Inexpensive Firewalls

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BayLISA

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http://reality.sgi.com/sc/papers/baylisa-apr00.pdf

- or -

http://www.sfik.com/papers/baylisa-apr00.pdf

A Firewall?

What is an inexpensive Firewall?

- a specific use device
- an “all in one” firewall (filters + apps)
- uses readily available hardware
- uses an OS you are familiar with
- uses free or affordable tools

What an inexpensive firewall isn't...

- NOT a high performance firewall
- NOT a high reliability firewall
- NOT a maximum security firewall
- NOT a "no cost" firewall
- NOT a "plug and play" firewall

What are they good for?

- a departmental network
- a lab network
- a small business
- a home
- a personal domain

Agenda

- Ingredients
- Service Providers
- Hardware and OS
- Filtering and Services
- Architecture
- Administration
- Tips for building
- Experiences
- Q&A

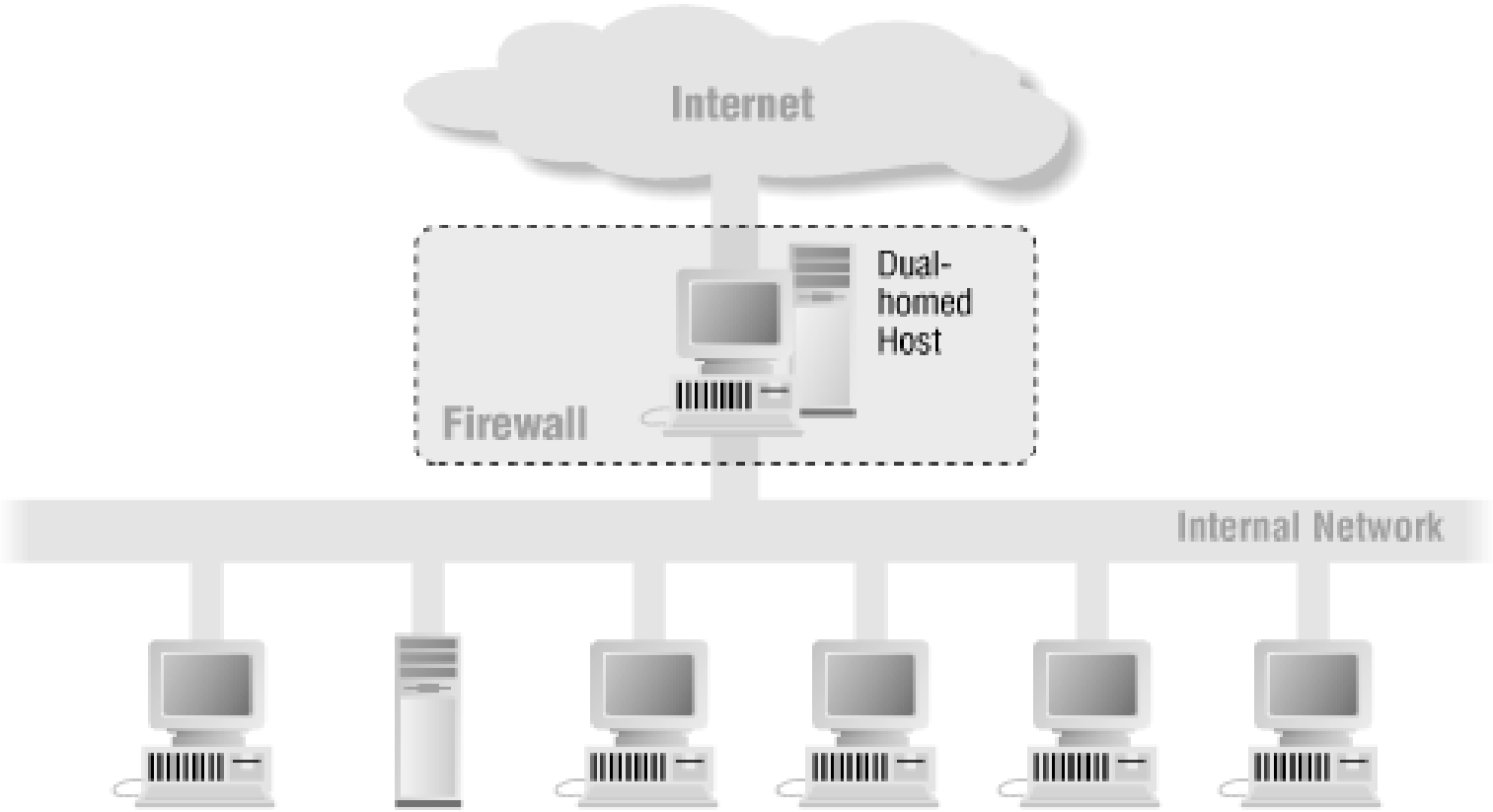
Ingredients

- know what you want to run on or pass through your firewall
- old or cheap hardware
- a suitable and **familiar** operating system
- free or affordable tools
- your time

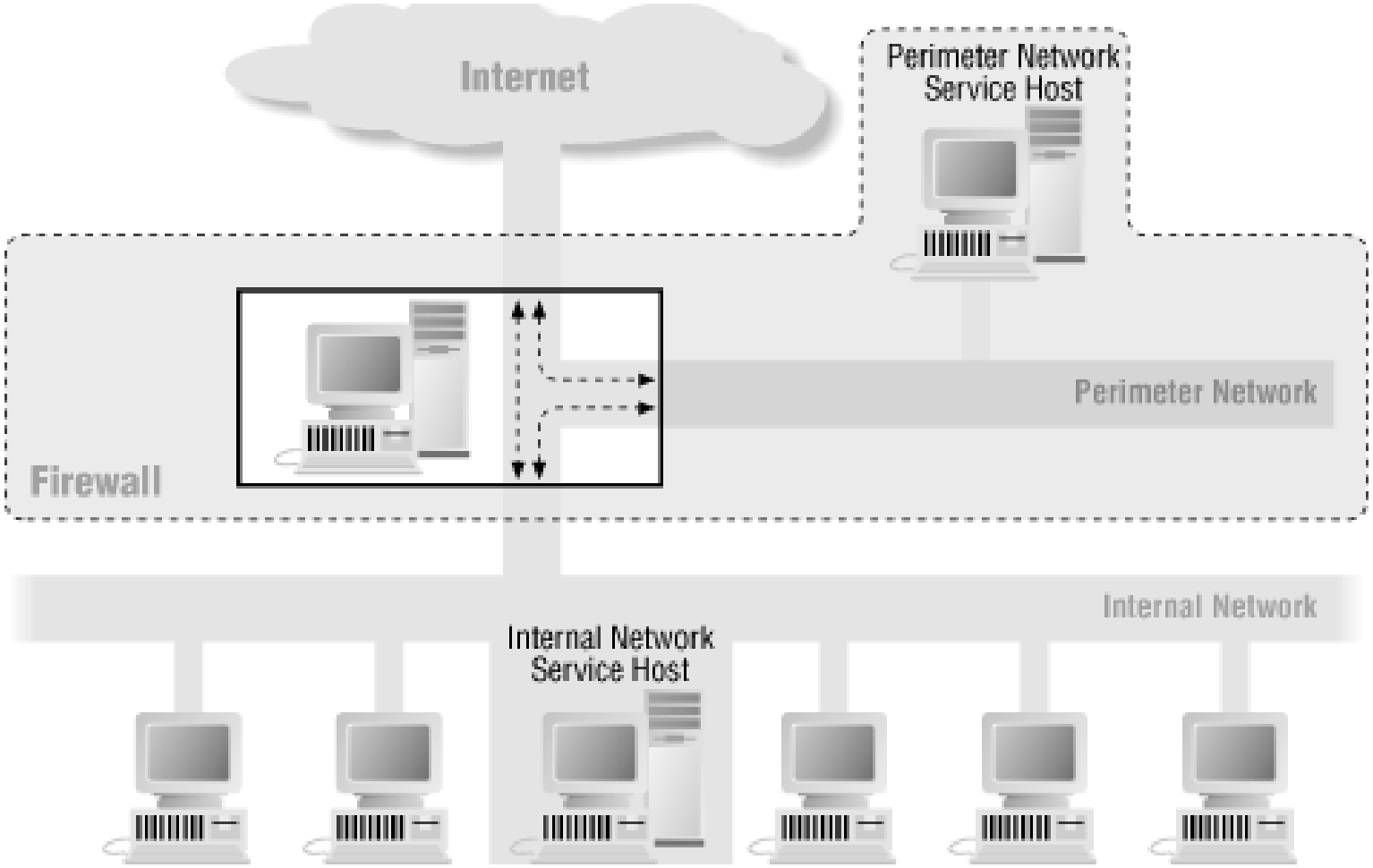
Know what you want to do

- who do you want to let in
- who do you want to try and keep out
- is it in alignment with your security policy
- what services will be offered

Architectures



Architectures



Selecting a Broadband ISP

Landon Curt Noll
<chongo@certive.com>

- Determine your requirements
- ISP Pre-selection questions
- ISP Selection
- ISP Quality Questions

Determine Your Requirements

- Home, Home Office or Business user?
- Minimum speed / % bandwidth?
- Number of IP addresses?
- What external services do I need?
- How much hand-holding do I need?

ISP Pre-selection Questions

- Is broadband service available?
- What speeds are available?
- How much can I afford per month?
- Consumer or Business Service?

ISP Selection

- Does the ISP understand their product?
- Is the ISP small or LARGE?
- Is the ISP “full service” or a “self-service”?
- Max %-age of the bandwidth allowed?
- Where is the ISP located?
- More...

ISP Selection

- How much do they oversell their bandwidth?
- How much does it cost?
- Who provides the physical network?
- Am I the right customer for the ISP?

ISP Quality Questions

- Hours of support?
- Is the support staff clue full?
- Does the ISP support my OS?
- How will my issues be tracked?
- How well connected is the ISP?
- How will network problems be fixed?

Hardware

- Use what you have
  - Suns, PCs, SGIs
- Laptops
  - Quiet, compact, built in UPS
- Last generation hardware
- Has (at least) two network interfaces

Hardware Issues

- Know which is the inside interface
  - choose the primary/first to be inside
- CDROM drive
  - check if it can read CD-R and CD-RW (this is worth a small investment)
- Power supplies, disks and fans wear out

Operating System

The operating system you use will need

- packet filtering
- free or affordable software for what you want to do
- to be **familiar** to you
- continued and active support
- an active security community

Operating System Examples

- Linux
- NT
- A BSD variant
- IRIX
- Solaris
- AIX

Hardening the OS

- Philosophy - disable/remove everything that is not needed
- Secure “distributions” exist
  - “freefire” pointers
    http://www.freefire.org/
  - Linux Router Project
    http://www.linuxrouter.org/
  - picoBSD
    http://www.FreeBSD.org/picobsd/

Hardening the OS

- Can do it yourself
- Keep a written log. Write a script
- Don’t build your firewall on the network you are going to protect!

Hardening the OS

There are cheat sheets on the web for many OS. Search for keywords and combinations like

hardening, securing, bastion, <OS Name>

Sites with particular OS information seem to be on the increase - try searching there first.

Some “security news” sites carry articles on securing a specific OS.

Check the OS release with the information you find - don’t completely rely on one information source unless you trust it!

The Kernel

Things to watch out for and protect against

- IP denial of service attacks
- IP forwarding off when system boots
- Default Deny Rules when system boots
- Packet filtering failure modes
- IP fragmentation - do re-assembly

Remote OS Logging

For unix

- syslog
  - some can be made send only
  - can send encrypted packets
  - use TCP rather than UDP

For NT

- A free syslog like tool, but simulates the behaviour. Not real time.

Check list

Turn off all services you won't be using

Secure the file system

- update file permissions
- remove pieces you won't be using

Apply Kernel changes/patches

Run your initial integrity check now!

Filtering Topics

Desired features

What is available

ipfilterd, ipfilter

ipchains, netfilter

Filtering issues

Example

Filtering: Desired Features

The wish list

- input & output rules for each interface
- interface forwarding rules
- ability to rewrite packets (masquerading)
- knowledge of ICMP, ability to rewrite
- logging of rejected or flagged packets
- hierarchical (user defined) rules

there is more...

Filtering: Desired Features (continued)

- handling of idle TCP sessions
- configurable handling of UDP
- detailed knowledge about some protocols (DNS, traceroute)
- configurable default policy

Filtering

- NT
- ipfilterd (IRIX, AIX), ipfilter (Solaris)
- ipfw (FreeBSD)
- ipchains (Linux)
- netfilter (Linux)

Currently no single operating system is “perfect”

ipchains (Linux 2.2.x)

What can it do

- in/out filters for each interface
- by protocol, port and addresses
- separate forwarding rules
- user defined rules
- support for packet rewriting (masquerading)
- understands ICMP packet types
- default policy

ipchains - weaknesses

- weak on logging
  - only logs a packet synopsis
- rules are built incrementally
- TCP is not statefull (no ACK/SEQ checking)
- Cannot reference interfaces unless they are “up” (complicates startup)
- Masquerading uses a limited port range

Filtering Issues

- icmp path MTU discovery
- auth/identd - reject but allow a response
- REJECT or DROP
- protect yourself from mishaps
- don’t assume inside is always inside

Example (input)

```
ipchains -F input
ipchains -P input reject
# Protect against IP address spoofing
ipchains -A input -i eth0 -s $inet -d $any -j ACCEPT
ipchains -A input -i eth1 -s $inet -d $any -l -j \
   REJECT

# Allow incoming SMTP
ipchains -A input -i eth1 -p tcp -s $any -d $me 25 \
   -j ACCEPT


# Catch all rule
ipchains -A input -s $any -d $any -l -j REJECT
```

Example (output)

```
# Protect against spoofing or routing errors
ipchains -F output
ipchains -P output REJECT
ipchains -A output -i eth0 -s $any -d $inet -j ACCEPT
ipchains -A output -i eth1 -s $any -d $inet -l -j REJECT

# Allow SMTP out
ipchains -A output -i eth1 -p tcp -s $me 25 -d $any -j \
ACCEPT

# Catch everything else
ipchains -A output -s $any -d $any -l -j REJECT
```

Resources for Creating Filters

Building Internet Firewalls,

2nd Edition, O'Reilly and Associates

By Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman

- Estimated June 2000
- Has handy tables of port numbers and details on the packets flow direction
- Bigger than before ~ 850 pages
- Includes information for Linux and NT

Linux HOWTOs for ipchains and masquerading

Services

Unix

- Mail - Postfix
- Web Proxy/Server - Apache
- DNS (Internal/External)
- Proxy - SOCKS
- Transparency/masquerading

NT

- Mail - Sendmail for NT (not free)
- Web Server - Apache for NT
- Proxy - Microsoft Proxy Server

Masquerading

How does it work?

- intercepts forwarded packets
- re-writes outgoing and return packets
- does it transparently
- can add dynamically loaded modules for “complicated” protocols

Masquerading Example

```
# Allow all non-blocked internal traffic to be
# masqueraded
ipchains -F forward
ipchains -P forward DENY
ipchains -A forward -i eth0 -s $inet -d $any -j MASQ
ipchains -A forward -s $any -d $any -l -j REJECT



# Allow direct SSH from external site to an internal
# system
ipmasqadm portfw -f
ipmasqadm portfw -a -P tcp -L $local 22 -R $internal 22
```

Administration

- ssh
- non-reusable passwords?
  - How about using a PDA
  - CryptoCard (Supports Linux)

Administration

Be certain of the integrity of the system

- will save you time and worry
- use tripwire or equivalent
  - Can get tripwire for NT (commercial)
  - store the database on CD-R
  - under unix statically link the binary and store on the CD-R

Tips for Building

Use a CD-R or CD-RW. CD-RW can be used to get the process right

Recent hardware can boot directly from CD

Tools exist under unix to create bootable CDs

Use automated installation tools

- SGI RoboInst

Only connect your system to dangerous networks when you have finished building it

Experiences

Small company

- using a Sun IPX
- SOCKS + DNS
- Connects to the Internet via DSL

Personal Domain

- using a pre-built $400 PC
- ipchains and masquerading
- Postfix, Web Server and DNS

Inexpensive Firewalls

Please do not test my firewall :-)

Inexpensive Firewalls

Conclusion

You can build and run a firewall for those places that should have some protection but they have perhaps been overlooked because it was too expensive or time consuming to purchase and install a commercial firewall

Q/A

A copy of the slides are available at,

http://reality.sgi.com/sc/papers/baylisa-apr00.pdf

- or -

http://www.sfik.com/papers/baylisa-apr00.pdf