

Network Security - ISA 656

Intro to Firewalls

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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.

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- 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.

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- 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

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- 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.

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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.

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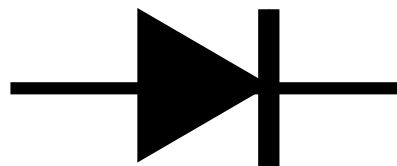
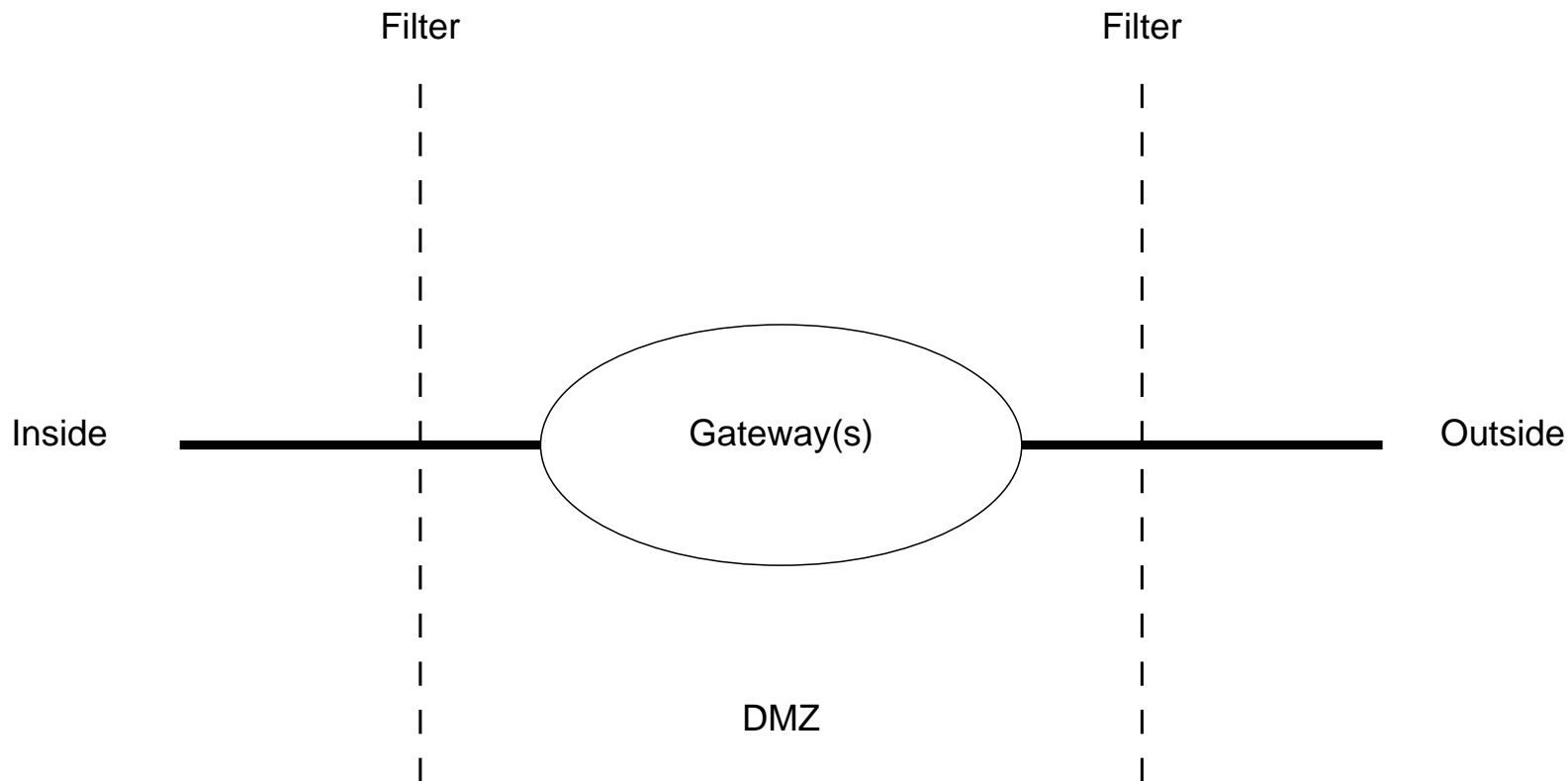
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- Can operate at various levels in the stack
- Link, network, application
- Examines packet headers of the appropriate layer
- Transparent vs. proxy
- Stateful vs. stateless

Schematic of a Firewall

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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

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- 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!

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Firewalls protect *administrative* divisions.

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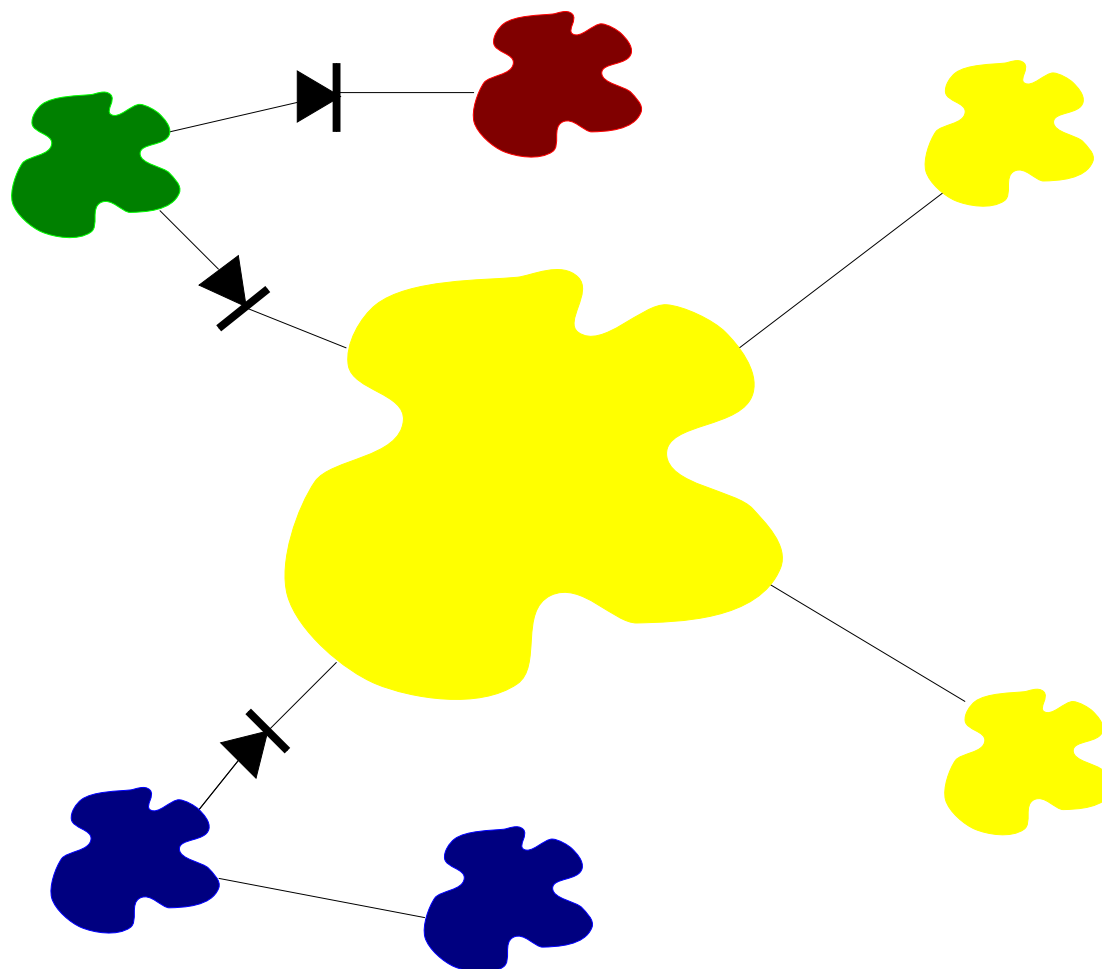
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Why Administrative Domains?

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

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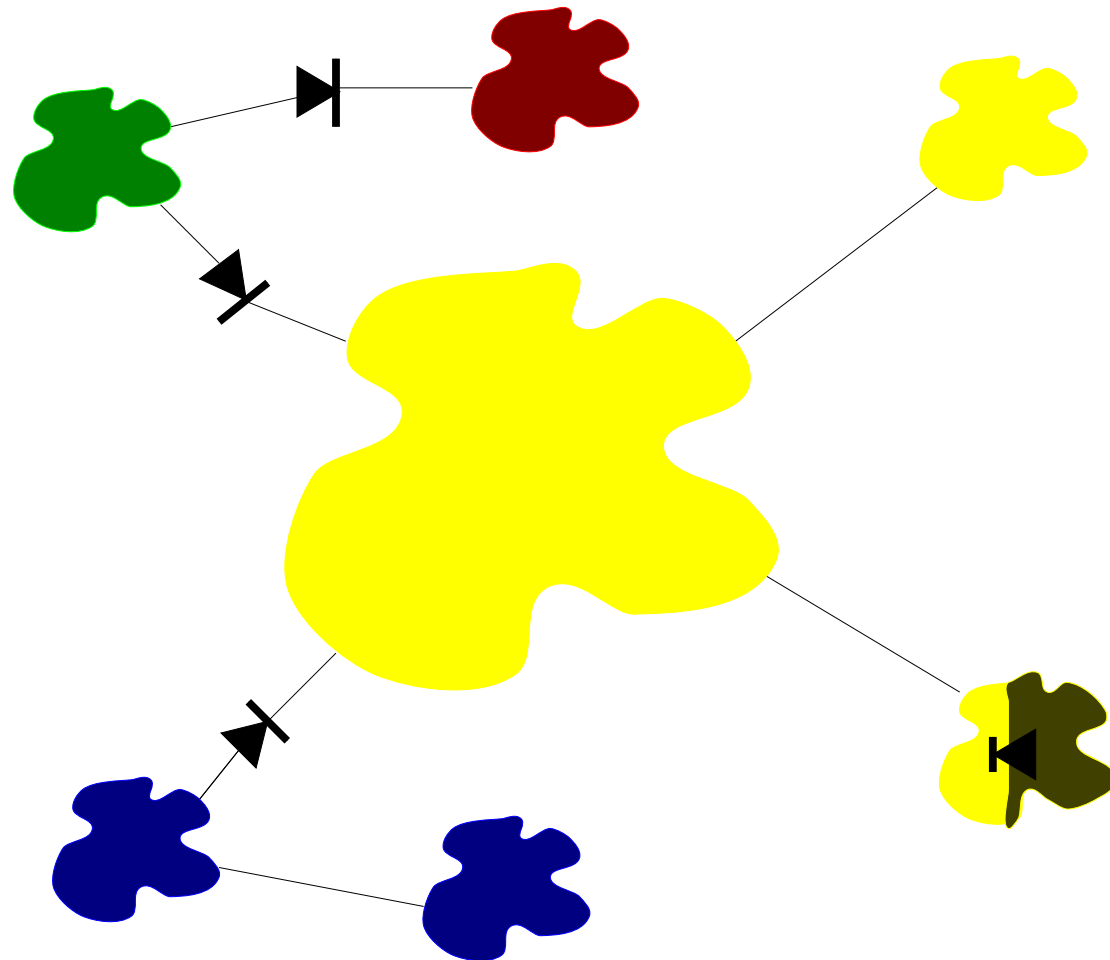
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Firewall Philosophies

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.

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Blocking Outbound Traffic?

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

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Next: Packet Filtering

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

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