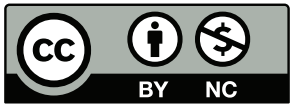
Physical and Procedural Security



Security Procedures

Creating Security Procedures

- Who creates them?
- How?
- What are the constraints? The competing issues?

Tech-Set Policies

- Too many technical people will set policies that are too strict
- They ignore business needs
- They're often unaware of financial and strategic issues
- Employee morale is important, too

Business-Set Policies

- Upper management is often better situated to understand the non-technical issues
- However, they do not understand the technical risks
- They can value convenience—their own convenience—too highly
- Best solution: set policies jointly
- Again: remember the discussion on security evaluation—you have to be precise and specific about risks, and be prepared to offer alternatives to policies deemed too strict

Organizational Culture

- It is impossible to enforce stricter security than the culture will accept
- A university is not a busines, a business is not the NSA
- Employees will evade too-strict security

Telecommuting in a Company that Banned It

- Circa 1995, a company got rid of its modem pool
- Bypass: employees bought modems and plugged them into their own computers
- Company: no more analog phone lines!
- Employees: “Can I have a fax line?”—and then connected modems to their “fax” lines
- Company: all is secure, no modems
- Disgruntled ex-employee: I know how to find the modems. . .

What Went Wrong?

- Employees wanted modems and ignored security rules
- These unofficial modems were not well-administered
- There was no link to HR to disable accounts of ex-employees
- Oops. . .

Physical Security

Practical Cryptanalysis

- During World War II, the British wanted the Vichy France naval code
- “CYNTHIA” seduced the press attaché
- They told the security guard they wanted to use the embassy for their trysts, and “tipped” him
- The guard became suspicious—but backed off when he encountered her nude
- Count the procedural errors. . .

Physical Security

- Another line of defense
- Violations sometimes lead to cyber breaches
- Remember: the usual goal of cybersecurity is to protect the *data*
- The attackers just want to win; they don't care about how

General Principles

- Who is the enemy?
- What are their resources?
- What are you trying to protect?
- The same as before!

Enemies

- Teenagers and other joy hackers—don't rule them out!
- Criminals—more likely after the hardware, but not always
- Governments
- Note well: physical attacks are much riskier for the attacker; there is no anomymity if detected. Physical attacks can be a high-stakes game.

Enemy Resources

- Technical skills: lock-picking, alarm neutralization, radio jammers, climbing, etc.
- Detailed knowledge of the facility
- Insider assistance?

Assets

- Direct access to computers
- Access to telecommunications lines
- Access to internal LANs
- Access to internal offices
- Information—hard-copy, removable media, etc.

Computer Access

- Remove the disk?
- Probe the RAM?
- Use the debugger to gain root privileges?
- Scan for cryptographic keys?
- Replace the BIOS?
- Install a keystroke logger?
- Physical access wins—always

Lines and LANs

- Plant wiretaps?
- Bypass firewall?
- Denial of service?

Specialized Attack Computers!

- Can look like power strips or “brick” transformers
- Communicate through firewalls or via cellular
- Can eavesdrop, scan, attack, etc.

Information!

- Manuals
- Phone books
- Organizational charts
- Learn enough to sound like an insider
- The garbage is interesting, too. . .

Dumpster Diving

- Raid your outside trash bins
- Discarded information is often almost as useful
- Probably legal under US law, if no trespassing is involved

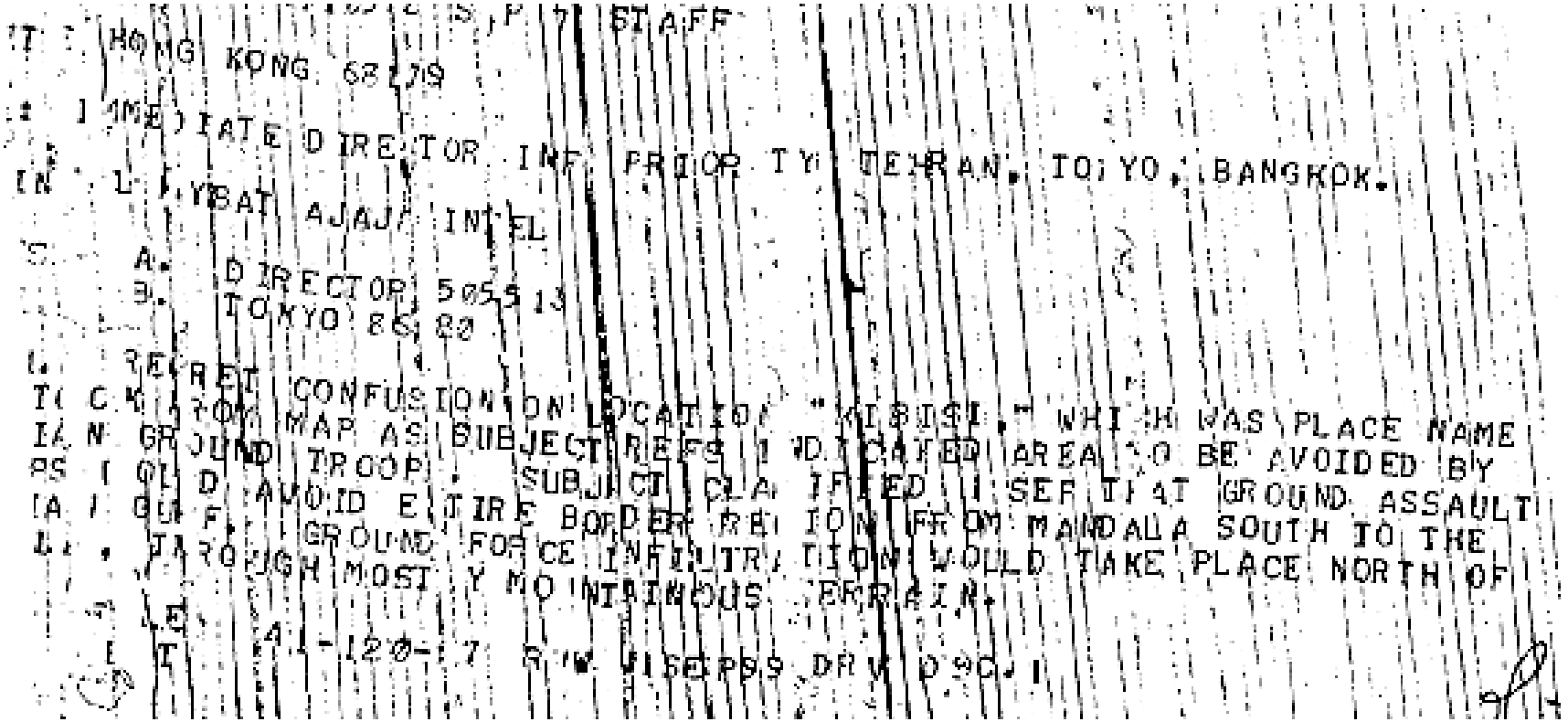
Shredding

- Best defense: shredding
- Interim step: internal locked garbage cans
- Use “cross-cut shredder”
- (NSA has standards for such things. . .)

☞ The Germans are using specialized algorithms to “unshred” old Stasi files

- Alternative: use *reliable* outside contractor for shredding

Shredding Done Poorly



Shredded CIA Cable reporting on information provided by an Iranian contact, *secret*.

Source: National Security Archive, George Washington University

Employees

- How are employees authenticated when they arrive?
- Badges? How are they checked?
- Guards? Turnstiles? PINs or chips?
- What links the employee to the badge?

Are Badge Rules Enforced?

- How are badges authenticated?
- Does the guard verify the picture?
- Is it possible to “tailgate”?
- What happens in abnormal situations, i.e., fire drills or fire alarms?
- What about holiday parties?
- What about external service personnel?

Locks

- Locks are not always as strong as they appear
- Experts have many ways to bypass locks
- Does your lock match your security needs?
- What about key control?

Pin and Tumbler Locks

- Most common form of lock
- Generally very easy to pick
- Guides and videos freely available on the Internet
- “Keep honest people honest”

Better Key Locks Exist

- Used for high-threat situations (i.e., bike locks in New York)
- (Not always as good as they seem—see the story of the Kryptonite bike lock and the Bic pen)
- Much harder to get duplicate keys made
- People frequently trade security for convenience

Combination Locks

- Often trivial to crack (i.e., most combination padlocks)
- But—safes often have *much* better ones
- High-end safes have electronic combination locks—turning the dial generates enough power
- If users pick their own combinations, are they guessable? Of course. . .

Richard Feynman on Safes

"I opened the safe that contained the secret of the atomic bomb—all the secrets, the formulas, the rates at which neutrons are liberated from uranium, how much uranium you need to make a bomb, how much was being made and available, all the theories, all the calculations, the WHOLE DAMN THING! . . .

"I remembered in the book about the psychology, and I said, 'You know, it's true. Psychologically, DeHoffman is just the kind of a guy to use a mathematical constant for his safe combination. And the other important mathematical constant is e.' So I walk back to the safe. 27–18–28—click, clock, it opens.

"I checked, by the way, that all the rest of the filing cabinets had the same combination."

Los Alamos From Below: Reminiscences 1943–1945, by Richard Feynman

Electronic Locks

- Many types
- Mag stripe (hotels; this CS department)
- ☞ Common hotel room lock has been cracked; apparently, there have been some thefts as a result
- RFID (this university)
- Keypads
- More

Internet-Controlled Locks

- Pick the lock? Possibly.
- Hack the radio signal to the lock? Maybe. . .
- Hack the app? Sure!
- Get all of the weaknesses of locks *plus* all of the weaknesses of the Internet
- You can even talk to Siri to open some locks!
- But—are burglars hackers? Are hackers burglars?

Key Control

- How easy is it to get a key or combination?
- (Note the analogy to cryptographic keys)
- Many different threat vectors

Key Labels

- Many common keys or locks have numbers stamped on them, i.e., “S-100” for file cabinets
- Most car keys have such numbers
- Combination locks used for school lockers have such numbers
- Anyone with access to the database can create a key
- The database isn’t hard to get. . .

Rekeying

- Home locks: generally must disassemble the lock
- Offices: remove just the cylinder, via a “control key”
- Hotels: put a “combination” on a magstripe; change the combination via a new mag stripe that lists the previous one

Other Issues

- The spare key safe
- Employees (or family members) who lose keys
- Fire department keys
- “Hidden” keys to houses and cars

Attacking Locks

- Lock picks and “bump keys”
- Drilling the lock
- Plastic or metal shims
- Many other techniques

Going Around Security

- “You don’t go through strong security, you go around it”
- Many ways to evade locks
- Physical security is also a systems property

Attacks

- Remove the hinges
- Break nearby glass and unlock from the inside
- Break down the door
- Pry off the door jamb

Attacking Electronic Locks

- Bug the cable?
- Hack the control computer!
- Often have modem access, default passwords, unpatched software
- Pry the door from the magnetic catch just a little bit—it's an inverse cube law
- Insiders: put transparent tape on the strike plate

Fool the Motion Detector

- Slide paper under the door
- Squirt Silly String in the gap
- Easier with glass doors

Evading Detection

- Locks are often rated by time-to-crack with and without power tools
- (Too bad software security doesn't have such ratings. . .)
- Power tools are *noisy*—use will be noticed
- Frequently, then, the goal is to combine the lock with surveillance or alarms

Process Helps

- Logs
- ID checks
- Protocols
- Disclosure
- But—don't just go through the motions

Logs

- Keep track of who enters and leaves
- Sometimes automated, via electronic keys (hackable?)
- Guard should match log entry against ID
- Look at the logs!

Chain of Evidence

- Do not separate authorization from entry
- Example: separation of ID check from actual gate
- Photo ID-checking not very useful for authorization unless matched against external data

Protocols

- Make sure everyone understands and follows the process
- Don't let someone talk you into something
- Education helps—make sure your employees know how they can be fooled, and why each part of the process exists

Social Engineering

- Talk your way into someplace
- Act and sound as if you belong
- Know the terminology (see dumpster diving, above)

Lots of Info Available

- LinkedIn
- Facebook
- Twitter and blog posts
- Corporate web sites

Why it Works

- Constant verification is too clumsy
- Most of the time, you're not being scammed
- But the bad guys know this

Data Matching

- Reconcile data after the fact
- Make sure that all records agree
- Doesn't prevent fraud; can detect it, and perhaps deter it
- That's how some fraudulent Microsoft code-signing certificates were discovered (CERT Advisory CA-2001-04)

Data Auditing

- In a large-scale system, you can't check all transactions in detail
- Pick a random subset, and investigate them carefully
- Check *all* links in the process—does everyone know about the transaction and have the same details recorded?

Risk Management

- We can't prevent all security problems
- What are the odds of a failure? What will one cost us?
- Easier in the physical world—we have a much better sense of the strength of security systems
- Electronic locks and access control systems turn a well-understood problem into a software security problem—and we don't know how to solve that very well. . .

Is This Computer Science?

- Many of the thought processes and techniques are the same
- Computer systems can be part of the problem
- These attacks are often used to penetrate computer systems
- Computer systems have to support the solutions