What’s a Firewall

Devices examining traffic making access control decisions

- Divide the world between trusted and not
- Only authorized traffic is allowed to pass
- Act as Barrier between *us* and *them*.
- Limits communication from the outside world.
- ⇒ The outside world can be another part of the same organization.
- Only a very few machines exposed to attack.
Why Use Firewalls?

- Most hosts have security holes. Proof: Most software is buggy. Therefore, most security software has security bugs.
- Firewalls run much less code, and hence have few bugs (and holes).
- Firewalls can be professionally (and hence better) administered.
Why Use Firewalls?

- Firewalls run less software, with more logging and monitoring.
- They enforce the partition of a network into separate security domains.
- *Without such a partition, a network acts as a giant virtual machine, with an unknown set of privileged and ordinary users.*
Traditional Firewalls by Analogy

- Passports are (generally) checked at the border.
- My office doesn’t have a door direct to the outside.
- My bedroom doesn’t have a real lock.
- But a bank still has a vault...
Should We Fix the Network Protocols Instead?

- Network security is not the problem.
- Firewalls are *not* a solution to network problems. They are a network response to a host security problem.
- More precisely, they are a response to the dismal state of software engineering; taken as a whole, the profession does not know how to produce software that is secure, correct, and easy to administer.
- Consequently, better network protocols will not obviate the need for firewalls. The best cryptography in the world will not guard against buggy code.
Firewall Advantages

If you don’t need it, get rid of it.

- No ordinary users, and hence no passwords for them
- Run as few servers as possible
- Install conservative software, don’t get the latest fancy servers, etc.
- Log everything, and monitor the log files.
- Keep copious backups, including a “Day 0” backup.

Ordinary machines cannot be run that way.
Firewall Advantages

- Can operate at various levels in the stack
- Link, network, application
- Examines packet headers of the appropriate layer
- Transparent vs. proxy
- Stateful vs. stateless
Intro to Firewalls

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Firewall Advantages

Schematic of a Firewall

Conceptual Pieces
The DMZ
Positioning Firewalls
Why Administrative Domains?
Splitting a Location
Firewall Philosophies
Blocking Outbound Traffic?
Next: Packet Filtering

Inside

Gateway(s)

DMZ

Outside

Filter

Filter
Conceptual Pieces

- An “inside” — everyone on the inside is presumed to be a good guy
- An “outside” — bad guys live there
- A “DMZ” (Demilitarized Zone) — put necessary but potentially dangerous servers there
The DMZ

- Good spot for things like mail and web servers
- Outsiders can send email, retrieve web pages
- Insiders can retrieve email, update web pages
- Must monitor such machines very carefully!
Positioning Firewalls

Firewalls protect *administrative* divisions.
Why Administrative Domains?

- Firewalls enforce policy
- Policy follows administrative boundaries, not physical ones
- Example: separate protection domains for Legal, HR, Research, etc.
Splitting a Location

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Firewall Philosophies

1. Block all dangerous destinations.
2. Block everything; unblock things known to be both safe and necessary.

Option 1 gets you into an arms race with the attackers; you have to *know* everything that is dangerous, in all parts of your network. Option 2 is much safer.
Blocking Outbound Traffic?

- Many sites permit arbitrary outbound traffic, but...
- Internal bad guys?
- Extrusion detection?
- Regulatory requirements?
- Other corporate policy?
Next: Packet Filtering

- Read the Readings list posted online
- Ask questions
- Are firewalls a full-proof solution?