NT COLLECTION PROGRAM SCHEDULER AT DESIGNATED TIME OF DAY
75l
BEGIN COLLECTION PROGRAM
75m
USE WIN32 API TO FIND PRIMARY DOMAIN CONTROLLER
75n
USE WIN32 API TO EXTRACT DOMAIN POLICY INFORMATION
75o
USE WIN32 API TO COLLECT USER AND GROUP INFORMATION
75p
GET LIST OF DOMAIN CONTROLLERS USING WIN32 API
75q
75r
FOR EACH DOMAIN CONTROLLER:
75s
USE WIN32 API TO COLLECT USER LAST LOGIN DATE
GET LIST OF ALL COMPUTERS IN DOMAIN USING WIN32 API
75t
USE WIN32 API TO COLLECT AUDIT EVENT AND FILE INFORMATION
WRITE DATA TO WORK FILE

FIG. 4b

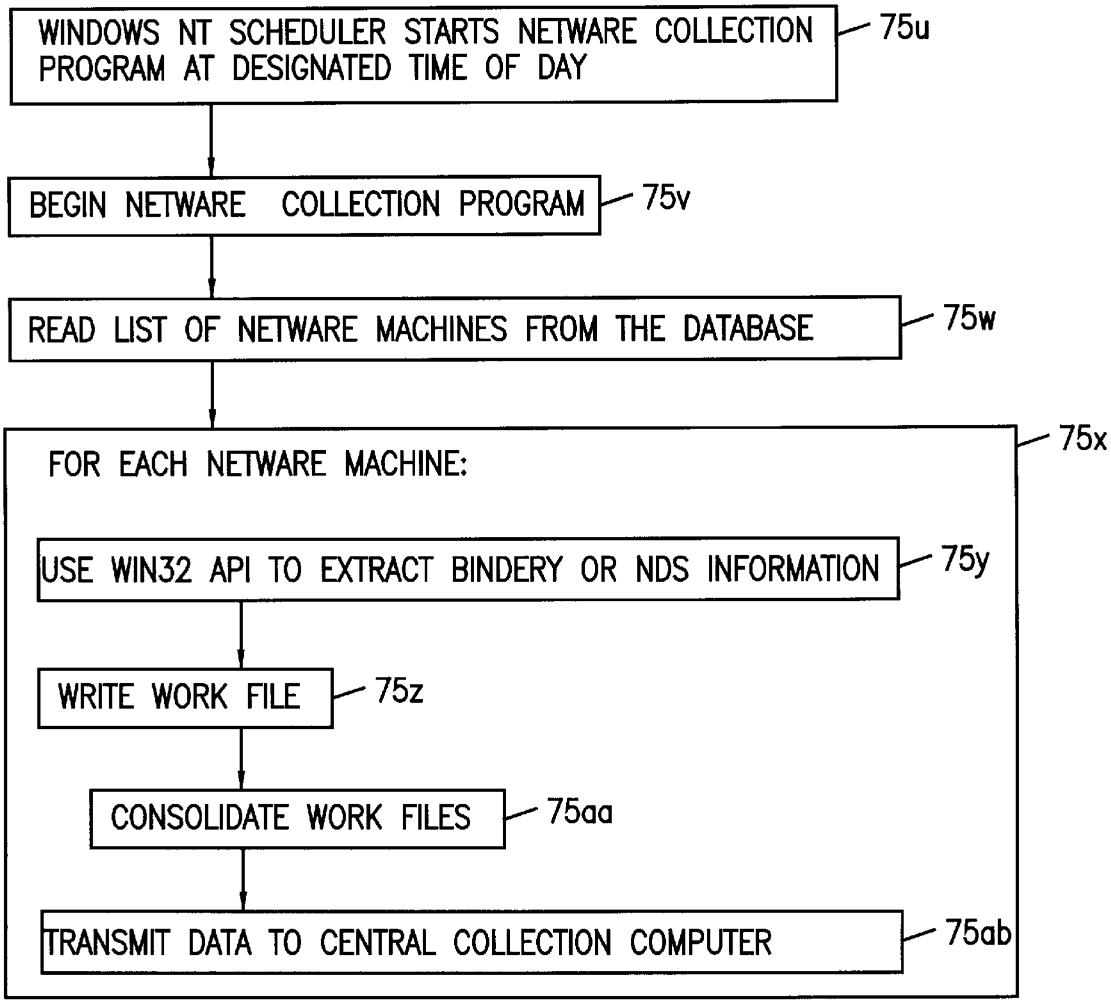

WINDOWS NT SCHEDULER STARTS NETWARE COLLECTION PROGRAM AT DESIGNATED TIME OF DAY
75u
BEGIN NETWARE COLLECTION PROGRAM
75v
READ LIST OF NETWARE MACHINES FROM THE DATABASE
75w
FOR EACH NETWARE MACHINE:
75x
USE WIN32 API TO EXTRACT BINDERY OR NDS INFORMATION
75y
WRITE WORK FILE
75z
CONSOLIDATE WORK FILES
75aa
TRANSMIT DATA TO CENTRAL COLLECTION COMPUTER
75ab

FIG. 4c

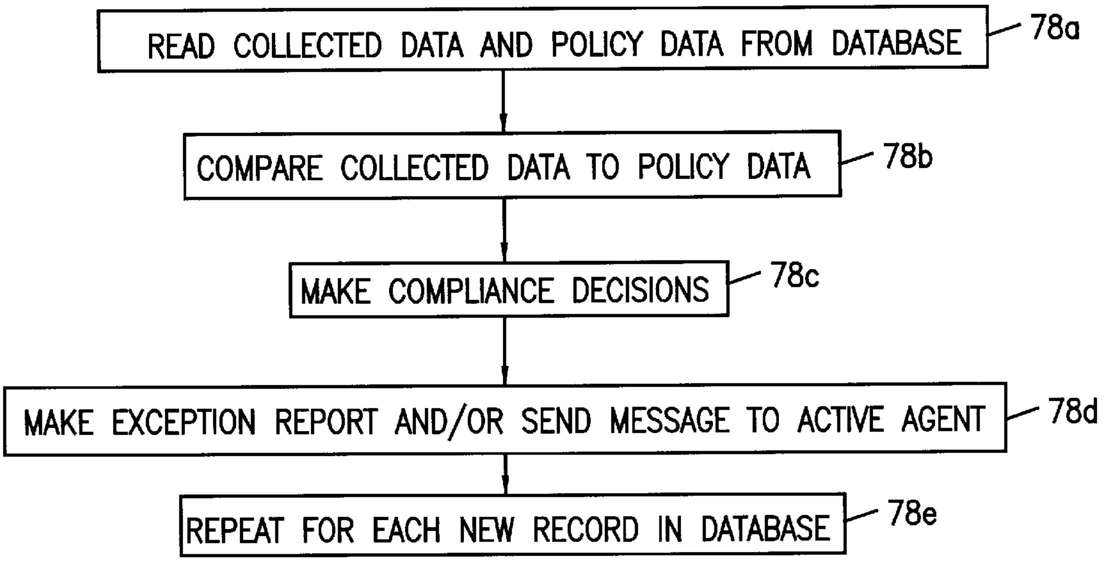

READ COLLECTED DATA AND POLICY DATA FROM DATABASE
78a
COMPARE COLLECTED DATA TO POLICY DATA
78b
MAKE COMPLIANCE DECISIONS
78c
MAKE EXCEPTION REPORT AND/OR SEND MESSAGE TO ACTIVE AGENT
78d
REPEAT FOR EACH NEW RECORD IN DATABASE
78e

FIG. 4d

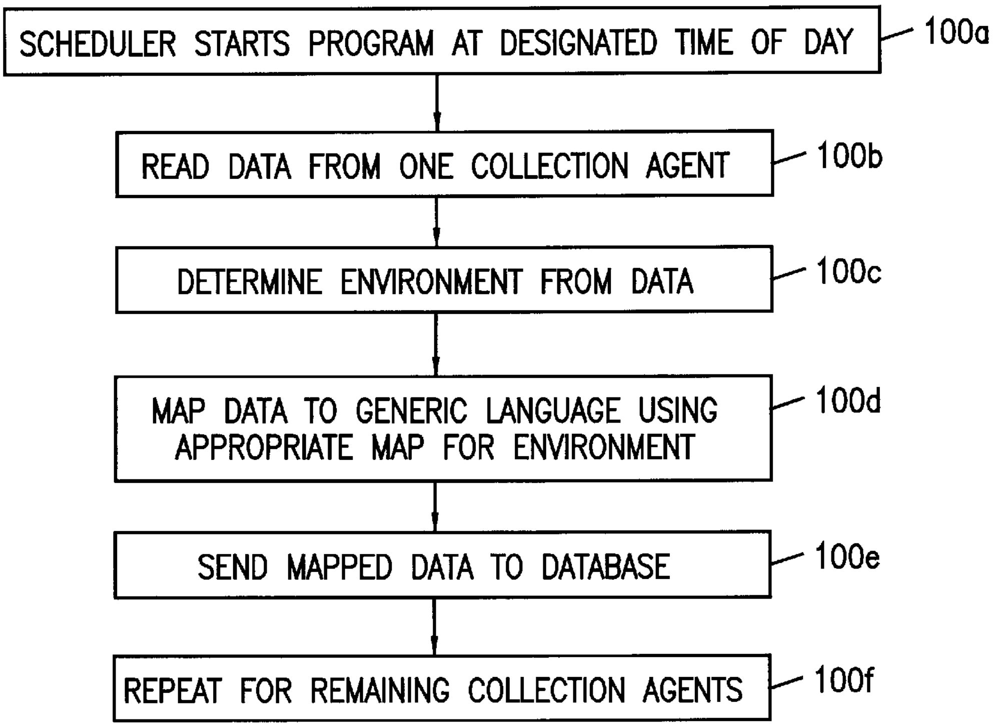

SCHEDULER STARTS PROGRAM AT DESIGNATED TIME OF DAY
100a
READ DATA FROM ONE COLLECTION AGENT
100b
DETERMINE ENVIRONMENT FROM DATA
100c
MAP DATA TO GENERIC LANGUAGE USING APPROPRIATE MAP FOR ENVIRONMENT
100d
SEND MAPPED DATA TO DATABASE
100e
REPEAT FOR REMAINING COLLECTION AGENTS
100f

FIG. 4e

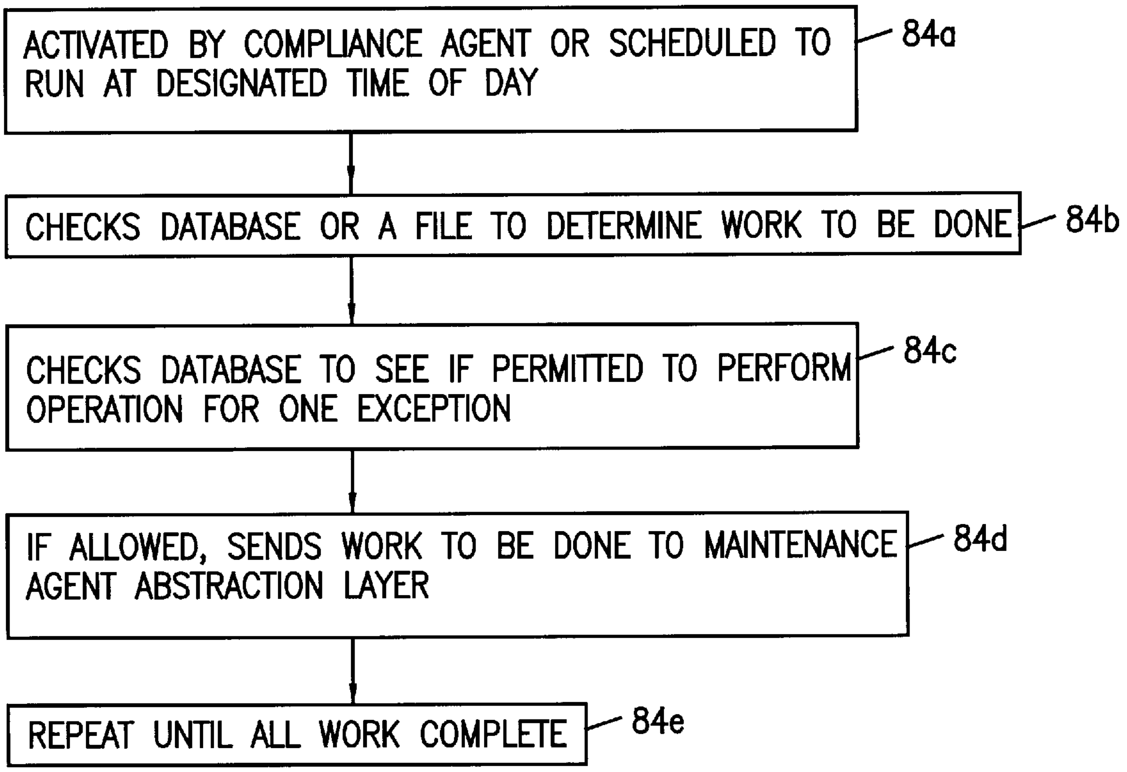

ACTIVATED BY COMPLIANCE AGENT OR SCHEDULED TO RUN AT DESIGNATED TIME OF DAY
84a
CHECKS DATABASE OR A FILE TO DETERMINE WORK TO BE DONE
84b
CHECKS DATABASE TO SEE IF PERMITTED TO PERFORM OPERATION FOR ONE EXCEPTION
84c
IF ALLOWED, SENDS WORK TO BE DONE TO MAINTENANCE AGENT ABSTRACTION LAYER
84d
REPEAT UNTIL ALL WORK COMPLETE
84e

FIG. 4f

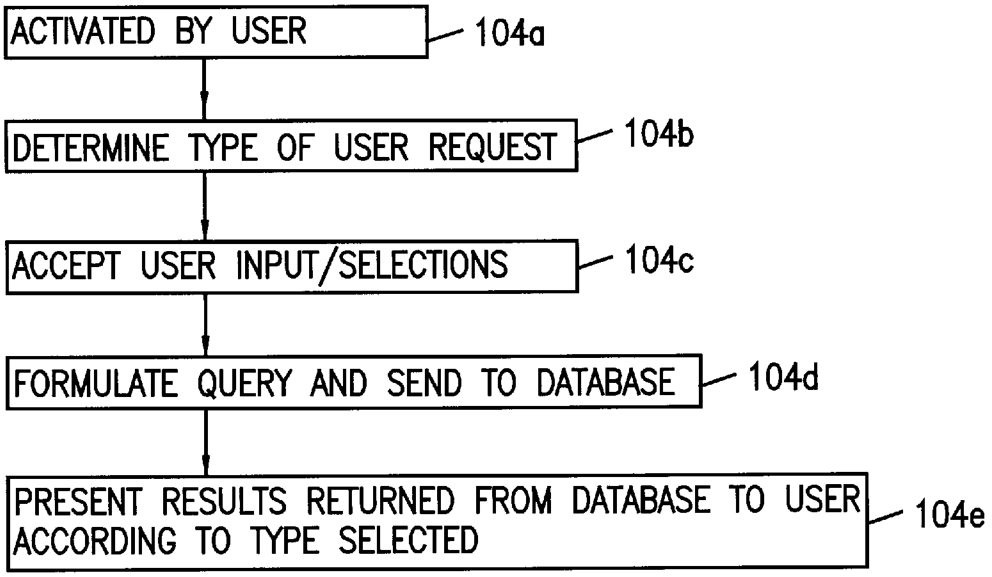

ACTIVATED BY USER
104a
DETERMINE TYPE OF USER REQUEST
104b
ACCEPT USER INPUT/SELECTIONS
104c
FORMULATE QUERY AND SEND TO DATABASE
104d
PRESENT RESULTS RETURNED FROM DATABASE TO USER ACCORDING TO TYPE SELECTED
104e

FIG. 4g

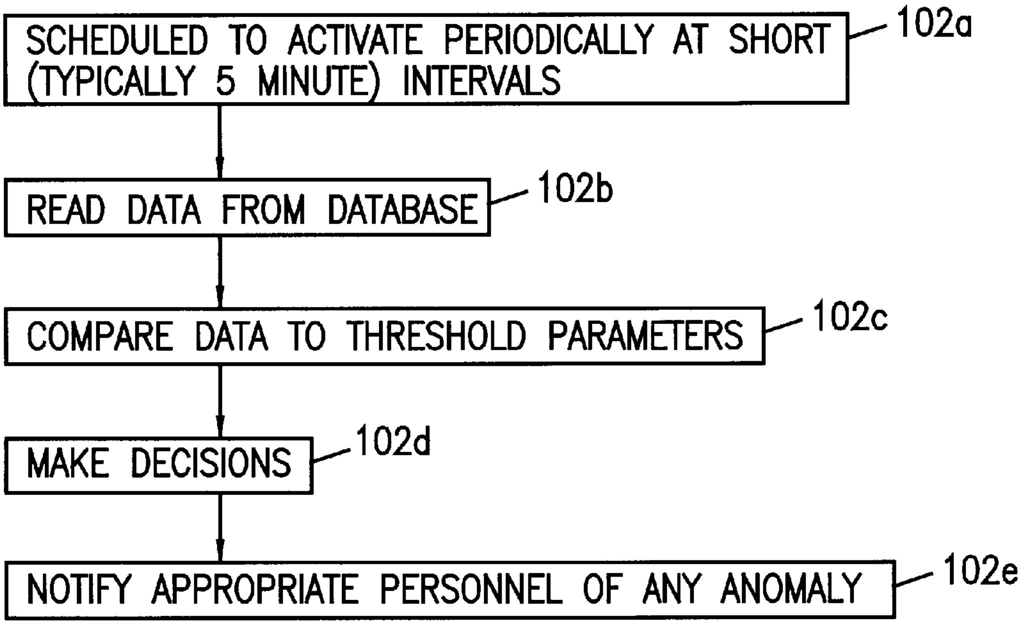

SCHEDULED TO ACTIVATE PERIODICALLY AT SHORT (TYPICALLY 5 MINUTE) INTERVALS
102a
READ DATA FROM DATABASE
102b
COMPARE DATA TO THRESHOLD PARAMETERS
102c
MAKE DECISIONS
102d
NOTIFY APPROPRIATE PERSONNEL OF ANY ANOMALY
102e

FIG. 4h

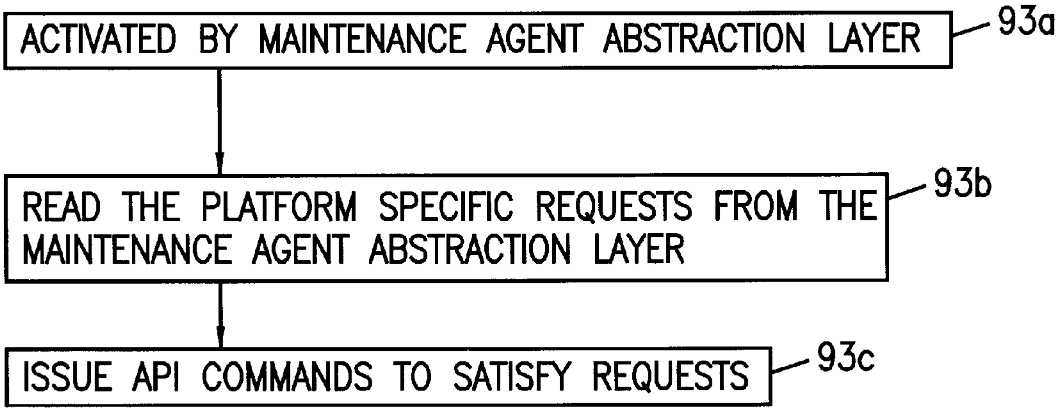
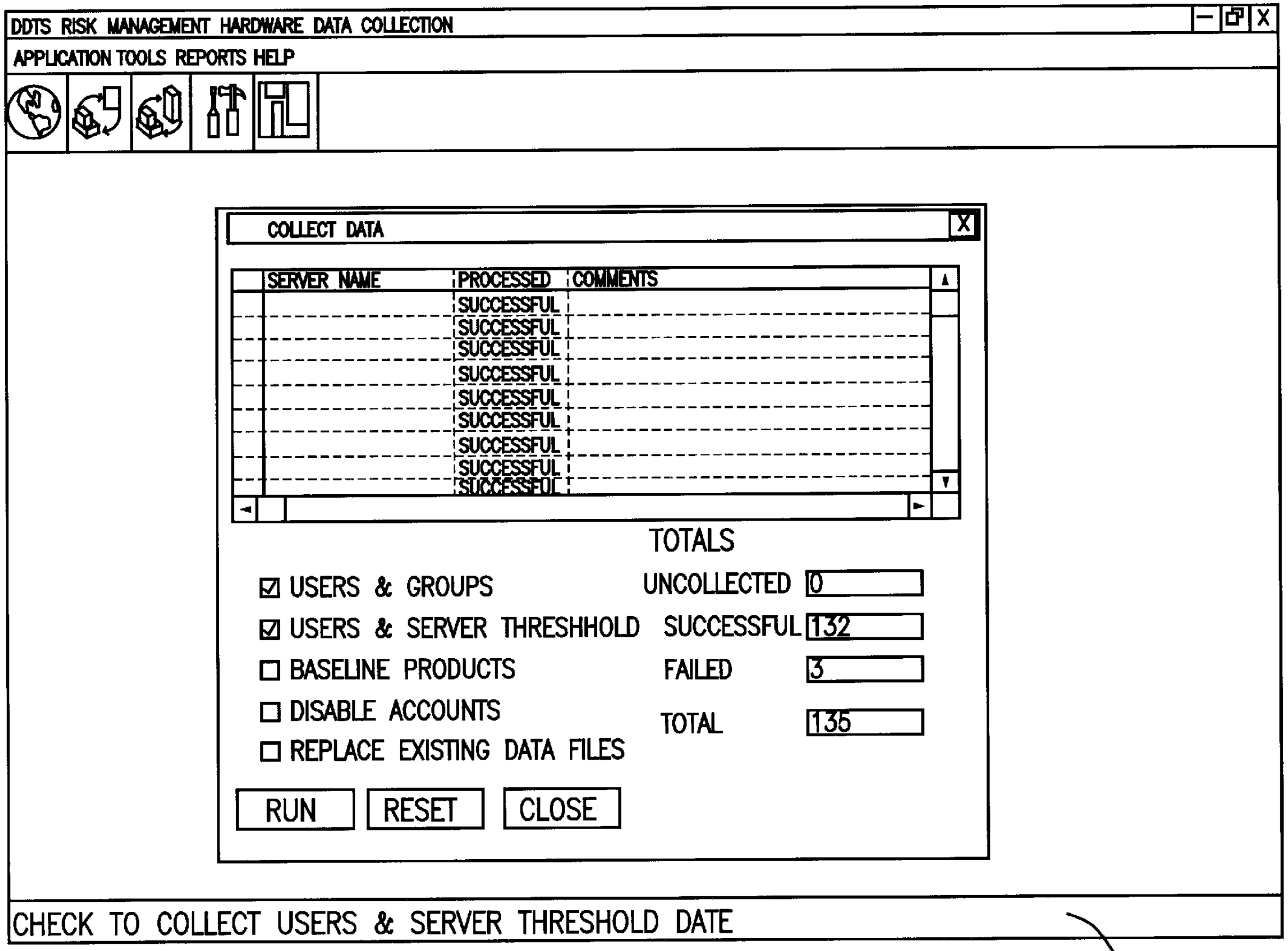

ACTIVATED BY MAINTENANCE AGENT ABSTRACTION LAYER
93a
READ THE PLATFORM SPECIFIC REQUESTS FROM THE MAINTENANCE AGENT ABSTRACTION LAYER
93b
ISSUE API COMMANDS TO SATISFY REQUESTS
93c

FIG. 4i



DDTS RISK MANAGEMENT HARDWARE DATA COLLECTION
APPLICATION TOOLS REPORTS HELP
COLLECT DATA
85a

SERVER NAME	PROCESSED	COMMENTS
	SUCCESSFUL	
	SUCCESSFUL	
	SUCCESSFUL	
	SUCCESSFUL	
	SUCCESSFUL	
	SUCCESSFUL	
	SUCCESSFUL	
	SUCCESSFUL	
	SUCCESSFUL	

☑ USERS & GROUPS
☑ USERS & SERVER THRESHHOLD
□ BASELINE PRODUCTS
□ DISABLE ACCOUNTS
□ REPLACE EXISTING DATA FILES

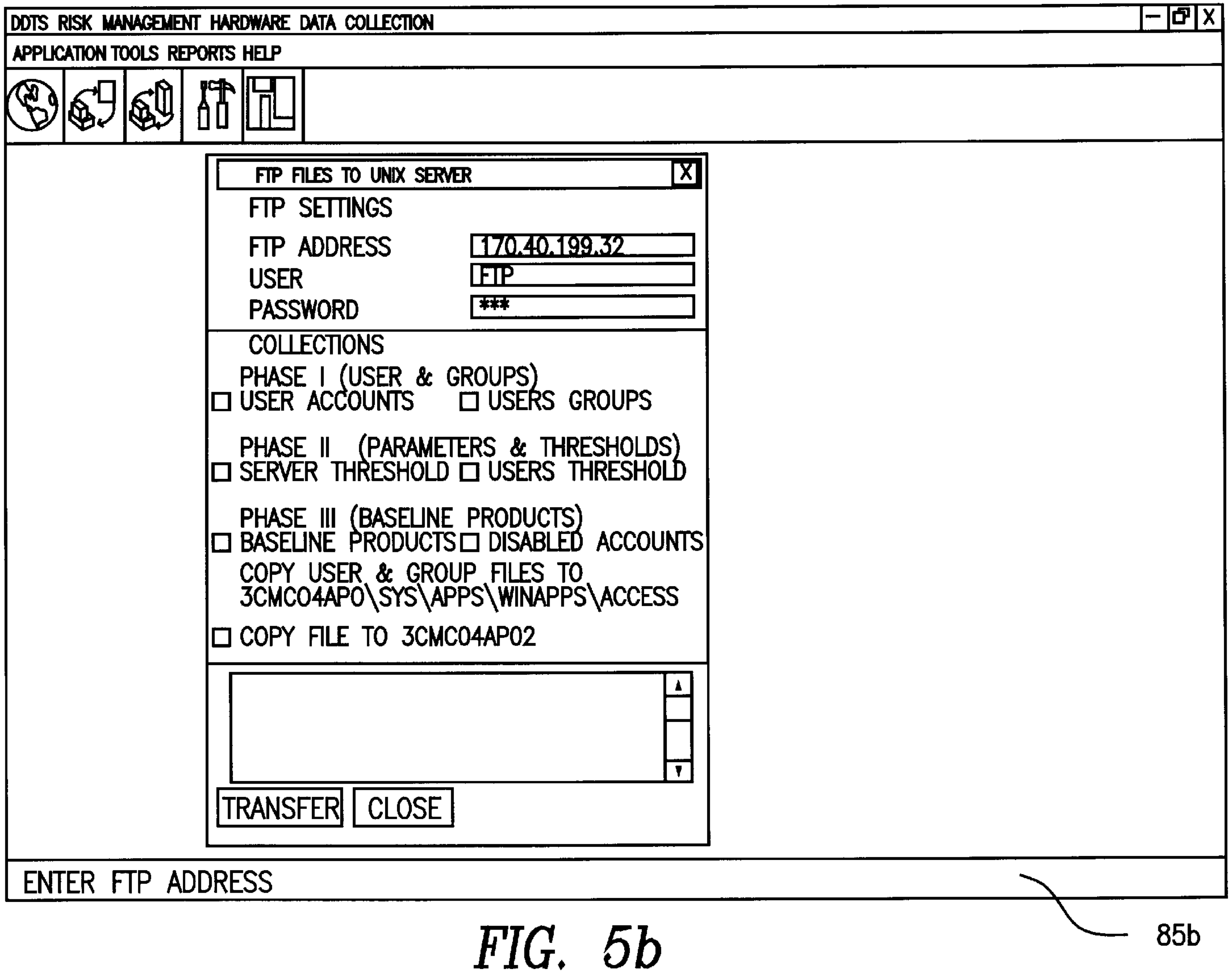
TOTALS

UNCOLLECTED 0
SUCCESSFUL 132
FAILED 3
TOTAL 135

RUN RESET CLOSE

CHECK TO COLLECT USERS & SERVER THRESHOLD DATE

FIG. 5a


DDTS RISK MANAGEMENT HARDWARE DATA COLLECTION
APPLICATION TOOLS REPORTS HELP
FTP FILES TO UNIX SERVER
TRANSFER
CLOSE
85b

FTP SETTINGS

FTP ADDRESS 170.40.199.32
USER FTP
PASSWORD ***

COLLECTIONS

PHASE I (USER & GROUPS)
□ USER ACCOUNTS □ USERS GROUPS

PHASE II (PARAMETERS & THRESHOLDS)
□ SERVER THRESHOLD □ USERS THRESHOLD

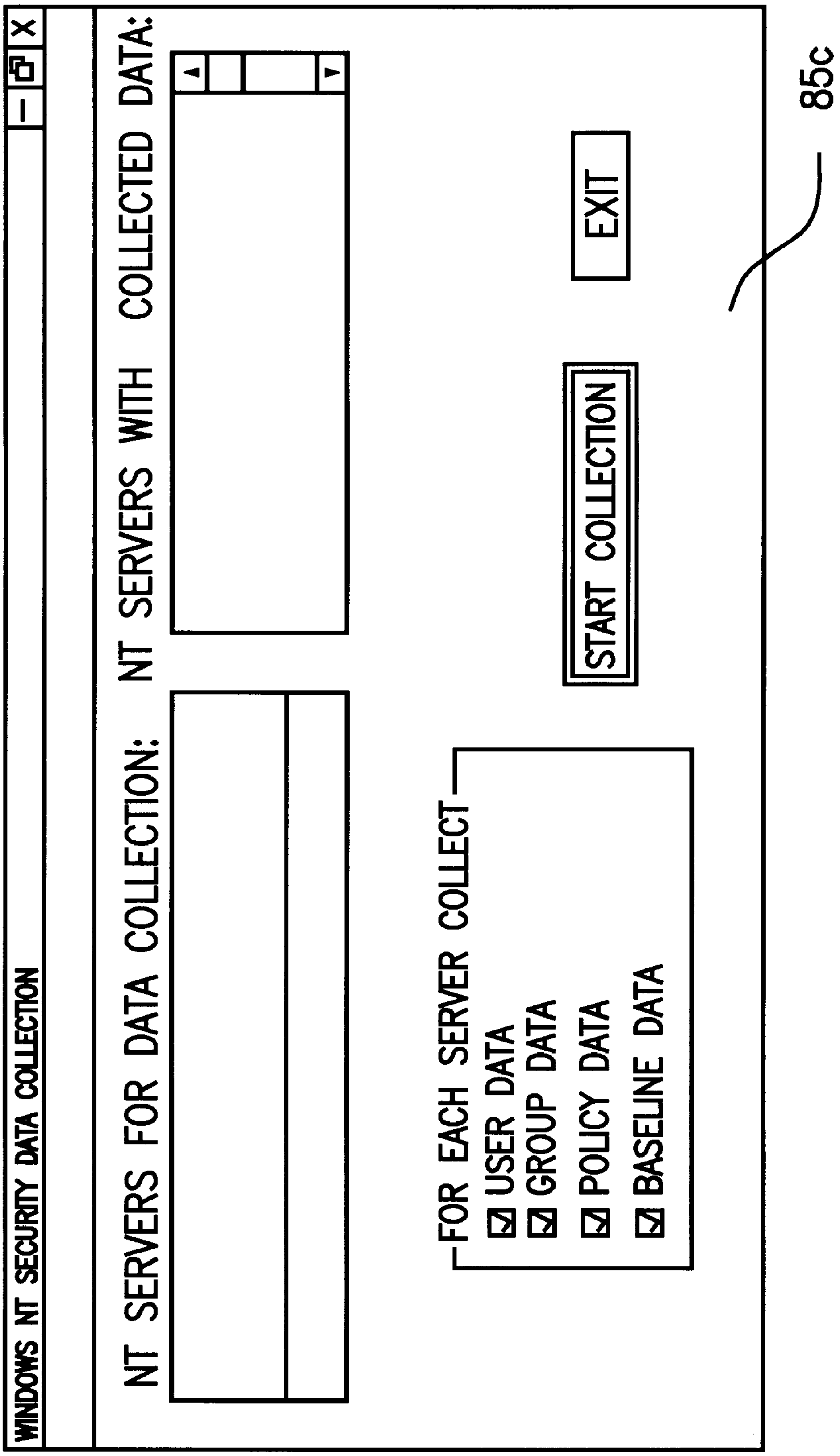
PHASE III (BASELINE PRODUCTS)
□ BASELINE PRODUCTS □ DISABLED ACCOUNTS

COPY USER & GROUP FILES TO
3CMC04AP0\SYS\APPS\WINAPPS\ACCESS

□ COPY FILE TO 3CMC04AP02

ENTER FTP ADDRESS

FIG. 5b



WINDOWS NT SECURITY DATA COLLECTION

NT SERVERS FOR DATA COLLECTION:

NT SERVERS WITH COLLECTED DATA:

FOR EACH SERVER COLLECT

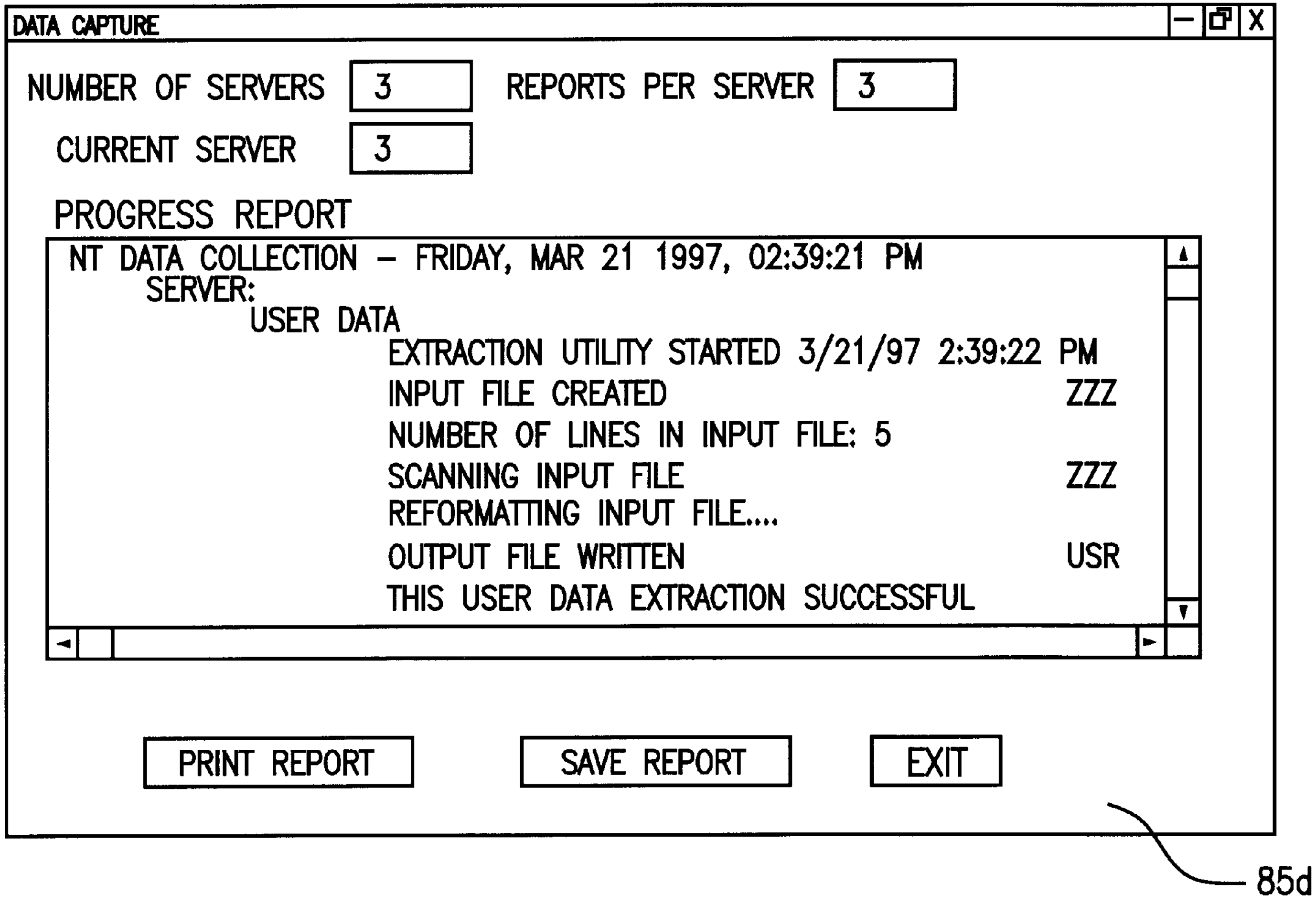
☑ USER DATA

☑ GROUP DATA

☑ POLICY DATA

☑ BASELINE DATA

FIG. 5c



NUMBER OF SERVERS 3 REPORTS PER SERVER 3

CURRENT SERVER 3

PROGRESS REPORT

```
NT DATA COLLECTION - FRIDAY, MAR 21 1997, 02:39:21 PM
    SERVER:
          USER DATA
                    EXTRACTION UTILITY STARTED 3/21/97 2:39:22 PM
                    INPUT FILE CREATED                        ZZZ
                    NUMBER OF LINES IN INPUT FILE: 5
                    SCANNING INPUT FILE                       ZZZ
                    REFORMATTING INPUT FILE....
                    OUTPUT FILE WRITTEN                       USR
                    THIS USER DATA EXTRACTION SUCCESSFUL
```

FIG. 5d

COMPLIANCE AGENT

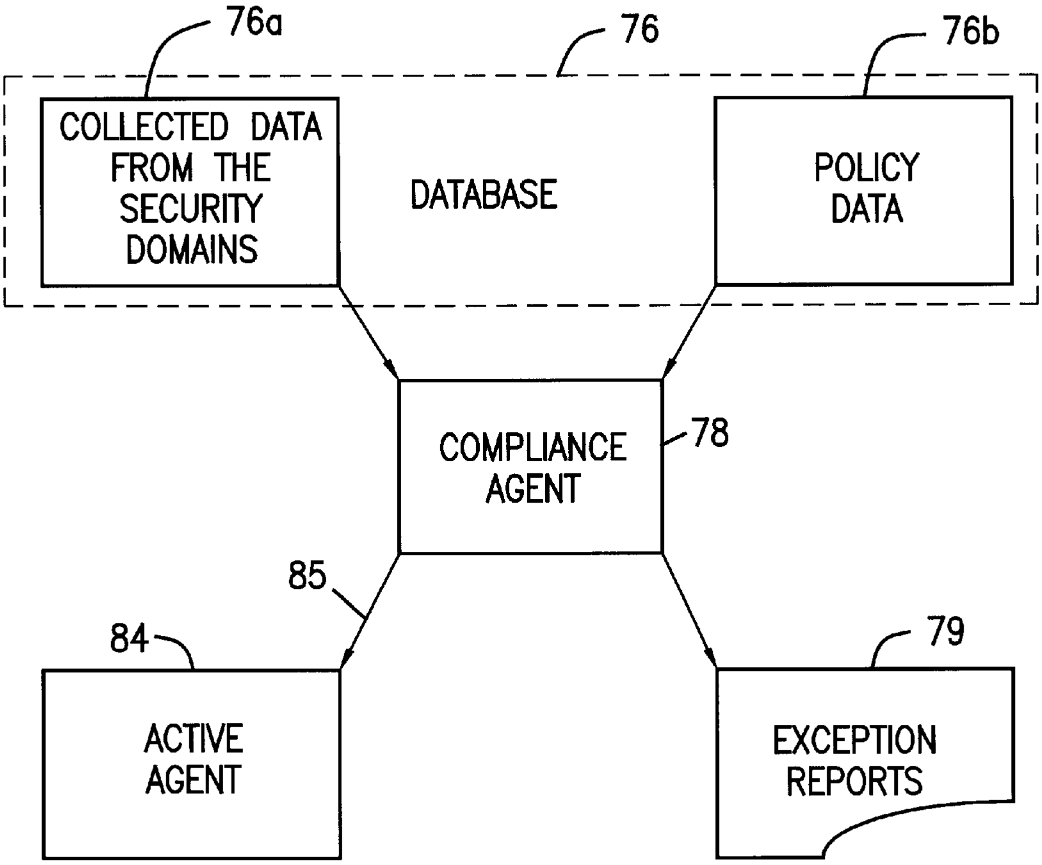


FIG. 6a

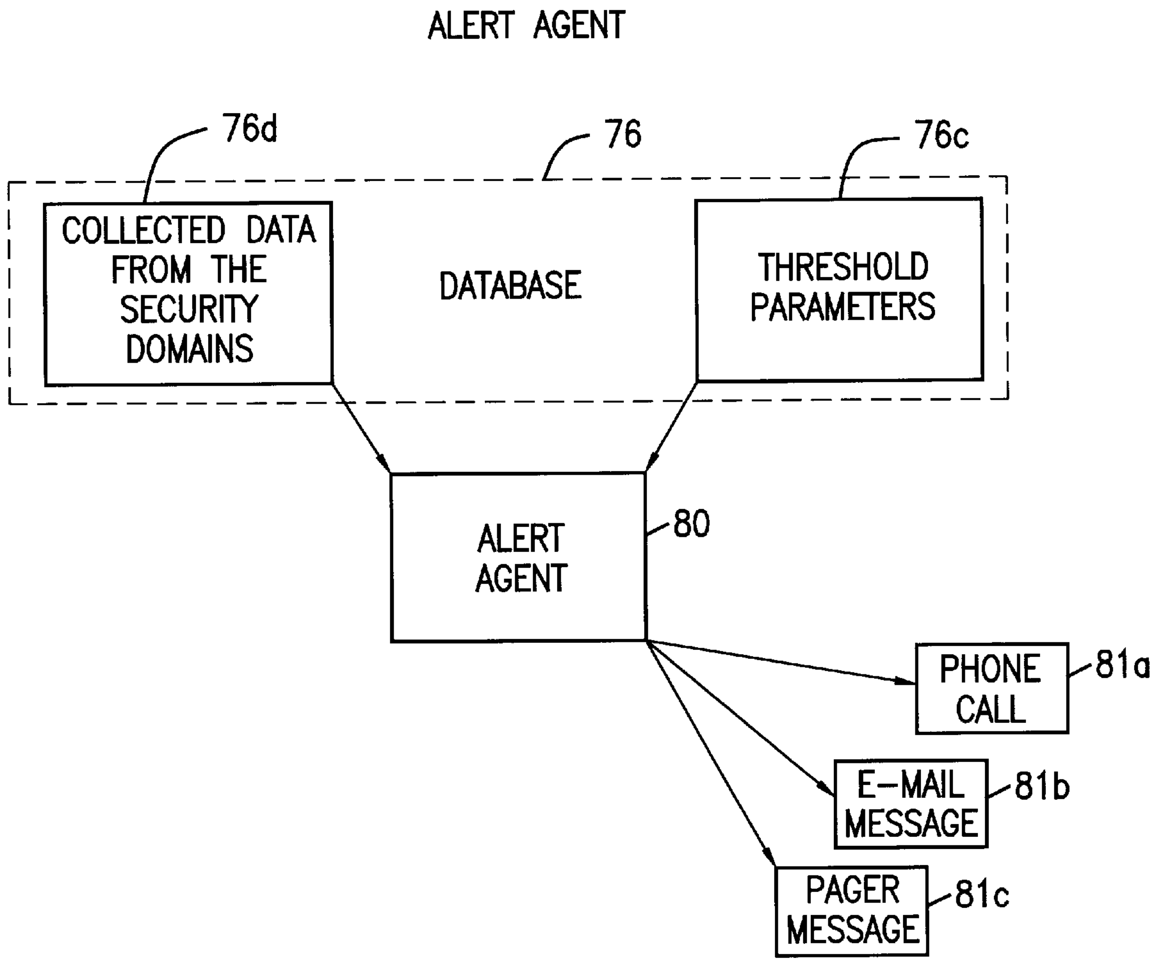

ALERT AGENT
76d
76
76c
COLLECTED DATA FROM THE SECURITY DOMAINS
DATABASE
THRESHOLD PARAMETERS
ALERT AGENT
80
PHONE CALL
81a
E-MAIL MESSAGE
81b
PAGER MESSAGE
81c

FIG. 6b

ACTIVE AGENT

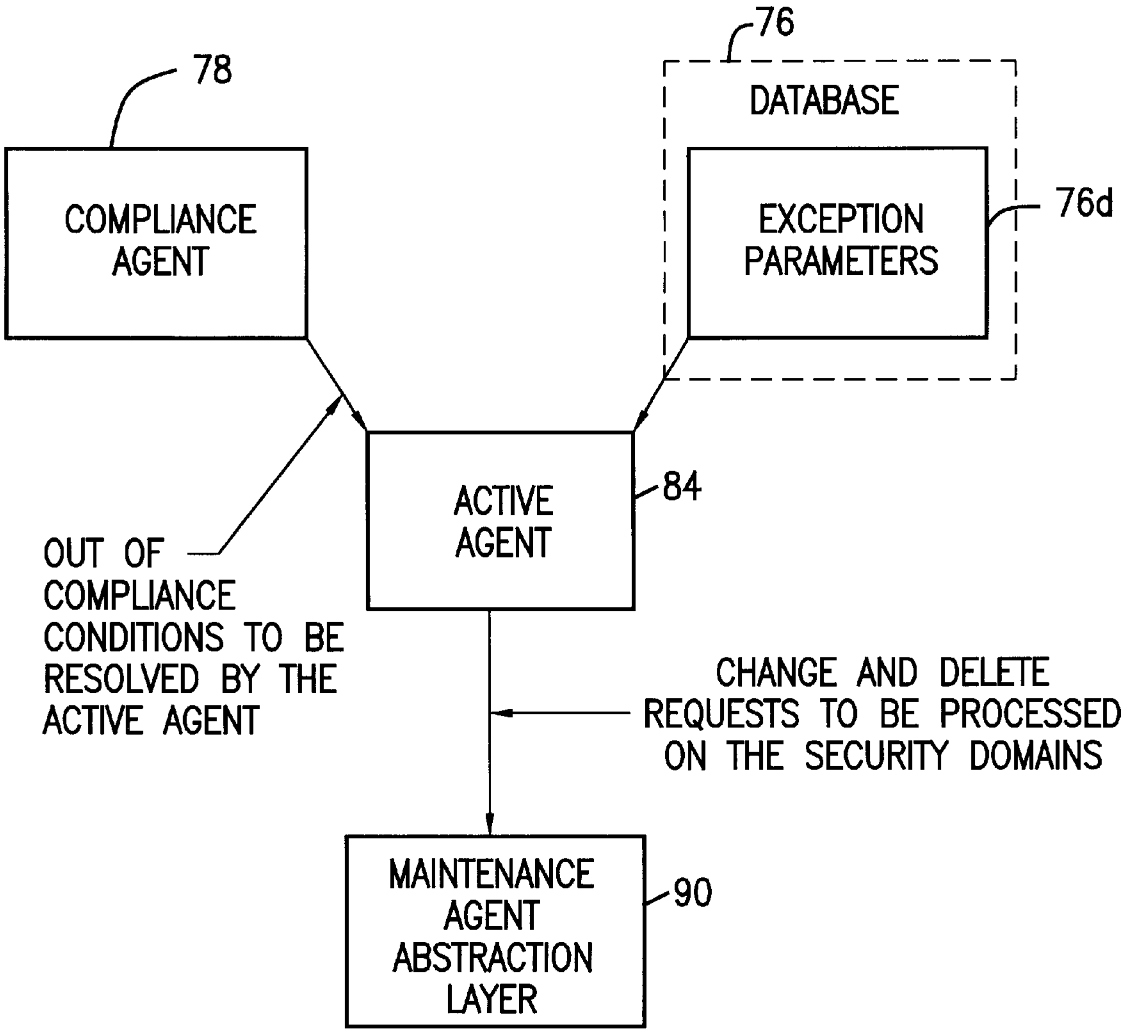

78
COMPLIANCE AGENT
76
DATABASE
EXCEPTION PARAMETERS
76d
ACTIVE AGENT
84
OUT OF COMPLIANCE CONDITIONS TO BE RESOLVED BY THE ACTIVE AGENT
CHANGE AND DELETE REQUESTS TO BE PROCESSED ON THE SECURITY DOMAINS
MAINTENANCE AGENT ABSTRACTION LAYER
90

FIG. 6c

QUERY AGENT

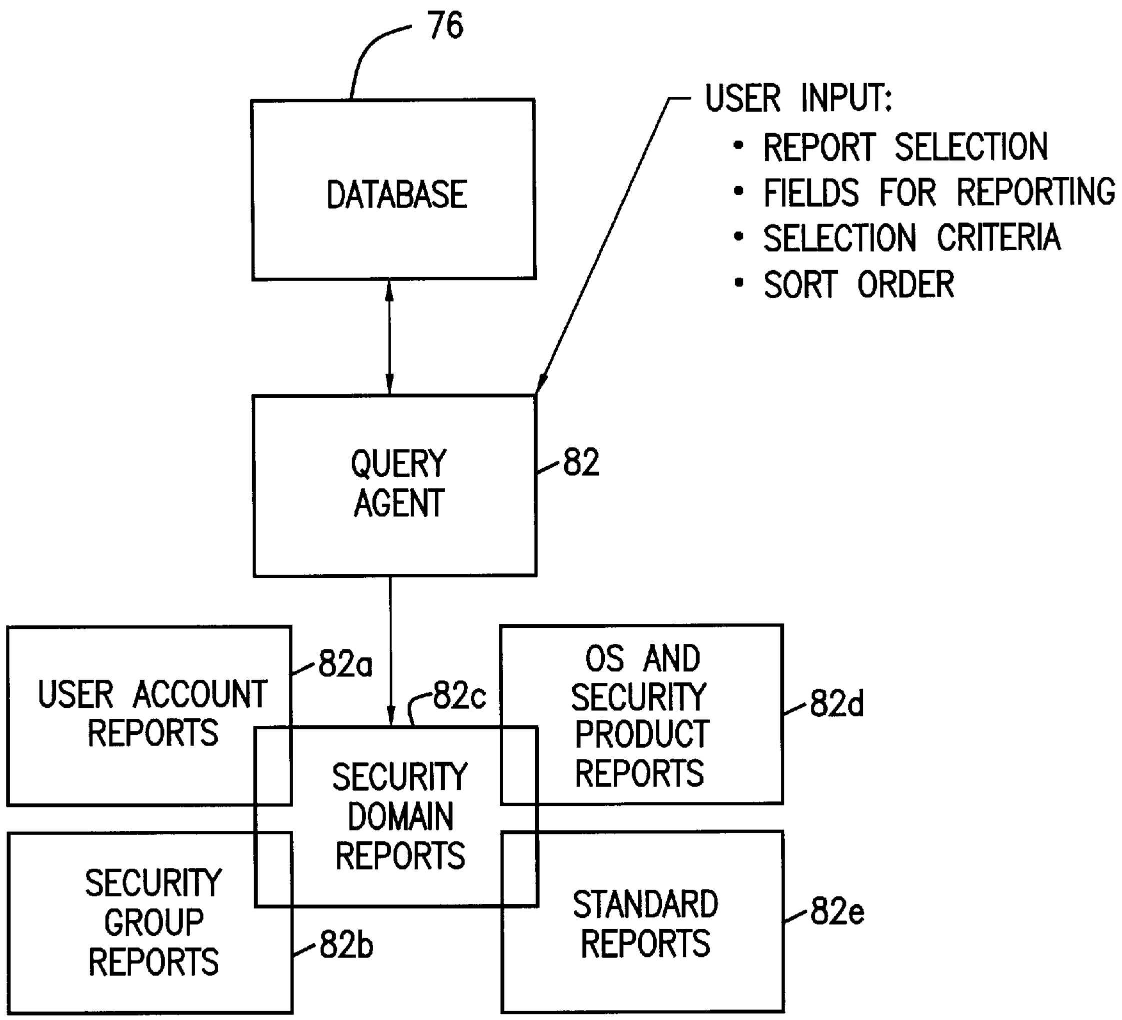


FIG. 6d

MANUAL MAINTENANCE AGENT

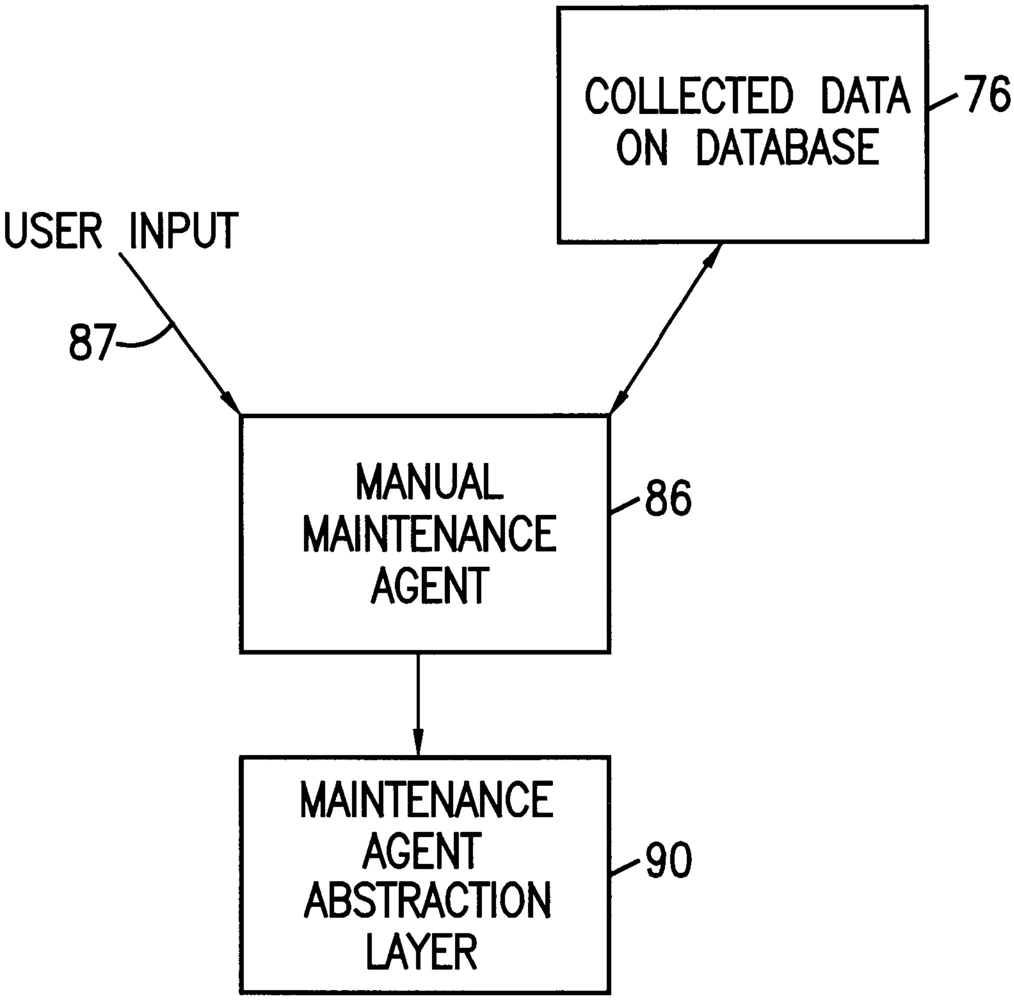
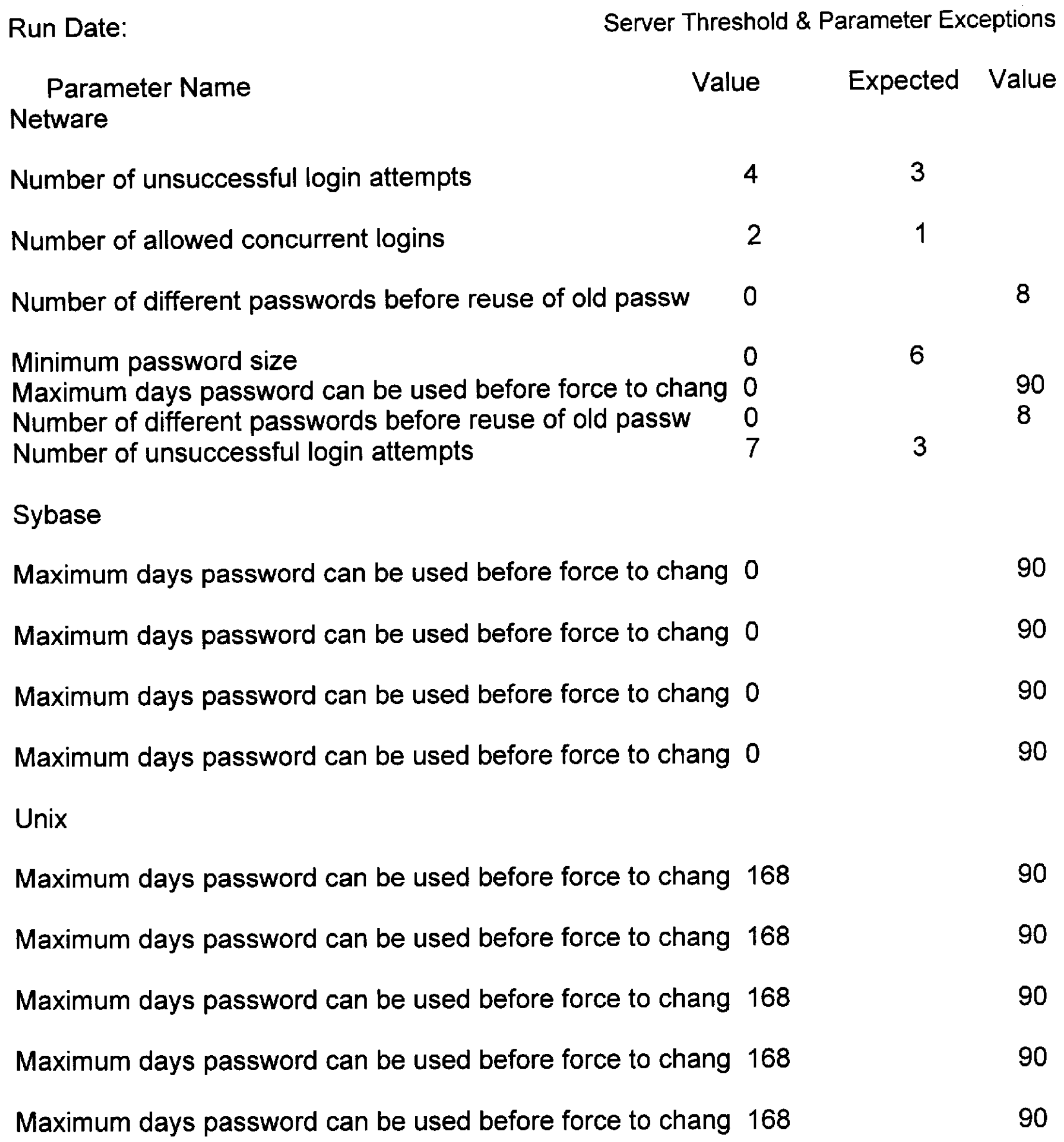

COLLECTED DATA ON DATABASE
76
USER INPUT
87
MANUAL MAINTENANCE AGENT
86
MAINTENANCE AGENT ABSTRACTION LAYER
90

FIG. 6e



Run Date: Server Threshold & Parameter Exceptions

Parameter Name	Value	Expected	Value
Netware			
Number of unsuccessful login attempts	4	3	
Number of allowed concurrent logins	2	1	
Number of different passwords before reuse of old passw	0		8
Minimum password size	0	6	
Maximum days password can be used before force to chang	0		90
Number of different passwords before reuse of old passw	0		8
Number of unsuccessful login attempts	7	3	
Sybase			
Maximum days password can be used before force to chang	0		90
Maximum days password can be used before force to chang	0		90
Maximum days password can be used before force to chang	0		90
Maximum days password can be used before force to chang	0		90
Unix			
Maximum days password can be used before force to chang	168		90
Maximum days password can be used before force to chang	168		90
Maximum days password can be used before force to chang	168		90
Maximum days password can be used before force to chang	168		90
Maximum days password can be used before force to chang	168		90

FIG. 7a

Account activity after Termination (Used in the past month)
List of User Accounts of Terminated Employees (LINE-OF-BUSINESS wise)
TGS RISK MANAGEMENT

Server	Name	User Id	Priv	Last Login	Created on	TermDate	Location	Floor	Action
PLATFORM:	Netware								
GARRY				Expense Code: 21902					
	caroline BROWN	C BROWN	N	1/21/97	8/19/96	1/17/97	1 CMP	50	
GLOBAL ASSET SERVICES				Expense Code: 20113					
	Brian BROWN	B BROWN	N	2/3/97	6/19/96	1/17/97	3 CMC	5	
GLOBAL SERVICES DELIVERY				Expense Code: 04570					
	Nadine BROWN	N BROWN	N	1/23/97	10/21/94	1/17/97	3 CMC	6	
	Angela BROWN	A BROWN	N	2/3/97	8/19/94	1/17/97	3 CMC	7	

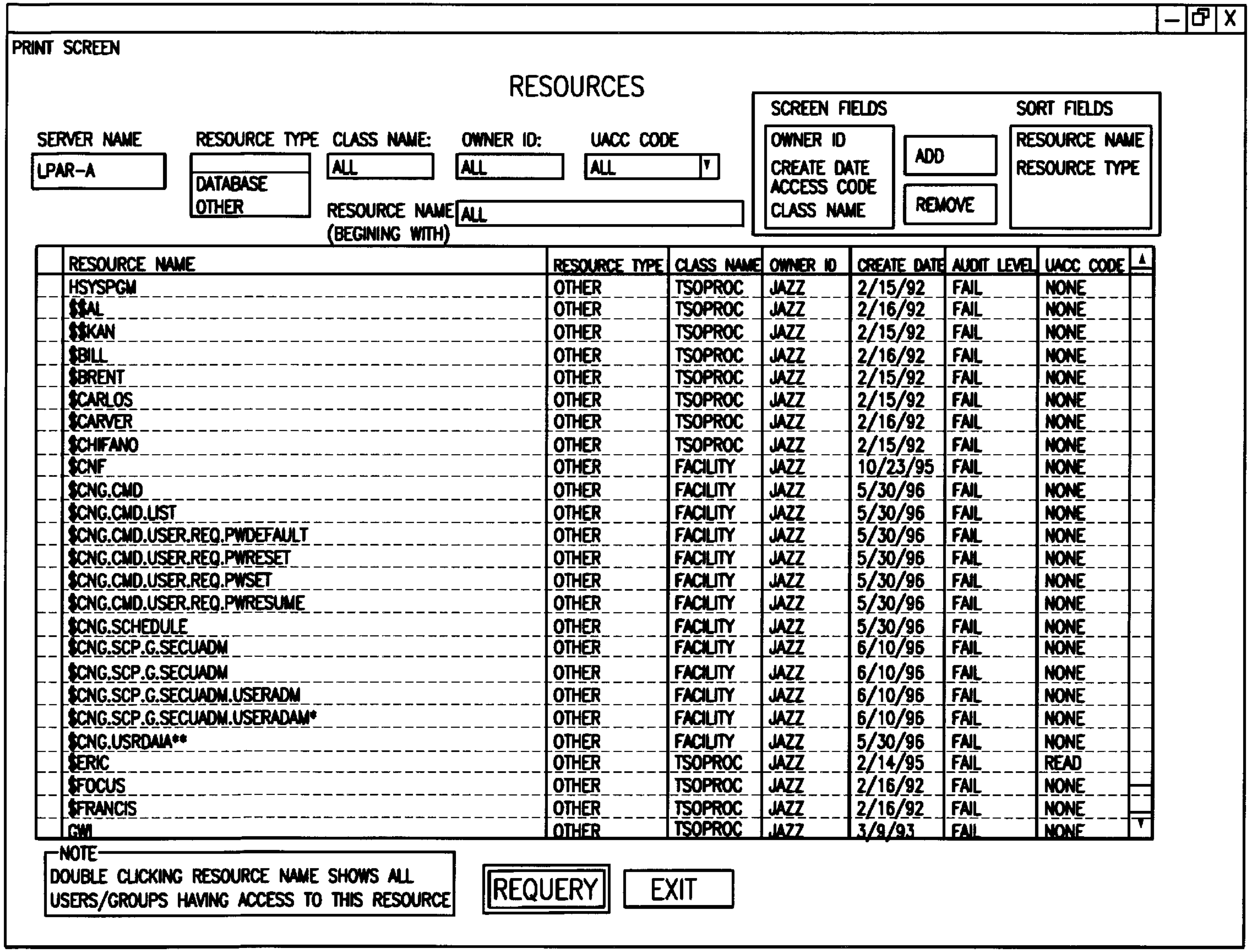
FIG. 7b

			Password							
User Id	Min Sz	Alpha	Life	Hist	Reuse	PreExp	Lgn Disb	Con Conn	Stn Disb	Banner
Netware										
Server Name										
Server Defaults:	6		90	8			3	1		
	5		90	8				1		
	5		90	8				1		
	5		90	8				1		
	6		40	0				0		
	6		90	8				3		
	6		40	0				0		
	6		90	8				2		
	6		90	8				4		
	6		90	8				1		
	5		90	8				1		
	6		90	8				3		
	5		40	0				0		
	0		0	0				0		
	6		90	8				3		
	5		90	8				1		
	6		0	8				3		
	6		0	0				2		
	5		0	8				1		
	6		90	0				2		
	6		0	8				2		
	6		90	8				2		
	6		90	8				2		
	6		90	8				2		
	6		90	8				3		
	6		90	8				2		
	6		90	8				3		
	6		90	8				3		
	6		90	8				2		
	0		0	0				0		
	6		90	8				2		
	6		40	8				2		
	6		90	8				2		
	6		90	8				2		
	6		90	8				3		
	6		90	8				2		
	0		0	0				0		
	6		90	8				2		
	6		90	0				0		
	6		90	0				0		

FIG. 7c

SERVER TYPE CD	SERVER NAME	USER ID	EVENT DATE	RESULT	EVENT DESCRIPTION
NT			APR 7 1997 1:01:47:000PM	S	ESTABLISH USER/ASSIGN CARD
NT			APR 7 1997 1:14:58:000PM	S	ESTABLISH USER/ASSIGN CARD
NT			APR 7 1997 1:15:06:000PM	S	ESTABLISH USER/ASSIGN CARD
NT			APR 7 1997 1:15:16:000PM	S	ESTABLISH USER/ASSIGN CARD
NT			APR 7 1997 1:36:17:000PM	S	ESTABLISH USER/ASSIGN CARD
NT			APR 7 1997 1:56:54:000PM	S	ESTABLISH USER/ASSIGN CARD
NT			APR 7 1997 9:22:11:000PM	S	ESTABLISH USER/ASSIGN CARD
NT			APR 7 1997 9:23:17:000PM	S	ESTABLISH USER/ASSIGN CARD
NT			APR 8 1997 10:26:00:000AM	S	ESTABLISH USER/ASSIGN CARD
NT			APR 8 1997 5:49:56:000PM	S	ESTABLISH USER/ASSIGN CARD
NT			APR 8 1997 1:40:07:000PM	F	POSSIBLE INTRUDER EVENT
NT			APR 8 1997 3:43:48:000PM	F	POSSIBLE INTRUDER EVENT
NT			APR 8 1997 3:43:50:000PM	F	POSSIBLE INTRUDER EVENT

FIG. 8a



RESOURCES

SERVER NAME: LPAR-A

RESOURCE TYPE: DATABASE
OTHER

CLASS NAME: ALL

OWNER ID: ALL

UACC CODE: ALL ▼

RESOURCE NAME (BEGINING WITH): ALL

SCREEN FIELDS: OWNER ID, CREATE DATE, ACCESS CODE, CLASS NAME

SORT FIELDS: RESOURCE NAME, RESOURCE TYPE

RESOURCE NAME	RESOURCE TYPE	CLASS NAME	OWNER ID	CREATE DATE	AUDIT LEVEL	UACC CODE
HSYSPGM	OTHER	TSOPROC	JAZZ	2/15/92	FAIL	NONE
$$AL	OTHER	TSOPROC	JAZZ	2/16/92	FAIL	NONE
$$KAN	OTHER	TSOPROC	JAZZ	2/15/92	FAIL	NONE
$BILL	OTHER	TSOPROC	JAZZ	2/16/92	FAIL	NONE
$BRENT	OTHER	TSOPROC	JAZZ	2/15/92	FAIL	NONE
$CARLOS	OTHER	TSOPROC	JAZZ	2/15/92	FAIL	NONE
$CARVER	OTHER	TSOPROC	JAZZ	2/16/92	FAIL	NONE
$CHIFANO	OTHER	TSOPROC	JAZZ	2/15/92	FAIL	NONE
$CNF	OTHER	FACILITY	JAZZ	10/23/95	FAIL	NONE
$CNG.CMD	OTHER	FACILITY	JAZZ	5/30/96	FAIL	NONE
$CNG.CMD.LIST	OTHER	FACILITY	JAZZ	5/30/96	FAIL	NONE
$CNG.CMD.USER.REQ.PWDEFAULT	OTHER	FACILITY	JAZZ	5/30/96	FAIL	NONE
$CNG.CMD.USER.REQ.PWRESET	OTHER	FACILITY	JAZZ	5/30/96	FAIL	NONE
$CNG.CMD.USER.REQ.PWSET	OTHER	FACILITY	JAZZ	5/30/96	FAIL	NONE
$CNG.CMD.USER.REQ.PWRESUME	OTHER	FACILITY	JAZZ	5/30/96	FAIL	NONE
$CNG.SCHEDULE	OTHER	FACILITY	JAZZ	5/30/96	FAIL	NONE
$CNG.SCP.G.SECUADM	OTHER	FACILITY	JAZZ	6/10/96	FAIL	NONE
$CNG.SCP.G.SECUADM	OTHER	FACILITY	JAZZ	6/10/96	FAIL	NONE
$CNG.SCP.G.SECUADM.USERADM	OTHER	FACILITY	JAZZ	6/10/96	FAIL	NONE
$CNG.SCP.G.SECUADM.USERADAM*	OTHER	FACILITY	JAZZ	6/10/96	FAIL	NONE
$CNG.USRDAIA**	OTHER	FACILITY	JAZZ	5/30/96	FAIL	NONE
$ERIC	OTHER	TSOPROC	JAZZ	2/14/95	FAIL	READ
$FOCUS	OTHER	TSOPROC	JAZZ	2/16/92	FAIL	NONE
$FRANCIS	OTHER	TSOPROC	JAZZ	2/16/92	FAIL	NONE
GWI	OTHER	TSOPROC	JAZZ	3/9/93	FAIL	NONE

NOTE
DOUBLE CLICKING RESOURCE NAME SHOWS ALL USERS/GROUPS HAVING ACCESS TO THIS RESOURCE

FIG. 8b

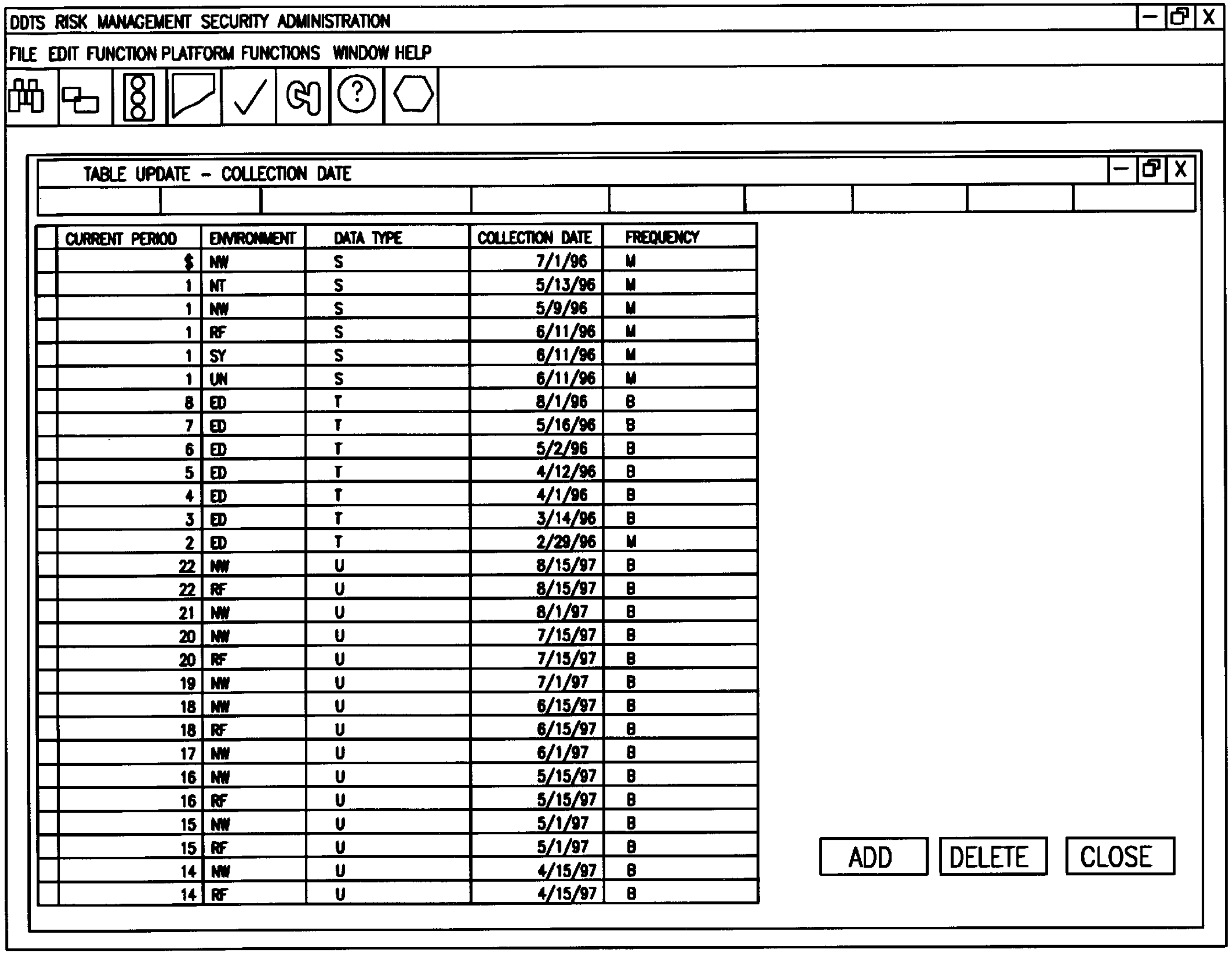
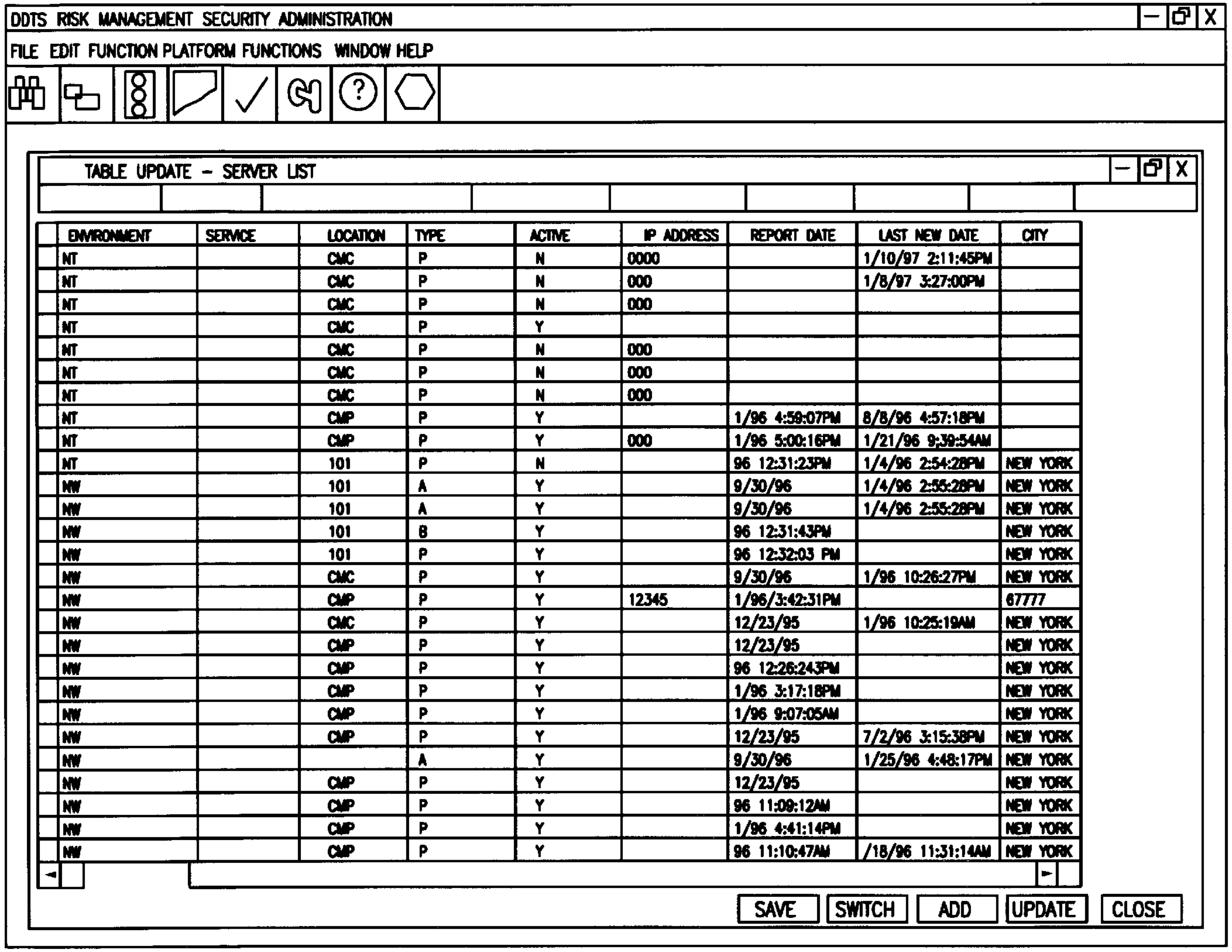

DDTS RISK MANAGEMENT SECURITY ADMINISTRATION
FILE EDIT FUNCTION PLATFORM FUNCTIONS WINDOW HELP
ADD
DELETE
CLOSE

TABLE UPDATE – COLLECTION DATE

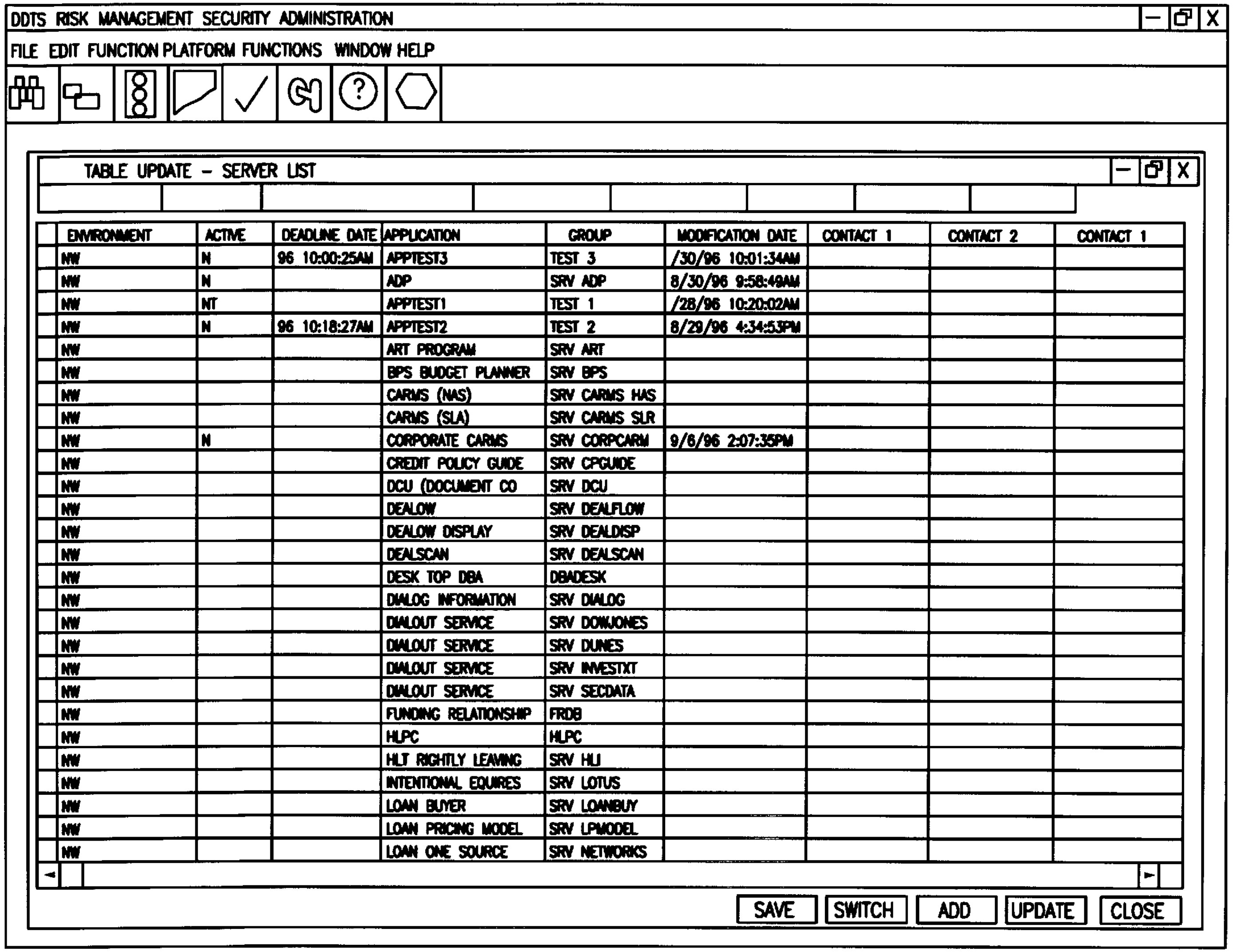
CURRENT PERIOD	ENVIRONMENT	DATA TYPE	COLLECTION DATE	FREQUENCY
$	NW	S	7/1/96	M
1	NT	S	5/13/96	M
1	NW	S	5/9/96	M
1	RF	S	6/11/96	M
1	SY	S	6/11/96	M
1	UN	S	6/11/96	M
8	ED	T	8/1/96	B
7	ED	T	5/16/96	B
6	ED	T	5/2/96	B
5	ED	T	4/12/96	B
4	ED	T	4/1/96	B
3	ED	T	3/14/96	B
2	ED	T	2/29/96	M
22	NW	U	8/15/97	B
22	RF	U	8/15/97	B
21	NW	U	8/1/97	B
20	NW	U	7/15/97	B
20	RF	U	7/15/97	B
19	NW	U	7/1/97	B
18	NW	U	6/15/97	B
18	RF	U	6/15/97	B
17	NW	U	6/1/97	B
16	NW	U	5/15/97	B
16	RF	U	5/15/97	B
15	NW	U	5/1/97	B
15	RF	U	5/1/97	B
14	NW	U	4/15/97	B
14	RF	U	4/15/97	B

FIG. 8c


DDTS RISK MANAGEMENT SECURITY ADMINISTRATION
FILE EDIT FUNCTION PLATFORM FUNCTIONS WINDOW HELP
TABLE UPDATE - SERVER LIST
SAVE
SWITCH
ADD
UPDATE
CLOSE

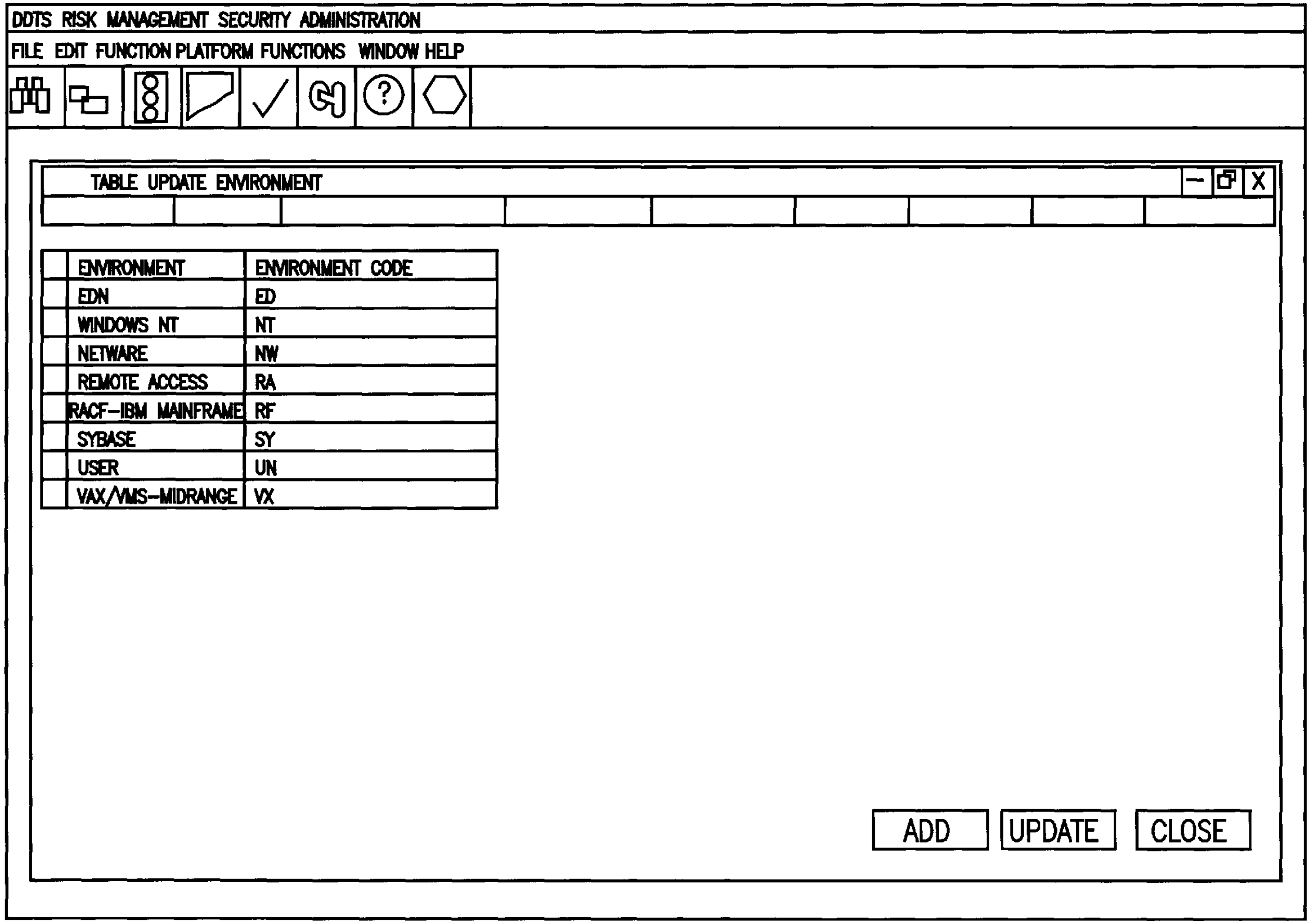
ENVIRONMENT	SERVICE	LOCATION	TYPE	ACTIVE	IP ADDRESS	REPORT DATE	LAST NEW DATE	CITY
NT		CMC	P	N	0000		1/10/97 2:11:45PM	
NT		CMC	P	N	000		1/8/97 3:27:00PM	
NT		CMC	P	N	000			
NT		CMC	P	Y				
NT		CMC	P	N	000			
NT		CMC	P	N	000			
NT		CMC	P	N	000			
NT		CMP	P	Y		1/96 4:59:07PM	8/8/96 4:57:18PM	
NT		CMP	P	Y	000	1/96 5:00:16PM	1/21/96 9;39:54AM	
NT		101	P	N		96 12:31:23PM	1/4/96 2:54:28PM	NEW YORK
NW		101	A	Y		9/30/96	1/4/96 2:55:28PM	NEW YORK
NW		101	A	Y		9/30/96	1/4/96 2:55:28PM	NEW YORK
NW		101	B	Y		96 12:31:43PM		NEW YORK
NW		101	P	Y		96 12:32:03 PM		NEW YORK
NW		CMC	P	Y		9/30/96	1/96 10:26:27PM	NEW YORK
NW		CMP	P	Y	12345	1/96/3:42:31PM		67777
NW		CMC	P	Y		12/23/95	1/96 10:25:19AM	NEW YORK
NW		CMP	P	Y		12/23/95		NEW YORK
NW		CMP	P	Y		96 12:26:243PM		NEW YORK
NW		CMP	P	Y		1/96 3:17:18PM		NEW YORK
NW		CMP	P	Y		1/96 9:07:05AM		NEW YORK
NW		CMP	P	Y		12/23/95	7/2/96 3:15:38PM	NEW YORK
NW			A	Y		9/30/96	1/25/96 4:48:17PM	NEW YORK
NW		CMP	P	Y		12/23/95		NEW YORK
NW		CMP	P	Y		96 11:09:12AM		NEW YORK
NW		CMP	P	Y		1/96 4:41:14PM		NEW YORK
NW		CMP	P	Y		96 11:10:47AM	/18/96 11:31:14AM	NEW YORK

FIG. 8d


DDTS RISK MANAGEMENT SECURITY ADMINISTRATION
FILE EDIT FUNCTION PLATFORM FUNCTIONS WINDOW HELP
TABLE UPDATE - SERVER LIST
SAVE
SWITCH
ADD
UPDATE
CLOSE

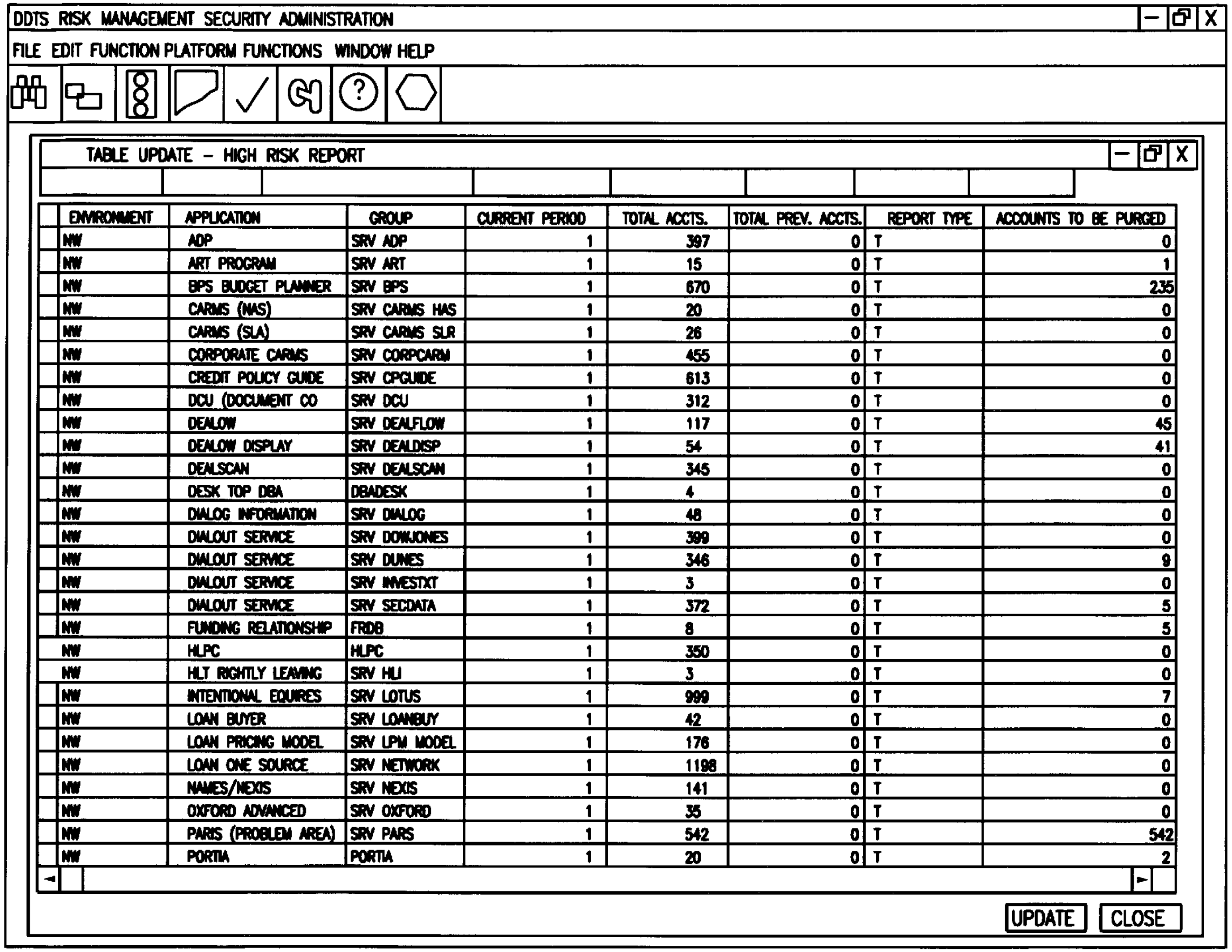
ENVIRONMENT	ACTIVE	DEADLINE DATE	APPLICATION	GROUP	MODIFICATION DATE	CONTACT 1	CONTACT 2	CONTACT 1
NW	N	96 10:00:25AM	APPTEST3	TEST 3	/30/96 10:01:34AM			
NW	N		ADP	SRV ADP	8/30/96 9:58:49AM			
NW	NT		APPTEST1	TEST 1	/28/96 10:20:02AM			
NW	N	96 10:18:27AM	APPTEST2	TEST 2	8/29/96 4:34:53PM			
NW			ART PROGRAM	SRV ART				
NW			BPS BUDGET PLANNER	SRV BPS				
NW			CARMS (NAS)	SRV CARMS HAS				
NW			CARMS (SLA)	SRV CARMS SLR				
NW	N		CORPORATE CARMS	SRV CORPCARM	9/6/96 2:07:35PM			
NW			CREDIT POLICY GUIDE	SRV CPGUIDE				
NW			DCU (DOCUMENT CO	SRV DCU				
NW			DEALOW	SRV DEALFLOW				
NW			DEALOW DISPLAY	SRV DEALDISP				
NW			DEALSCAN	SRV DEALSCAN				
NW			DESK TOP DBA	DBADESK				
NW			DIALOG INFORMATION	SRV DIALOG				
NW			DIALOUT SERVICE	SRV DOWJONES				
NW			DIALOUT SERVICE	SRV DUNES				
NW			DIALOUT SERVICE	SRV INVESTXT				
NW			DIALOUT SERVICE	SRV SECDATA				
NW			FUNDING RELATIONSHIP	FRDB				
NW			HLPC	HLPC				
NW			HLT RIGHTLY LEAVING	SRV HLI				
NW			INTENTIONAL EQUIRES	SRV LOTUS				
NW			LOAN BUYER	SRV LOANBUY				
NW			LOAN PRICING MODEL	SRV LPMODEL				
NW			LOAN ONE SOURCE	SRV NETWORKS				

FIG. 8e


DDTS RISK MANAGEMENT SECURITY ADMINISTRATION
FILE EDIT FUNCTION PLATFORM FUNCTIONS WINDOW HELP
TABLE UPDATE ENVIRONMENT
ADD
UPDATE
CLOSE

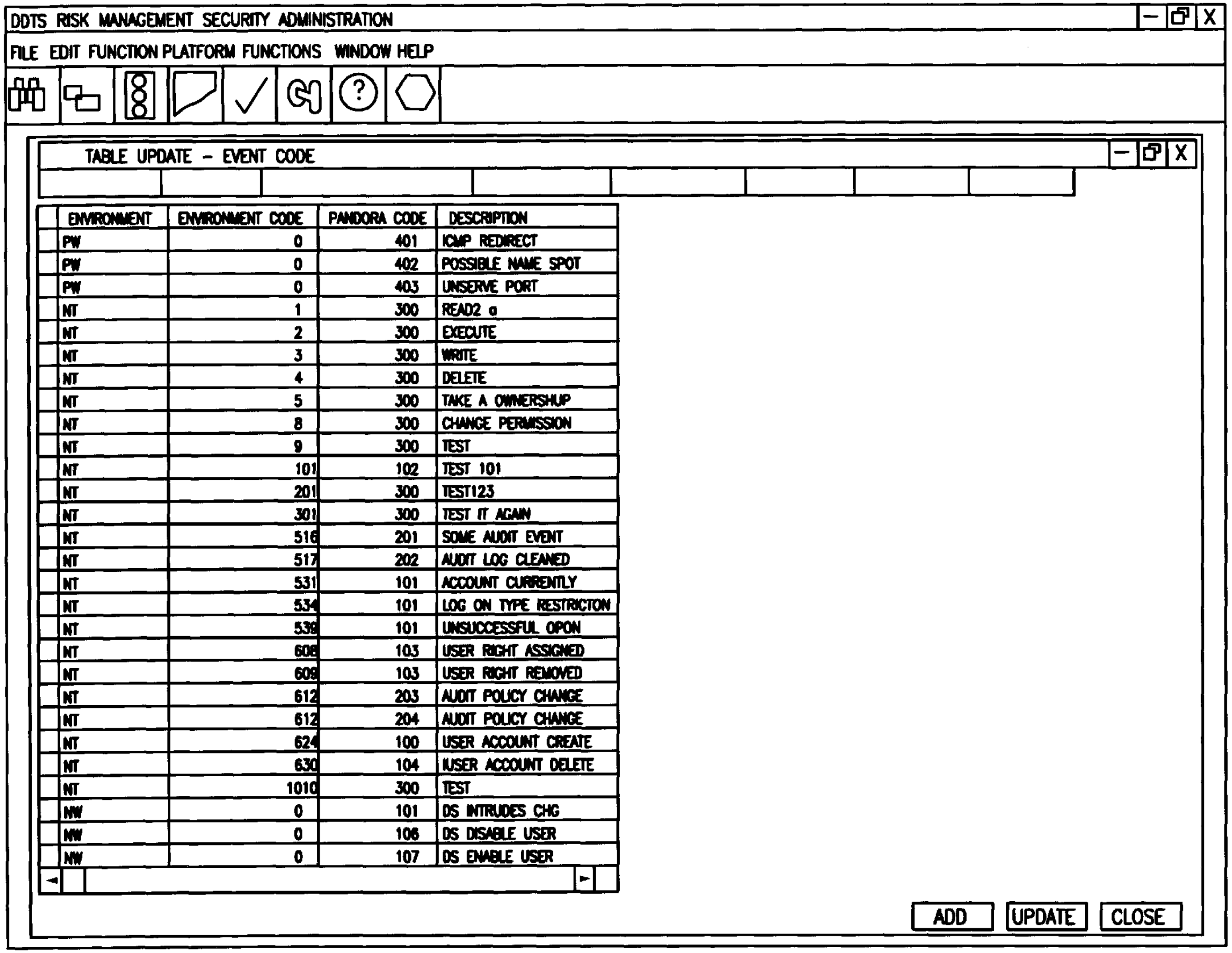
	ENVIRONMENT	ENVIRONMENT CODE
	EDN	ED
	WINDOWS NT	NT
	NETWARE	NW
	REMOTE ACCESS	RA
	RACF–IBM MAINFRAME	RF
	SYBASE	SY
	USER	UN
	VAX/VMS–MIDRANGE	VX

FIG. 8f


DDTS RISK MANAGEMENT SECURITY ADMINISTRATION
FILE EDIT FUNCTION PLATFORM FUNCTIONS WINDOW HELP
TABLE UPDATE – HIGH RISK REPORT
UPDATE
CLOSE

ENVIRONMENT	APPLICATION	GROUP	CURRENT PERIOD	TOTAL ACCTS.	TOTAL PREV. ACCTS.	REPORT TYPE	ACCOUNTS TO BE PURGED
NW	ADP	SRV ADP	1	397	0	T	0
NW	ART PROGRAM	SRV ART	1	15	0	T	1
NW	BPS BUDGET PLANNER	SRV BPS	1	670	0	T	235
NW	CARMS (NAS)	SRV CARMS HAS	1	20	0	T	0
NW	CARMS (SLA)	SRV CARMS SLR	1	26	0	T	0
NW	CORPORATE CARMS	SRV CORPCARM	1	455	0	T	0
NW	CREDIT POLICY GUIDE	SRV CPGUIDE	1	613	0	T	0
NW	DCU (DOCUMENT CO	SRV DCU	1	312	0	T	0
NW	DEALOW	SRV DEALFLOW	1	117	0	T	45
NW	DEALOW DISPLAY	SRV DEALDISP	1	54	0	T	41
NW	DEALSCAN	SRV DEALSCAN	1	345	0	T	0
NW	DESK TOP DBA	DBADESK	1	4	0	T	0
NW	DIALOG INFORMATION	SRV DIALOG	1	48	0	T	0
NW	DIALOUT SERVICE	SRV DOWJONES	1	399	0	T	0
NW	DIALOUT SERVICE	SRV DUNES	1	346	0	T	9
NW	DIALOUT SERVICE	SRV INVESTXT	1	3	0	T	0
NW	DIALOUT SERVICE	SRV SECDATA	1	372	0	T	5
NW	FUNDING RELATIONSHIP	FRDB	1	8	0	T	5
NW	HLPC	HLPC	1	350	0	T	0
NW	HLT RIGHTLY LEAVING	SRV HLI	1	3	0	T	0
NW	INTENTIONAL EQUIRES	SRV LOTUS	1	999	0	T	7
NW	LOAN BUYER	SRV LOANBUY	1	42	0	T	0
NW	LOAN PRICING MODEL	SRV LPM MODEL	1	176	0	T	0
NW	LOAN ONE SOURCE	SRV NETWORK	1	1198	0	T	0
NW	NAMES/NEXIS	SRV NEXIS	1	141	0	T	0
NW	OXFORD ADVANCED	SRV OXFORD	1	35	0	T	0
NW	PARIS (PROBLEM AREA)	SRV PARS	1	542	0	T	542
NW	PORTIA	PORTIA	1	20	0	T	2

FIG. 8g


DDTS RISK MANAGEMENT SECURITY ADMINISTRATION
FILE EDIT FUNCTION PLATFORM FUNCTIONS WINDOW HELP
TABLE UPDATE - EVENT CODE
ADD
UPDATE
CLOSE

ENVIRONMENT	ENVIRONMENT CODE	PANDORA CODE	DESCRIPTION
PW	0	401	ICMP REDIRECT
PW	0	402	POSSIBLE NAME SPOT
PW	0	403	UNSERVE PORT
NT	1	300	READ2 a
NT	2	300	EXECUTE
NT	3	300	WRITE
NT	4	300	DELETE
NT	5	300	TAKE A OWNERSHUP
NT	8	300	CHANGE PERMISSION
NT	9	300	TEST
NT	101	102	TEST 101
NT	201	300	TEST123
NT	301	300	TEST IT AGAIN
NT	516	201	SOME AUDIT EVENT
NT	517	202	AUDIT LOG CLEANED
NT	531	101	ACCOUNT CURRENTLY
NT	534	101	LOG ON TYPE RESTRICTON
NT	539	101	UNSUCCESSFUL OPON
NT	608	103	USER RIGHT ASSIGNED
NT	609	103	USER RIGHT REMOVED
NT	612	203	AUDIT POLICY CHANGE
NT	612	204	AUDIT POLICY CHANGE
NT	624	100	USER ACCOUNT CREATE
NT	630	104	IUSER ACCOUNT DELETE
NT	1010	300	TEST
NW	0	101	OS INTRUDES CHG
NW	0	106	OS DISABLE USER
NW	0	107	OS ENABLE USER

FIG. 8h

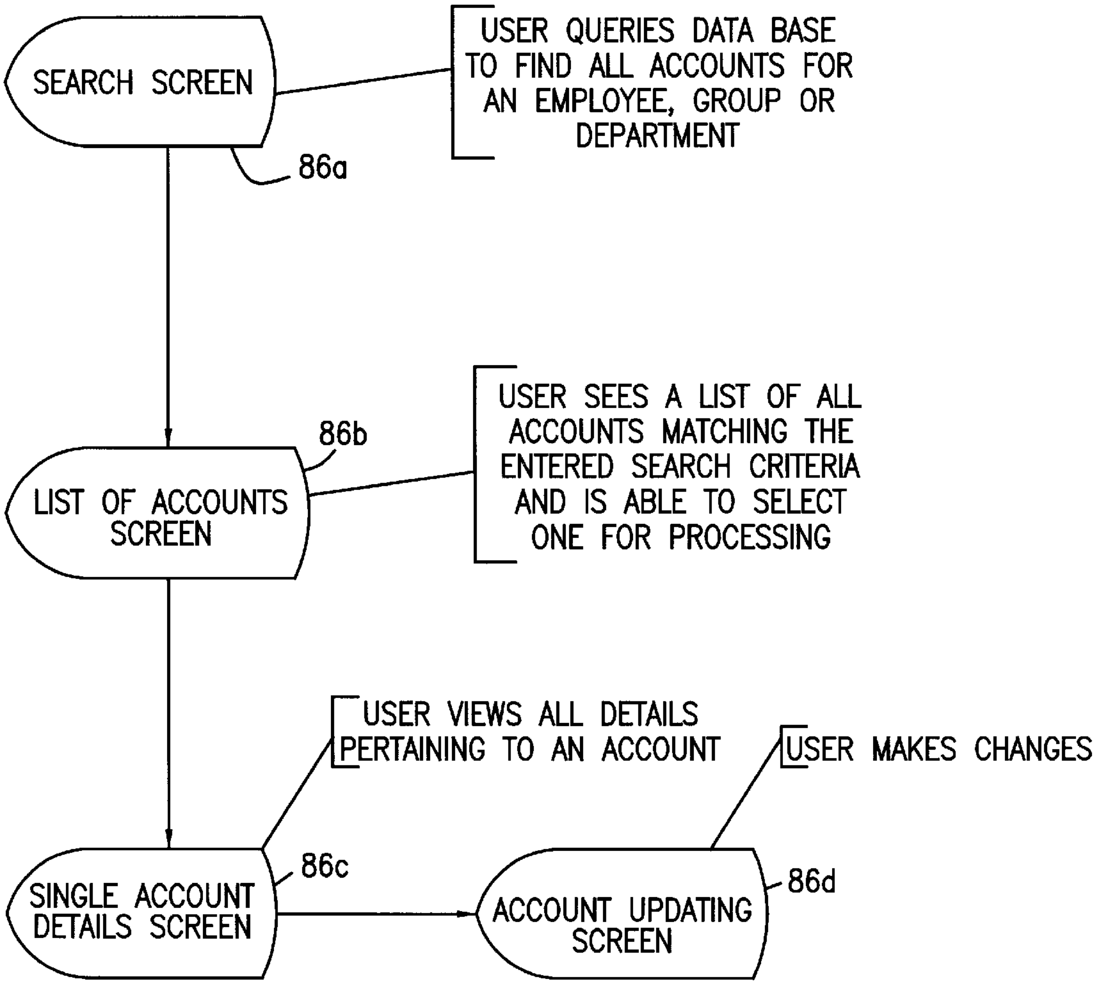

SEARCH SCREEN
USER QUERIES DATA BASE TO FIND ALL ACCOUNTS FOR AN EMPLOYEE, GROUP OR DEPARTMENT
86a
86b
LIST OF ACCOUNTS SCREEN
USER SEES A LIST OF ALL ACCOUNTS MATCHING THE ENTERED SEARCH CRITERIA AND IS ABLE TO SELECT ONE FOR PROCESSING
USER VIEWS ALL DETAILS PERTAINING TO AN ACCOUNT
USER MAKES CHANGES
SINGLE ACCOUNT DETAILS SCREEN
86c
ACCOUNT UPDATING SCREEN
86d

FIG. 9a

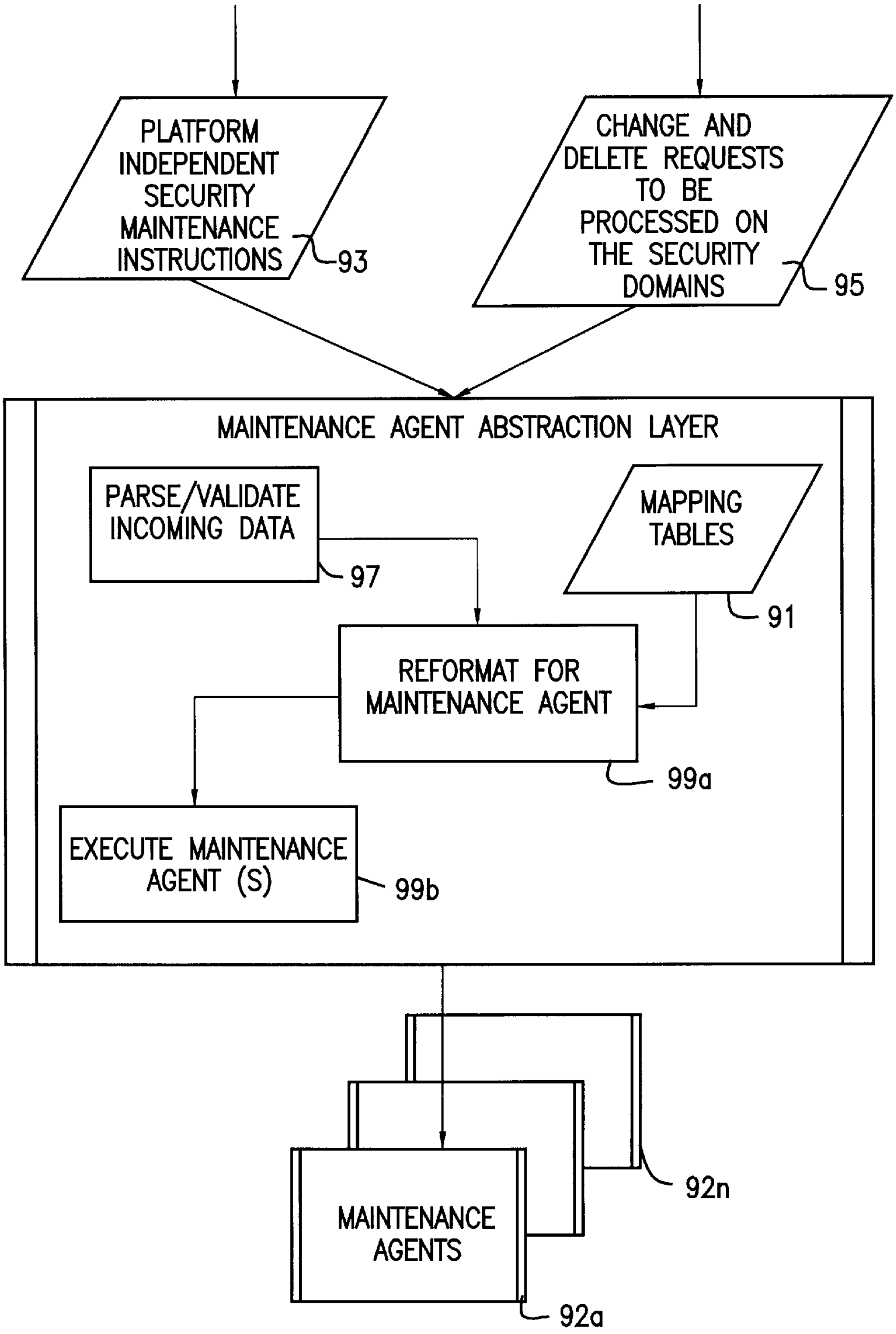

PLATFORM INDEPENDENT SECURITY MAINTENANCE INSTRUCTIONS
93
CHANGE AND DELETE REQUESTS TO BE PROCESSED ON THE SECURITY DOMAINS
95
MAINTENANCE AGENT ABSTRACTION LAYER
PARSE/VALIDATE INCOMING DATA
97
MAPPING TABLES
91
REFORMAT FOR MAINTENANCE AGENT
99a
EXECUTE MAINTENANCE AGENT (S)
99b
MAINTENANCE AGENTS
92n
92a

FIG. 9b

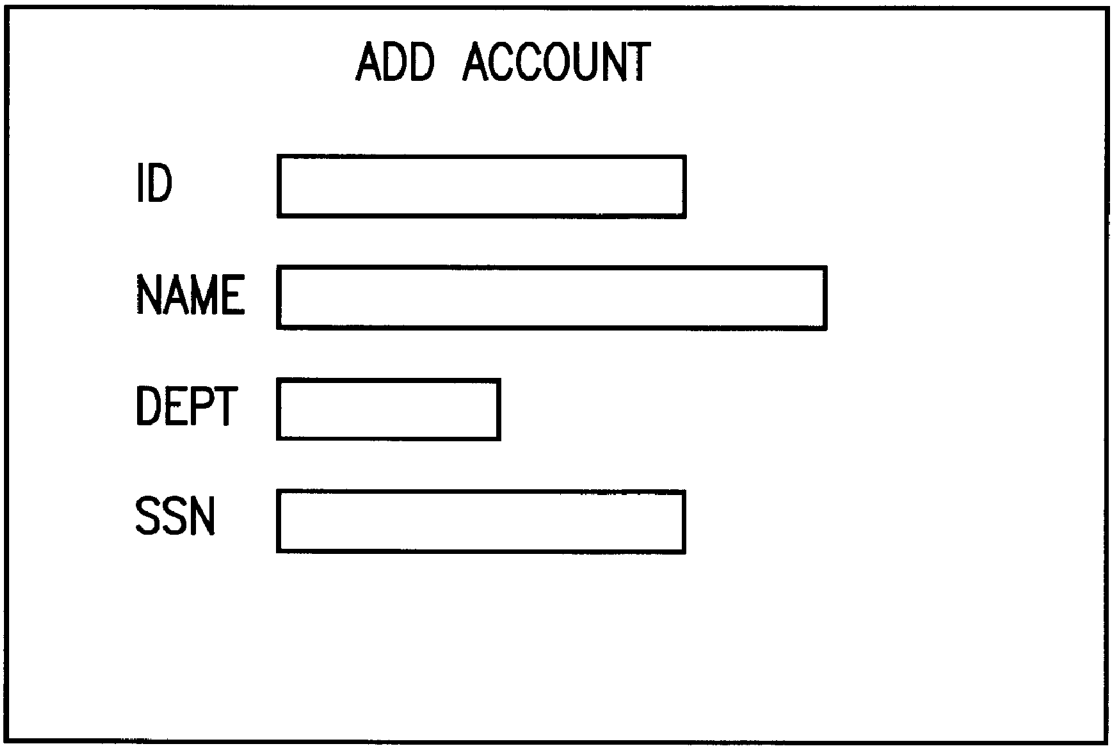


FIG. 10

```
8                                   # of input fields
15                                # of output fields
I                                 field delimiter
0 1 "NW"                        for this line and the next 14 lines...
1 2 " "                              column 1 is the field position
2 3 " "                                   in the input.  "0" means
3 4 " "                                   there is no input fields
4 5 ""                               column 2 is the field position
5 0 ""                                    in the output.
0 6 "" add_year (5)                  column 3 is used to place constant
7 7 ""                                    data is an output field
8 8 ""                               column 4 is the name of a routine
6 9 ""                                    that gets executed to fill
0 10 "0"                                   in the output field.
0 11 "0"
0 12 "" get_first3 (3)            these routines cause the name field to be
0 13 "" get_sec2or3 (3)            broken up into up to 3 parts to facilitate
0 14 "" get_first1 (3)            searching, and also extract the social
0 15 " "  get_ssn (3)              security number into a separate output field.
```

FIG. 11a

```
#
#
# Glean desired data from Somar NT audit file
#
#

$ARGV (0) =~ s?\\?/g;    #change backslash in file name to forward slash
$ARGV (1) =~ s?\\?/g;    #change backslash in file name to forward slash
open  ( SECLOG,  "$ARGV [0]"  )   || die "ERROR – Could not open SECLOG $ARGV(0)\n";
open  ( OUTFILE, ">$ARGV [1]" )   || die "ERROR - Could not open OUTFILE $ARGV(1)\n"
;
readloop: while  (<SECLOG>)  {

        $_=~ s/\|/ /g;
        @recflds        = split ( ',', $_, 9 );
#       $logtype        =  $recflds [0];
        $datatime       =  $recflds [1];
#       $source         =  $recflds [2];
        $eventcd        =  $recflds [3];
        $successcd      =  substr ($recflds[4],0,1);
#       $successcd      =  $recflds [4];
#       $category       =  $recflds [5];
        $recflds [6]    =~ m/(\\) (.+)/;
        $user           =  $2;
        $computer       =  $reflds[7];
        $recdata        =  $recflds[8];

        ### some audit event recs discarded
        if  ( $eventcd == 516 )  {
                $pandoracd = 201;
                print OUTFILE "NT|$computer|$user|$pandoracd|$eventcd|$datetime|
$successcd|0||||\|n";
```

FIG. 11b

```
next;   ### audit log cleared
        if ( $eventcd = =  517 ) {
                $recdata = ~ m/ (Client User Name: ) (\t) (.+) /;
                $x =   index ($3, `^^`) ;
                $user  =  substr ( $3, 0, $x) ;
                $pandoracd  =  202;
                print OUTFILE “NT| $computer | $user | $pandoracd | $eventcd | $datetime |
$successcd | 0 | | | | \ n ” ;
                next ;
        }

        ### account currently disabled
        if  (  $eventcd = = 531  )  {
                $recdata = ~ m/ ( User Name : ) (\s+) (.+) / ;
                $x = index ($3,  `^^`) ;
                $user = subtr ( $3, 0, $x);
                $recdata = ~ m/( Domain: ) ( \s+ ) ( .+ ) / ;
                $x = index ( $3, `^^` ) ;
                $miscdata = $1  .  `  `  .  substr ( $3,  0,  $x )  .  ` ;  ` ;
                $recdata = ~ m/ (Workstation  Name : ) ( \s+ ) ( .+ ) / ;
                $x = index ( $3,  `^^` ) ;
                $miscdata .= $1  .  `  `  .  substr (  $3,  0,  $x )  .  ` ;  ` ;
                $pandoracd = 101 ;
                print OUTFILE  “NT | $computer | $user | $pandoracd | $eventcd | $datetime|
$successcd | 0 | | $miscdata “ ;
                print OUTFILE “Logon attempted to disable account | | \n” ;
                next ;
        }

        ### logon type restricted
        if  (  $eventcd = =  534 )  {
                $recdata = ~ m/ (User Name : ) ( \s+ ) ( .+ ) / ;
                $x = index ( $3, `^^` ) ;
                $user = sub  r (  $3,  0,  $x ) ;
```

FIG. 11c

COMPUTER NETWORK SECURITY MANAGEMENT SYSTEM

BACKGROUND OF THE INVENTION

The present invention is generally directed to a computer security system and, more particularly, to a centralized, computer-network security management system capable of handling many different kinds of equipment in a standardized format despite differences in the computer security features among the diverse range of computer equipment in the computer network.

With the current-day increase in dependence on information systems for doing business the risk of misuse or sabotage of those systems has grown to be very real. Making the problem more real are the daily news stories of hackers breaking into computers, and computers being infected with viruses. Adding to the risk is the rise in the number of mergers and acquisitions, which has resulted in large numbers of both new system users and potentially disgruntled displaced workers.

To reduce the risk, various technical solutions have been developed, for example the requirement for a password to be entered before logging on to a system. In addition, non-technical solutions have been developed, for example in the form of company policies that mandate the disablement of logon accounts not used for 90 days or more.

These solutions have helped alleviate the problems but have also opened up new ones. The technical solutions have brought with them the need for security administration, and with that has sometimes come incomplete or incompetent administration. There is a need for constant auditing of security systems to ensure compliance. The large number of users and systems makes manual auditing impractical. Larger companies tend to have the additional problem arising from their use of large computer networks containing many different kinds of equipment, each with its own version of security handling features and protocols. These incompatible protocols and the added problem of rapidly changing technical environments on world wide networks have aggravated and impeded the search for a satisfactory solution.

At present, many large companies are saddled with large, complicated information security schemes that contain loopholes and which cannot be supervised and audited effectively. This has increased their vulnerability to unauthorized use of their confidential information systems and databases for industrial espionage or even to sabotage.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an improved security management system for computer networks.

It is a further object of the invention to provide a computer network security management system which is easier to implement and use.

Yet another object of the invention is to provide a computer network security management system which provides a high measure of confidence that the security of a computer network will not be breached.

A further object of the invention is to provide a computer network security management system having a standardized protocol for handling security issues across a large range of different pieces of computer equipment.

The foregoing and other objects of the invention are realized in accordance with the present invention by a system which collects information from all repositories of security data on a computer network, standardizes it, stores the data in a central database and enables automatic and manual correction of erroneous data.

Components of the invention report on exceptions to, i.e. deviations from, security policies, and an automatic mechanism dynamically fixes compliance problems by administering the native security platforms. An analysis component reviews incoming data, looking for system break-in attempts and irregular or suspicious changes to vital security components. Another analysis component enables grouping of data by person or organization, across security platform boundaries. A manual maintenance component allows system maintenance to be done through a common user interface.

The invention uses a layered software architecture, enabling a separation of basic functions from the complications of differing technologies, and facilitating automated handling of many operations. The architecture can be viewed at a very high level as consisting of two layers: technology specific and technology independent. The technology specific layer consists of many groups of software modules, each group addressing the complexities of a single technology (e.g., NetWare™ 3.1, Windows NT, AIX, Sybase, etc.). The primary functions of the technology specific layer are extracting and maintaining security data on the target platforms, and converting the data to and from the common data model used by the technology independent layer.

The technology independent layer handles the main functionality of the system: locating terminating employees, auditing system and user data, monitoring security events (e.g. failed login attempts), automatically initiating corrective action, interfacing with the system users, reporting, querying and storing of collected data.

The invention is unique in many aspects including the following. It is a self-correcting data security audit system. In contrast, many existing approaches rely on manual correction after policy discrepancies are detected. The invention automatically takes action, changing system parameters (e.g., minimum password length made consistent with policy) or user parameters (e.g., forcing a password change at the next login if time limit is exceeded) as necessary.

The invention is also able to capture security data from all of the different platforms, consolidate it and operate on it in a common format. It is also unique in that it is able to identify the persons who own the various accounts. Existing products collect data only for a single environment or machine, leaving the security officers to manually consolidate across platforms.

Analyzing multi-platform data for security break-in attempts is another unique aspect. Sophisticated attacks on the information systems can be detected with this feature. The invention also provides the ability to manage security with a single user interface while not giving up the ability to simultaneously use platform specific tools. Prior to the invention, a decision to use centralized security management forced abandonment of platform specific tools. This is because centralized management tools use their own accounts data base which is then replicated to the actual platforms. Changes not made through the centralized tool are "lost" as far as the centralized tool is concerned. The invention avoids this limitation by routinely collecting data from the platforms, so it is always aware of changes.

Other features and advantages of the present invention will become apparent from the following description of the invention which refers to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of a prior art computer security management system.

FIG. **2** is a conceptual block diagram of the system layout of a centralized computer network security management system in accordance with the present invention.

FIG. **3***a* is a block diagram and flow-chart delineating the information flow and major functions of the system of FIG. **2**.

FIG. **3***b* is a continuation of FIG. **3***a*.

FIGS. **4***a*–**4***i* are flow charts depicting major functions that are carried out by various components of the invention.

FIGS. **5***a*–**5***d* are sample computer screens generated in the course of the collection agent component of the present invention performing its tasks.

FIGS. **6***a*–**6***e* are flow charts which depict interactions between various components of the system of the present invention.

FIGS. **7***a*–**7***c* are sample security reports produced by the present invention.

FIGS. **8***a*–**8***h* show further computer operator screens generated in the course of the operation of the present invention.

FIGS. **9***a*–**9***b* are further flow charts illustrating the operation of the present invention.

FIG. **10** shows an information entry block form used to add an account in the system of the present invention.

FIGS. **11***a*–**11***c* show portions of computer source code used to implement certain functions performed by the present invention.

DETAILED DESCRIPTION OF THE INVENTION

With reference to FIG. **1**, typical large business or governmental organizations have complex computer systems comprising many different computer hardware units or networks that operate under diverse and disparate software products which are intrinsically incompatible with one another. In a typical system, one group of computers may operate under a Netware software system **12**, another group **14** may use the Unix operating system **14**, a third Windows NT **16**, or AIX **18** or constitute a database operating under the Sybase **20** database software system. Each of these systems has a different and unique security management approach and protocol, as represented by the security system software blocks **22**, **24**, **26**, **28**, **30** which correspond to the software systems **12**, **14**, **16**, **18**, **20**, respectively.

To the extent that a system administrator wishes to exercise supervision and control over security issues relating to such systems, it is necessary for the various groups of computers to be connected to a central security administration system **10** via specifically designated lines **32**, **34**, **36**, **38** and **40**. In the prior art, the security administration system **10** may comprise no more than individual computer terminal (s) (not shown) which allow security personnel to individually query and maintain security standards at the different computer systems on a system-by-system basis. The approach of the prior art is cumbersome and not particularly reliable.

The present invention allows a security administration system **50** (conceptually shown in FIG. **2**) to handle security issues on a global basis by enabling personnel which are responsible for it or automatic computer equipment to issue common commands that are applicable to the various pieces of hardware and software subsystems. With reference to FIG. **2**, a company-wide computer network **52** consists of different hardware/software subsystems, **12**, **14**, **16**, **18** and **20** each of which has a specific security domain **22**–**30** (FIG. **1**) are all coupled to an abstraction facility **54** which serves to reformat and standardize security related data packets. Thereby, the abstraction facility **54** is able to provide over line **55** security data pertaining to all of the subsystems **12**–**20** for the purpose of being handled by the central security processor **60** in a consistent and standard manner. This enables the security administration or personnel **62** which is coupled to the central security processor **60** to handle and deal with security issues in a direct, globally applicable and standardized format. Indeed, the central processor **60** is programmed to act on many security related decisions automatically. Either way, when a decision concerning security matters is made, the processor responds by taking several actions, including providing relevant information and commands to a compliance facility **58** which process the information and causes the central security processor **60** to issue the appropriate commands to the local commands translator **56**.

The function of the local commands translator **56** is to convert common security-related instructions to group-wise or device-specific instructions which can be understood by the individual subsystems **12**–**20** of the computer network **52**. The compliance facility **58** also interfaces with an alerting facility agent **64** that is able to contact key personnel or other computer systems, e.g. an external system **68**, regarding security breaches. Appropriate hard copy reports and the like can be provided through a reports generator **66**.

Reference is now made to FIGS. **3***a* and **3***b* which explain in greater detail the system configuration and overall software flow of the system of the present invention. The technology specific layer consists of many groups of security related software modules which are depicted in FIG. **3***a* as security domains **70***a*, **70***b*, **70***c* . . . **70***n*. The security domains **70***a*–**70***n* represent workstations, servers, LANs, Windows NT and other such computer software or hardware that are of interest to security officers and auditors. The definition of a security domain depends on the security architecture of the platform. For example, Windows NT normally manages security at a domain level, managing a group of machines, while NetWare™ manages it on a per-machine basis. Each security domain houses its own store of security information, i.e. parameter settings, user Ids, passwords, etc.

The security domains **70***a*–**70***n* communicate with collection agents **72***a*, **72***b*, **72***c* . . . **72***n*, respectively. These collection agents **72***a*–**72***n*, a part of security administration system **50**, represent software facilities written specifically for the corresponding operating system or system software components, for example the workstation server, LAN or NetWare™ software facility comprising the security domains **70***a*–**70***n*. Therefore, there are many different collection agents, each of which is associated with a specific security domain type. The present invention has been reduced to practice with collection agents specific to NetWare™ 3.1, NetWare™ 4.0, Windows NT, two different remote access servers, RACF, ACF2, Sybase, Oracle, AS 400, VAX/VMS, Tandem, Lotus Notes, four different UNIX operating systems and an Internet firewall.

The collection agents **72***a*–**72***n* use system utilities and/or APIs (Application Programming Interfaces) to extract from the individual security domains **70***a*–**70***n* specific data defining security information pertaining to the system users, passwords, security groups, and where applicable:

permissions, access controllers, logon events, file access events, system management events, file attributes, software and hardware versions, password control parameters, system parameters and the like. The information they collect is passed to the collection agent abstraction layer or facility **74** for further processing.

The collection agent abstraction facility **74** comprises a rule-driven software facility that rationalizes the data collected by the collection agents **72***a*–**72***n* into standardized sets of data. This allows software modules which subsequently handle the data to ignore platform specific differences, in a manner which enables further processing of security data to be handled as source-independent information. The collection agent abstraction facility **74** takes into account platform differences as well as other differences such as administrative conventions used at each specific security domain. It enhances the data by identifying account owners, thereby forming a link to personnel and organizational information. This facility **74** is a key component of the solution because it allows auditors and security officers to view their many environments with a single tool, and a single, enhanced view of the data.

The collection agent abstraction facility **74** may run on one or more computers, as may be necessitated by system considerations. Furthermore, more than one software package may run on the same machine. The collection agent abstraction facility **74** may execute on the same machine and at the same time as other software (to be described) is running.

The information developed and organized by the collection agent abstraction facility **74** is stored in the database **76**. This database **76** uses off-the-shelf software for storing and receiving collected data. In an embodiment of the invention which has been reduced to practice the database **76** has been implemented through the use of the well-know Sybase™ database engine. Data rationalized by the collection agent abstraction facility **74** has been organized and stored in the embodiment that has been reduced to practice in the manner shown in the Table I below.

TABLE I

DATABASE TABLES (Technology Independent)

Table Name	Column Name
User accounts	security domain type code
	security domain name
	user account id
	user account name
	user account last login date
	user account creation date
	user account created by id
	user account disabled
	user account name tokens
	user account ssn token
	user account department token
	user encrypted password
Privilege groups	security domain type code
	security domain name
	group name
Privilege group members	security domain type code
	security domain name
	group name
	user account id
Security domains	security domain type code
	security domain name
	security domain minimum password length
	security domain password requires alpha and num
	security domain password history count

TABLE I-continued

DATABASE TABLES (Technology Independent)

Table Name	Column Name
	security domain password reuse count
	security domain password pre-expired indicator
	security domain failed login disable count
	security domain workstation disable indicator
	security domain legal notice indicator
	security domain operating system version
	security domain operating system type

TABLE I

DATABASE TABLES (Technology Independent)

Table Name	Column Name
	security domain operating system patch number
	security domain hardware information
Resource access privileges	security domain type code
	security domain name
	user account id
	resource name
	resource type
	resource access privileges
Monitored files	security domain type code
	security domain name
	file name
	file creation data
	file created by
	file last updated date
	file last updated by
	file size
	file permissions
	file location
Audit events	security domain type code
	security domain name
	event code
	event date and time
	event user
	event success or fail indicator
	event file name
	event other information
Security policies	security policy minimum password length
	security policy password requires alpha and num
	security policy password history count
	security policy password reuse count
	security policy password pre-expired indicator

TABLE I

DATABASE TABLES (Technology Independent)

Table Name	Column Name
	security policy failed login disable count
	security policy workstation disable indicator
	security policy legal notice indicator
Baseline files	security domain type code
	file name
	file creation data
	file created by
User account maintenance	security domain type code
	security domain name
	user account id
	user account name
	user account disabled
	user account ssn token
	user account department token
	maintenance action code
Privilege groups maintenance	security domain type code
	security domain name

TABLE I-continued

DATABASE TABLES (Technology Independent)

Table Name	Column Name
	group name maintenance action code (add. remove)
Privilege group members maintenance	security domain type code security domain name group name user account id maintenance action code (add. remove)
Resource access privileges maintenance	security domain type code

TABLE I

DATABASE TABLES (Technology Independent)

Table Name	Column Name
	security domain name user account id resource name resource type resource access privileges maintenance action code (add. remove. change)

The database component **76** also includes graphical user interface (GUI) programs that allow the system's administrators to maintain "static" tables, such as the security policy and base file tables, as shown in Table I.

Referring now to FIG. **3***b*, note that the standardized information in the database **76** is accessible to several different software facilities identified as the compliance agent **78**, the alert agent **80** and the query agent **82**.

The compliance agent software **78** is software that analyzes collected data to determine if user and system data complies with security policy requirements. This component of the invention is another key component of the solution, which allows auditors and security officers to automatically monitor the computer network security environments. In the prior art, security officers had to manually check the settings for each machine, LAN, domain, etc. The compliance agent **78** produces exception reports identifying non-complying systems and users, and also passes its findings to a system component called the active agent **84** for further processing.

The active agent **84** is software that determines whether and how to bring non-complying computer subsystems into compliance. To this end, the active agent **84** issues instructions and commands to the maintenance agent abstraction layer or facility **90**. Typical instructions are to disable user accounts of terminated employees, disable accounts that have not been used recently, change server parameters to ensure adequate password rules and force users to change their non-compliant passwords at the next logon, when this is warranted. The active agent **84** can be suppressed for certain user accounts or certain ones of the security domains **70***a*–**70***n*, based on exception records stored in the database **76**. For example, administrator or supervisor accounts may be dormant for many months on a particular computer, but must not be disabled or deleted. The active agent **84**, operating in conjunction with the compliance agent **78** constitutes a self-policing, self-enforcing security system that operates automatically to keep the individual security domains **70***a*–**70***n* in compliance with company security policies and regulations.

The logical flow and key software steps of the active agent comprise the self-explanatory steps **84***a*, **84***b*, **84***c*, **84***d* and **84***e* shown in FIG. **4***f*. The interaction of the active agent **84** with a data block **76***d* of the database **76**, which contains exception parameters, and with other components of the invention is illustrated in FIG. **6***c*.

Typical instructions of the active agent **84** includes such instructions as to disable user accounts of terminated employees, disable accounts that have not been used recently, change server parameters to ensure adequate password rules and force users to change their non-compliant passwords at the next logon. The active agent **84** can be suppressed for certain user accounts or security domains, based on exception records stored in the database **76**.

Commands and instructions concerning security measures to be taken relative to the security domains **70***a*–**70***n* are also received by the maintenance agent abstraction facility **90** from the manual maintenance agent **86**. The manual maintenance agent receives manual inputs **87** which are translated into commands concerning security issues that are manually inputted by the administrator or security officer of the system of the present invention.

The maintenance agent abstraction facility **90** is accordingly configured to received hardware and software independent instructions from the active agent **84** and from the manual maintenance agent **86**. It converts these instructions into general hardware and software instructions that pertains to the individual platforms, i.e. security domains **70***a*–**70***n*. More specifically, the maintenance agent abstraction facility **90** passes the instructions and commands to the individual maintenance agents **92***a*–**92***n*. Each of these maintenance agents **92***a*–**92***n* communicates exclusively with a corresponding one of the security domains **70***a*–**70***n* and is designed to convert the general hardware and software instructions to specific instructions that can be understood by the individual platforms, i.e. security domains **70***a*–**70***n*. Since the data collection is standardized by the collection agent abstraction facility **74** and the issuance of instructions to the security domains **70***a*–**70***n* is also standardized in the maintenance agent abstraction facility **90**, the invention obviates the need for separate local databases. This allows account maintenance to be done using any available tools such as native environment tools, or by the manual maintenance agent **86** or the active agent **84** working in conjunction with the compliance agent **78**.

Internally (FIG. **9***b*), the maintenance agent abstraction facility **90** receives incoming platform independent instructions **93** (via the manual maintenance agent **86**) and requests **95** involving requests for changes and deletions (via the active agent **84**). It then parses and validates these requests as shown at step **97**. It converts the parsed requests into platform-specific requests as shown at steps **99***a* and **99***b* of FIG. **9***b*. It does this by consulting internal mapping tables **91** which direct movement of data from the input fields to the output fields, i.e. from the general format security instruction protocol to the protocol that is more appropriate to the individual security domains. Finally, the maintenance agent abstraction facility commands the appropriate maintenance agents **92***a*–**92***n* to carry out the specific requests and/or commands. In this manner, one platform independent request might result in iterative execution of a single maintenance agent function and/or the execution of multiple maintenance agent actions depending on the request.

The maintenance agents **92***a*–**92***n* comprise platform-specific software, so there are many different types of maintenance agents. This software invokes the security processing of the native platforms, i.e. of the security domain **70***a*–**70***n*, through commands or programming APIs, to accomplish the work passed from the active agent **84** and the manual maintenance agent **86** through the maintenance agent abstraction facility **90**. The broadly described program steps **93***a*, **93***b* and **93***c* are self-explanatorily depicted in FIG. **4***i*.

The specific architectures of the various maintenance agents **92***a*–**92***n* can take on different forms depending on the environment. For example, in the NetWare™ environment, the maintenance agent is a Visual Basic™ application that issues NetWare™ API calls to accomplish its work. In the Windows NT environment, the maintenance agent is also a Visual Basic™ application, but uses the Win32 API. For Unix environments, the maintenance agent may be a C program that issues Unix commands and operates on the security files. In the RACF and ACF2 environments, the maintenance agents produce command files which are uploaded to the hosts and executed there. Since the maintenance agent abstraction facility **90** has already prepared most of the protocol and command structure necessary to control the security domains **70***a*–**70***n*, the maintenance agents **92***a*–**92***n* are generally simpler programs. The overall flow diagram of the maintenance agents **90***a*–**90***n* includes steps **93***a*, **93***b* and **93***c* which are presented in FIG. **4***i*.

As described above, the system of the present invention constitutes a self-correcting data security audit system which operates both in an automatic mode and in response to specific inputs from the administrator or other security personnel through the manual maintenance facility **86**. The invention automatically takes actions and changes system parameters or user parameters as necessary. The invention automatically, reliably and consistently captures all of the security data from all of the different platforms, consolidates the data and operates on it in accordance with a common format and protocol. It then acts on that information to control the system, again employing a common format that gets translated only at the last layer via the maintenance agents **92***a*–**92***n* to fit the specific formats required by the security domains **70***a*–**70***n*. Additional functions and features of the aforementioned components of the system of the present invention are described in further detail with reference to the remaining figures.

FIGS. **4***a*–**4***c* provide three examples of procedures used in the collection agents **72***a*–**72***n* by setting forth various process steps executed in those elements of the instant invention. More specifically, FIG. **4***a* shows the steps **75***a*, **75***b*, **75***c*, **75***d*, **75***e*, **75***f*, **75***g*, **75***h*, **75***i*, **75***j* and **75***k* for a Unix controlled security domain. FIG. **4***b* shows steps **75***l* through **75***t* for a Windows NT security domain and FIG. **4***c* the steps **75***u*–**75***ab* for a NetWare™ environment. In this connection, Table II reproduced below shows the data that is collected by the collection agents **72***a*–**72***n* and passed to the collection agent abstraction facility **74**, via database **76**.

TABLE II

COLLECTION AGENT OUTPUT HELDS

TABLE II-continued

Field Name	Unix	NT	NetWare
USER ACCOUNT RELATED			
user account id	x	x	x
user account name	x	x	x
user account last login date	x	x	x
user account creation date	x	x	x
user account created by id			x
user account disabled	x	x	x
user encrypted password	x	x	
SECURITY GROUP RELATED			
group name	x	x	x
group user accounts	x	x	x
SECURITY DOMAIN RELATED			
security domain type code	x	x	x
security domain name	x	x	x

TABLE II

COLLECTION AGENT OUTPUT HELDS

Field Name	Unix	NT	NetWare
security domain minimum password length	x	x	x
security domain password requires alpha and num			
security domain password history count		x	x
security domain password reuse count		x	
security domain password pre-expired indicator	x		x
security domain failed login disable count	x	x	x
security domain workstation disable indicator			
security domain legal notice indicator	x	x	
security domain operating system version	x	x	x
security domain operating system type	x	x	x
security domain operating system patch number	x	x	x
security domain hardware information	x	x	
RESOURCE ACCESS RELATED			
user account id			
resource name	x	x	x
resource type	x	x	x
resource access privileges	x	x	x
FILE RELATED			
file name	x	x	x
file creation data	x	x	x
file created by		x	x
file last update date		x	
file last updated by		x	
file size	x	x	x
file permissions	x	x	x
file location	x	x	x
AUDIT EVENT RELATED			
event code		x	x
event date and time		x	x
event user		x	x
event success or fail indicator		x	x
event file name		x	x
event other information		x	x

For example, the collection agents are able to extract and report to the collection agent abstraction facility the "user account ID" for the Unix, Windows NT and NetWare™ platforms. However, a field such as the "user account created by ID" can only be gathered from the NetWare™ platform. Table II further shows that the different data pieces can be grouped into different categories, for example, a group of data which is "user account" related and another which is "security group" related, etc.

FIGS. **5***a* and **5***b* show, respectively, computer screens **85***a*, **85***b* provided to the system operator to enable the selection and control of collection activities and the entering of necessary parameters for the NetWare™ environment. Sample screens **85***c*, **85***d* for Window NT environments are shown in FIGS. **5***c* and **5***d*.

As previously noted, only information provided by the various collection agents **70***a*–**70***n* is provided to the collection agent abstraction facility **74**, which performs the major function steps identified in FIG. **4***e*. These steps include step **100***a* involving scheduling the starting of the program at a designated time of day. This is followed by steps **100***b*, **100***c*, **100***d*, **100***e* and **100***f* which entail such functions as reading data from the particular collection agents, determine the type of environment of the received data; mapping the data to a generic language using an appropriate map for the environment, sending the map data to the database **76** and repeating the above steps for the remaining collection agents.

FIG. **11***a* is an example of source code or control statements for a parsing utility used as a part of the implementation of the collection agent abstraction facility **74** for NetWare™ parsing. Its basic function is to rearrange and decipher platform-specific input fields into the common format. FIG. **11***b* is an example of the beginning of a Perl script used to parse and reformat detailed Windows NT security log records into the standard internal format used for audit data. FIG. **11***c* is a continuation of the Perl script of FIG. **11***b*.

While Table II presented above shows the type of data that is input to the collection agent abstraction facility **74**, Table III reproduced below shows the output data fields of the collection agent abstraction facility.

TABLE III

Collection Agent Abstraction Layer Output Field (technology independent)
USER ACCOUNT RELATED
security domain type code
security domain name
user account id
user account name
user account last login date
user account creation date
user account created by id
user account disabled
user account name tokens
user account ssn token
user account department token
user encrypted password
SECURITY GROUP RELATED
security domain type code
security domain name
group name
group user accounts
SECURITY DOMAIN RELATED
security domain type code
security domain name
security domain minimum password length
security domain password requires alpha and num
security domain password history count
security domain password reuse count
security domain password pre-expired indicator
security domain failed login disable count
security domain workstation disable indicator
security domain legal notice indicator
security domain operating system version
security domain operating system type
security domain operating system patch number
security domain hardware information
RESOURCE ACCESS RELATED
security domain type code
security domain name
user account id
resource name
resource type
resource access privileges
FILE RELATED
security domain type code
security domain name
file name
file creation data
file created by
file last update date
file last updated by
file size
file permissions
file location
AUDIT EVENT RELATED
security domain type code
security domain name
event code
event date and time
event user
event success or fail indicator
event file name
event other information

The major enhancement to the collected data centers around decoding information that is normally placed in the name field of each user account record. Common practice is to include name and/or payroll number and/or organization code. The name is also split into "tokens" to allow searching and facilitate analysis of collected information.

As shown in FIG. **6***a*, the database **76** stores data **76***a* obtained from the security domains **70***a*–**70***n* which has been rationalized and reformatted by the collection agent abstraction facility **74**. It also holds policy data **76***b* which reflects the set of rules and regulations applicable to the security system which has been manually inputted by security personnel as indicated by reference numeral **77** in FIG. **3***b* or pre-stored therein. The compliance agent **78** serves to review the reformatted data **76***a* and the policy data **76***b* and to compare the same. Whenever the collected data indicates non-compliance or less stringent compliance than standard policy requirements an exception is triggered and appropriate exception reports **79** are generated. Certain ones of the exception reports **79** may also be sent to the active agent **84** as indicated by line **85**, for further processing and action by the active agent. FIGS. **7***a*, **7***b* and **7***c* are examples of compliance agent reports, i.e. the exception reports **79**.

The following is a partial list of exception conditions:

minimum password length is too short

password life is longer than 90 days

more than 3 failed logins are being allowed before an account is disabled

concurrent logins are allowed

account has not been used in 90 days and is not disabled

account was used after employee termination date

Certain conditions can be automatically fixed by the system. Unused accounts can be automatically disabled. Password length and life parameters can be changed. In cases where automatic correction is desired, the compliance agent **78** sends instructions to the active agent **84** specifying what needs to be changed. The active agent **84** can then correct the exception condition by sending the appropriate instruction to the maintenance agent abstraction facility **90**.

FIG. 4*d* presents in a self-explanatory manner the key steps **78***a*, **78***b*, **78***c*, **78***d* and **78***e* that are carried out by the compliance agent **78**.

Referring again to FIG. **3***b*, the alert agent **80** comprises software that analyzes collected data residing in the database **76** to determine if unusual security activities have taken place. An example of such activity is an unusually large increase in the number of failed access attempts, repeated failed attempts from a single user or location, or modification of certain key security or operating system files within any one of the security domains **70***a*–**70***n*. The alert agent **80** automatically notifies appropriate personnel by e-mail, phone and/or pager. This is indicated by the alarm arrow **81** in FIG. **3***b*. The alert agent **80** is unique in that it is able to monitor across dissimilar environments, protecting against more sophisticated intrusion attacks that cannot be detected with previous generations of tools, which could only monitor one security domain at a time. The main sequence of program events taking place at the alert agent **80** are indicated in FIG. **4***h*. The logic of the alert agent **80** is shown in FIG. **4***h* to include the major software steps **102***a*, **102***b*, **102***c*, **102***d* and **102***e*, which are self-explanatorily presented.

As further shown in FIG. **6***b*, the database **76** also includes a threshold parameters data block **76***c* and the alert agent **80** is responsive both to the security domain collected data **76***a* and to the threshold parameters **76***c*. The alert agent **80** scans the collected data looking mostly at an event audit table which has the general organization shown in FIG. **8***a* (in which server names and user IDs have been blanked out for security reasons). It counts failed login attempts and failed file accesses by user, domain, location, file name, computer name, etc. It reports exception conditions based on reaching thresholds that are kept in the database as parameters **76***c*. The alert agent **80** also reports on single critical events such as a change made to a key security control (e.g. the stopping of the logging or counting of failed logins), or deactivation or failure of a security component (for example clearing of a security log file). The alarm line **81** of FIG. **3***b* can result in the automatic placements of a phone call **81***a* or an e-mail message **81***b* or a pager message **81***c* as indicated in FIG. **6***b*.

The query agent **82** of FIG. **3***b* similarly interfaces with the database **76** and comprises an interface software that allows system users to access the database information. Both standard and ad-hoc queries are supported by the software implementation of the agent **82**. The query agent **82** has been reduced to practice in a form that uses an Internet/Intranet technology, i.e. a web browser, to allow access with a minimum of connectivity and software distribution problems. Any query tools that handles Sybase™ could be used in the implementation. The tool used in the embodiment that has been reduced to practice is Sybperl™. The flow logic of the query agent **82** is shown in FIG. **4***g* to include major software steps **104***a*, **104***b*, **104***c*, **104***d* and **104***e*, which are self-explanatorily presented.

As shown in FIG. **6***d*, the query agent **82** supports queries on the following data objects: user accounts **82***a*, security groups **82***b*, security domain reports **82***c*, operating system and security product reports **82***d* and standard audit/alert reports **82***e*. The foregoing queries on objects **82***a* through **82***b* allow the user to select which data fields to report, sort order, and record selection criteria.

In addition to customizable queries, the query agent **82** also supports standard reports **82***e*, for example, accounts used after an employee is terminated and a report of users of "high risk applications". A typical standard report from the query agent **82** is shown in FIG. **8***b*.

The manual maintenance agent software **86** (FIG. **3***b*) is a user interface software that allows maintenance to be done on any supported platform using a standard user interface, for example, a user interface that operates in accordance with the flow-chart of FIG. **9***a*. Such a user interface may comprise a search screen **86***a*, a list of accounts screen **86***b*, a single account detail screen **86***c*, an account updating screen **86***d* and such other screens as are necessary to provide full and effective communication by users of the system. Differences between different platforms are handled behind the scenes by the maintenance agent abstraction facility **90** (FIG. **3***b*) which receives instructions from the manual maintenance agent **86**.

As shown in FIG. **6***e*, the manual maintenance agent software **86** allows the user to query collected data and make changes based on manual/user inputs **87** which are conveyed to the maintenance agent abstraction facility **90**. Complex queries are supported, such as the ability to reveal all accounts for a single user. Complex changes are also supported, including the ability to propagate a single change to multiple security domains **70***a*–**70***n*. This is useful, for example, when a user's name changes, or when a new user is added to several environments and services. Changes are stored in separate database tables from the collected data.

The manual maintenance agent **86** takes inputs from the user and converts them into platform independent security maintenance instructions which are then processed by the maintenance agent abstraction facility **90**. Examples of platform independent security maintenance categories and data are as follows:

AddUserAccount(id, platformList, name, Payroll Number, expenseCode)

RemoveUserAccount(id, platformList)

AddUserAccountToGroup(id, platformList, GroupName)

RemoveUserAccountFromGroup(id, platformList, GroupName)

ModifyUserAccountName(id, platformList, name)

ModifyUserAccountPay(id, platformList, Pay)

ModifyUserAccountExpenseCode(id, platformList, expenseCode)

DisableUserAccount(id, platformList)

FIG. **8***c* shows the screen used to designate how often data should be collected. FIG. **8***d* shows the screen used to designate the server from which data should be collected. FIG. **8***e* shows the screen used to designate high risk applications. FIG. **8***f* shows the screen used to designate the environment. FIG. **8***g* shows the screen used to designate high risk reports. FIG. **8***h* shows the screen used to designate event code mapping of native codes to the common system code.

The mapping tables are generated from data entered by the user. FIG. **10** shows the input screen presented to the user. For a NetWare™ platform, the data provided by the user would be placed into two field in the following format:

ID=ID

Name=Name+/+Dept+/+Pay.

For an NT platform, the same data would be placed in different fields as:

Name=Name

Extra Info=Dept+Pay.

Although the present invention has been described in relation to particular embodiments thereof, many other variations and modifications and other uses will become apparent to those skilled in the art, such as the functional split between collection agents **72***a*–**72***n* and the collection agent abstraction layer or facility **74**, and between the individual maintenance agents **92***a*–**92***n* and the maintenance agent abstraction layer or facility **90**. It is preferred, therefore, that the present invention be limited not by the specific disclosure herein, but only by the appended claims.

What is claimed is:

1. A centralized security system for a computer network comprising a plurality of discrete computer subsystems, each subsystem having a discrete security domain associated therewith, the centralized security system comprising:

a plurality of collection agents, each agent being operatively coupled with a respective one of said discrete security domains for collecting differently presented security-related data of said security domains;

a collection agent abstraction facility coupled to said collection agents and effective for transforming the differently presented security-related data into a common-format security data which has a format common across said security domains;

a database for storing said common-format security data from the collection agent abstraction facility, the database being comprised of a standardized, off-the-shelf database software program;

a security controlling facility for examining the security data stored in the database, for ensuring that the security related data in the database indicates that the security domains are in compliance with predetermined security regulations and for issuing security related common-format commands effective for correcting computer security breach conditions; and

a security maintenance software facility for receiving the common format commands and translating them into specific commands that are specific to and understandable by the various security domains.

2. The computer security system of claim **1**, in which the security controlling facility includes a maintenance agent abstraction facility for producing the common-format commands.

3. The computer security system of claim **2**, in which the security maintenance software facility includes a plurality of maintenance agents coupled to the maintenance agent abstraction facility, each maintenance agent being configured to communicate and provide the specific commands to a specific one of said security domains with which it is associated.

4. The computer security system of claim **2**, in which the security controlling facility includes means for parsing and validating incoming data.

5. The computer security system of claim **2**, in which the security controlling facility includes means for consulting mapping tables which convert incoming data to said common-format commands.

6. The computer security system of claim **1**, in which the security controlling facility comprises a compliance facility coupled to and communicating with the database for analyzing the data in the database and for determining that individual ones of the security domains are out of compliance with the security regulations, when warranted.

7. The computer security system of claim **6**, further comprising an active agent coupled to the compliance facility for formulating specific corrective actions needed to correct said computer security breach conditions.

8. The computer security system of claim **7**, further comprising an alert agent coupled to the database for communicating said computer security breach conditions to personnel responsible for security.

9. The computer security system of claim **8**, further including a manual maintenance agent coupled to the security controlling facility for providing manual control over the security controlling facility.

10. The computer security system of claim **9**, in which the security manual maintenance agent includes means for conducting searches of user accounts.

11. The computer security system of claim **8**, further comprising a query agent coupled to the security controlling facility for enabling personnel to obtain specific information concerning security conditions within the computer network.

12. The computer security system of claim **11**, in which the query agent includes means for generating security group reports.

13. The computer security system of claim **11**, in which the query agent includes means for generating operating system and security product reports.

14. The computer security system of claim **8**, in which the alert agent comprises means for communicating with personnel via communication links selected from the group including telephones, e-mail and pagers.

15. The computer security system of claim **1**, wherein the security domains are comprised of different software operating systems.

16. The computer security system of claim **1**, further comprising a facility for generating exception reports describing deviations from the security regulations.

17. The computer security system of claim **1**, in which the database comprises security-policy data.

18. The computer security system of claim **1**, in which the database comprises threshold parameters which define situations triggering alarm conditions.

19. The computer security system of claim **1**, in which each one of the security domains associated with an entire network of an organization is connected to a respective one of said collection agents.

20. A method of centrally controlling security in a computer network comprising a plurality of discrete computer subsystems each having a discrete security domain associated therewith, the method comprising the steps of:

separately collecting from each of the security domains security-related data associated with each security domain, wherein each security-related data is uniquely presented;

supplying the security-related data collected from the security domains to a collection agent abstraction facility and deploying the collection agent abstraction facility to transform the separately collected security-related data into a common-format security data, said transformation of the separately collected security-related data including the steps of:

mapping the data collected from a single security domain to a generic language using a predetermined map for the environment; and

sending the mapped data to a database;

storing the common-format security data in the database;

analyzing the common-format security-related data for discerning in the data out-of-compliance conditions in specific ones of said security domains by comparing the data with predetermined security regulations;

issuing common-format security-related commands effective for controlling security at the individual security domains;

converting the common-format security-related commands to a plurality of specific security commands which are configured to be understood by corresponding ones of said security domains; and

repeating the above-steps for remaining ones of said security domains.

21. The method of claim **20**, including converting the common-format security-related commands to at least one specific command which results in iterative execution of a single maintenance agent function.

22. The method of claim **20**, in which the out-of-compliance conditions include one or more of the following conditions:

a) an unusually large increase in the number of failed access attempts;

b) repeated failed attempts from a single user or location;

c) attempted modification of predetermined key security regulations;

d) minimum password length is less than a predetermined number of characters;

e) password life is longer than 90 days;

f) more than three failed logins not being disallowed before an account is disabled;

g) concurrent logins are allowed;

h) account has not been used in 90 days and has not been disabled; and

i) account was used after employee termination date.

23. The method of claim **20**, including storing in the database threshold parameters for triggering alarm conditions which require the alerting of security personnel.

24. The method of claim **20**, including controlling how often security-related data is collected from each of the security domains.

25. The method of claim **20**, including providing an operator controlled field which can be used to designate from which one of said security domains security-related data is to be collected.

26. The method of claim **20**, in which the step of separately collecting the security-related data from the security domains comprises providing a plurality of collection agents, each agent being operatively coupled with a respective one of said discrete security domains for collecting differently presented security-related data of said security domains.

27. The method of claim **20**, in which the step of converting the common-format security-related commands to specific security commands comprises using a plurality of maintenance agents coupled to a maintenance agent abstraction facility, wherein each maintenance agent is configured to communicate and provide the specific security commands to a specific one of said security domains with which it is associated.

28. A method of centrally controlling security in a computer network comprising a plurality of discrete computer subsystems each having a discrete security domain associated therewith, the method comprising the steps of:

separately collecting from each of the security domains security-related data associated with each security domain, wherein each security-related data is uniquely presented;

supplying the security-related data collected from the security domains to a collection agent abstraction facility and deploying the collection agent abstraction facility to transform the separately collected security-related data into a common-format security data;

storing the common-format security data in a database;

analyzing the common-format security-related data for discerning in the data out-of-compliance conditions in specific ones of said security domains by comparing the data with predetermined security regulations;

issuing common-format security-related commands effective for controlling security at the individual security domains; and

converting the common-format security-related commands to a plurality of specific security commands which are configured to be understood by corresponding ones of said security domains, the plurality of specific security commands including a specific command which results in the execution of multiple maintenance agent actions.

29. The method of claim **28**, in which the out-of-compliance conditions include one or more of the following conditions:

a) an unusually large increase in the number of failed access attempts;

b) repeated failed attempts from a single user or location;

c) attempted modification of predetermined key security regulations;

d) minimum password length is less than a predetermined number of characters;

e) password life is longer than 90 days;

f) more than three failed logins not being disallowed before an account is disabled;

g) concurrent logins are allowed;

h) account has not been used in 90 days and has not been disabled; and

i) account was used after employee termination date.

30. The method of claim **28**, including storing in the database threshold parameters for triggering alarm conditions which require the alerting of security personnel.

31. The method of claim **28**, including controlling how often security-related data is collected from each of the security domains.

32. The method of claim **28**, including providing an operator controlled field which can be used to designate from which one of said security domains security-related data is to be collected.

33. The method of claim **28**, in which the step of separately collecting the security-related data from the security domains comprises providing a plurality of collection agents, each agent being operatively coupled with a respective one of said discrete security domains for collecting differently presented security-related data of said security domains.

34. The method of claim **28**, in which the step of converting the common-format security-related commands to specific security commands comprises using a plurality of maintenance agents coupled to a maintenance agent abstraction facility, wherein each maintenance agent is configured to communicate and provide the specific security commands to a specific one of said security domains with which it is associated.

* * * * *