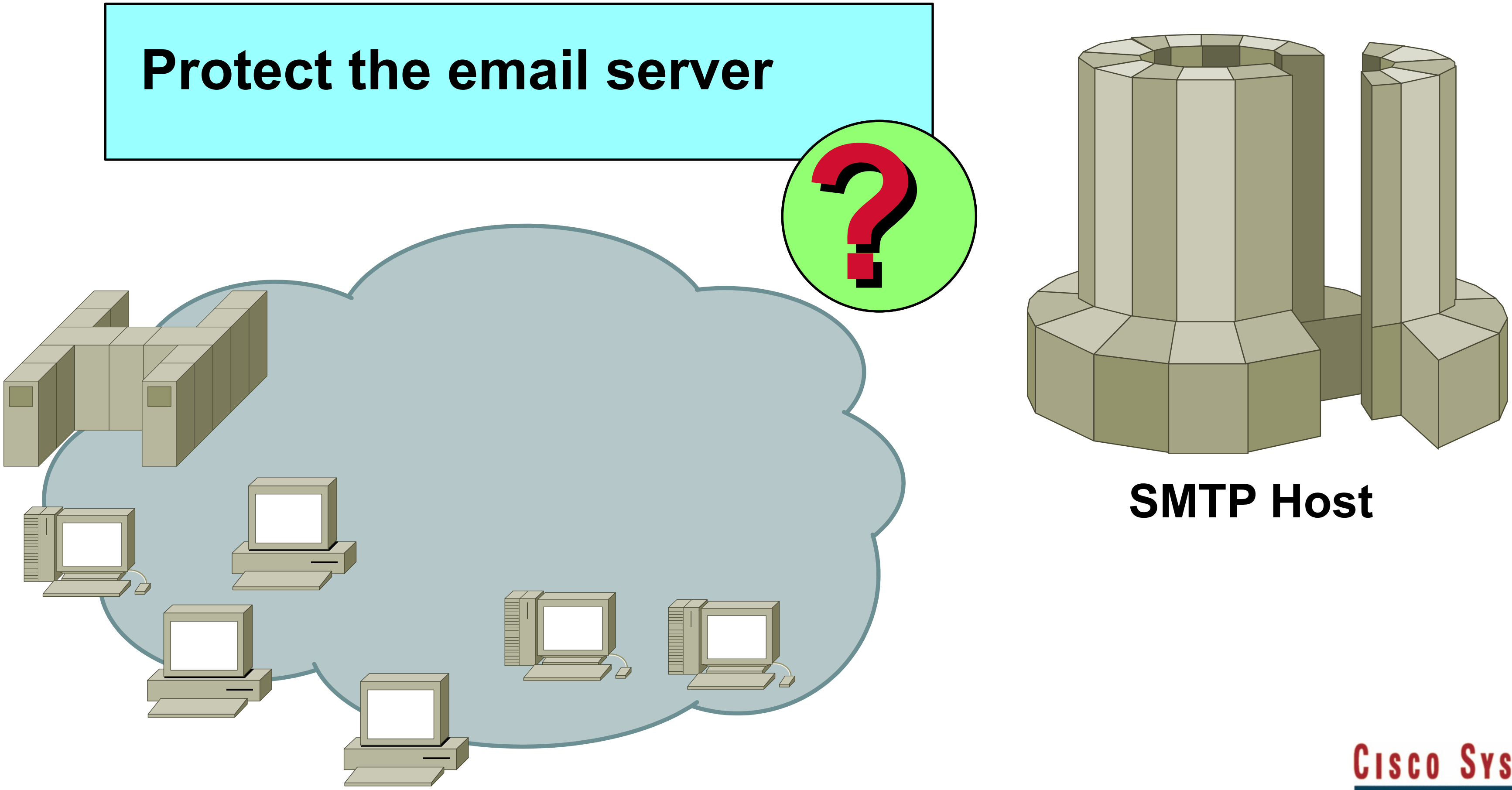
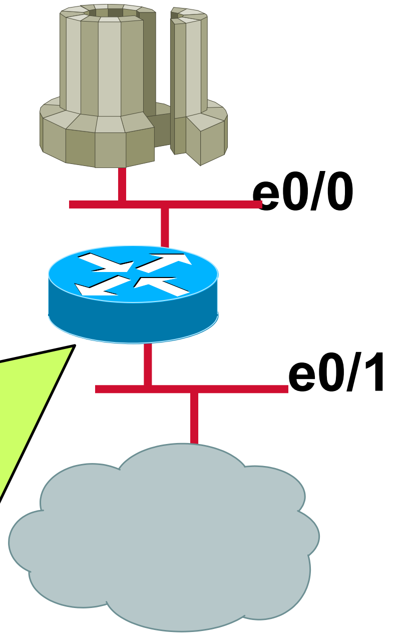
Example Scenario

Protect the email server



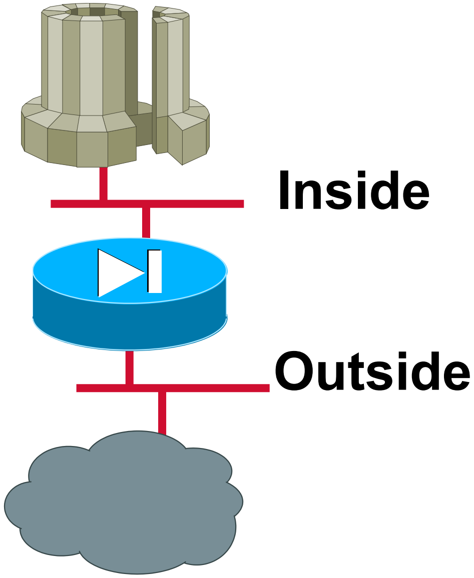
Cisco IOS with an Access List

```
interface ethernet 0/0
ip address 172.16.1.100  255.255.0.0
!
interface ethernet 0/1
ip address 172.17.1.100  255.255.0.0
ip access-group 111 in
no ip unreachables
no ip redirects
!
access-list 111 permit tcp any host 172.16.1.1 eq smtp
access-list 111 permit tcp any host 172.16.1.1 established
access-list 111 permit icmp any host 172.16.1.1
```



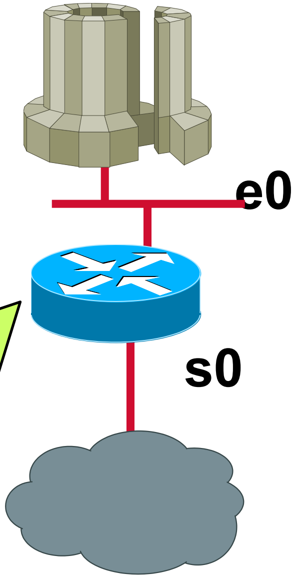
PIX

```
PIX Version 4.0.7
interface ethernet outside 10baset
interface ethernet inside 10baset
ip address inside 10.1.1.101  255.255.0.0
ip address outside 172.17.1.100  255.255.0.0
arp timeout 14400
mailhost 172.17.1.12  10.1.1.2
conduit 172.17.1.12  25 tcp 0.0.0.0  0.0.0.0
conduit 172.17.1.12  110 tcp 0.0.0.0  0.0.0.0
conduit 172.17.1.12  113 tcp 0.0.0.0  0.0.0.0
```

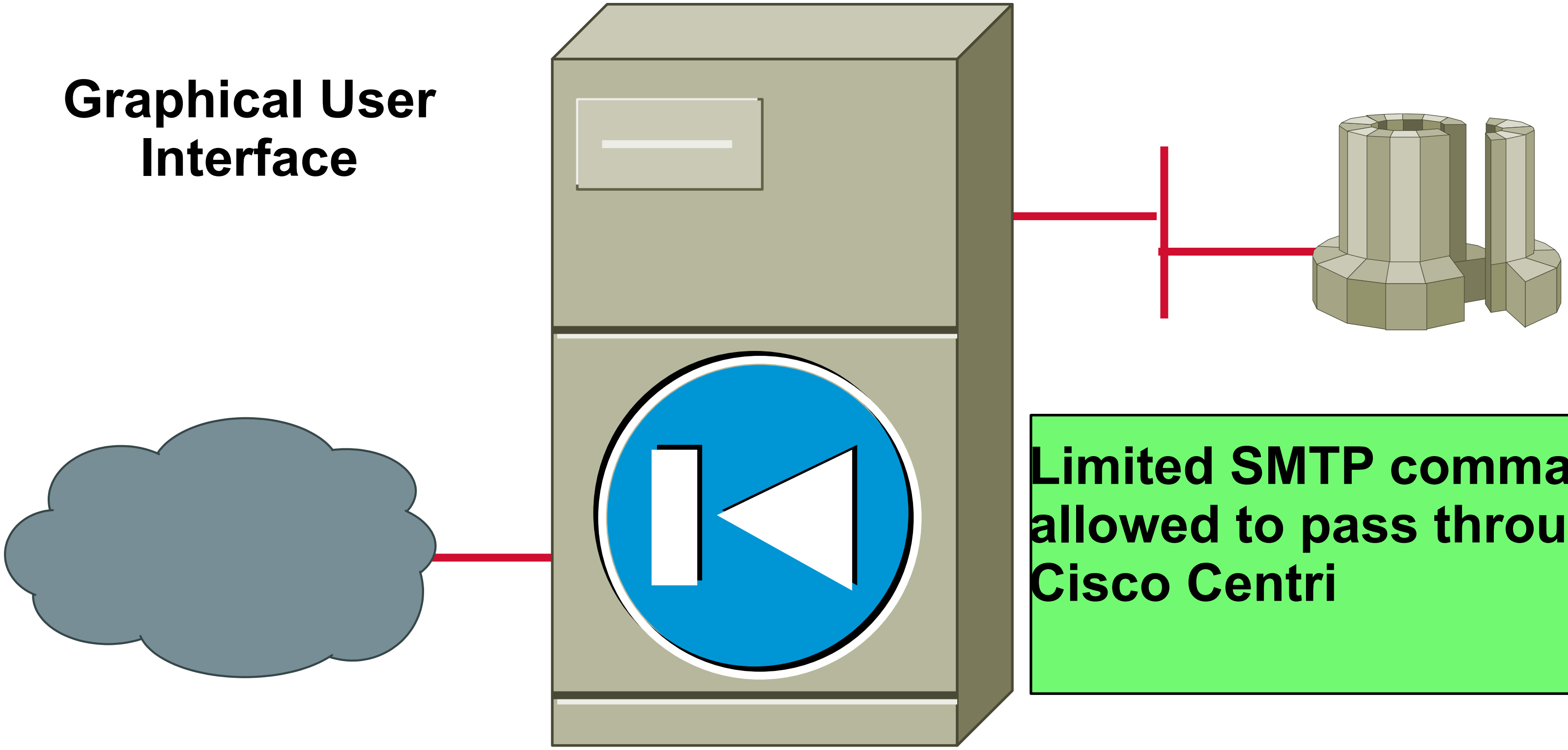


Cisco IOS Firewall Feature Set

```
logging 172.16.27.131
ip inspect audit-trail
ip inspect dns-timeout 10
ip inspect tcp idle-time 60
ip inspect name myfw smtp timeout 3600
ip inspect name myfw tcp timeout 3600
!
interface Ethernet 0
 ip address 172.16.1.100 255.255.0.0
 ip inspect myfw in
!
interface Serial 0
 ip address 172.19.139.1 255.255.255.248
 ip access-group 111 in
!
access-list 111 permit tcp any host 172.16.1.1 eq smtp
access-list 111 permit tcp any host 172.16.1.1 eq pop3
access-list 111 permit tcp any host 172.16.1.1 eq ident
```



Cisco Centri Firewall



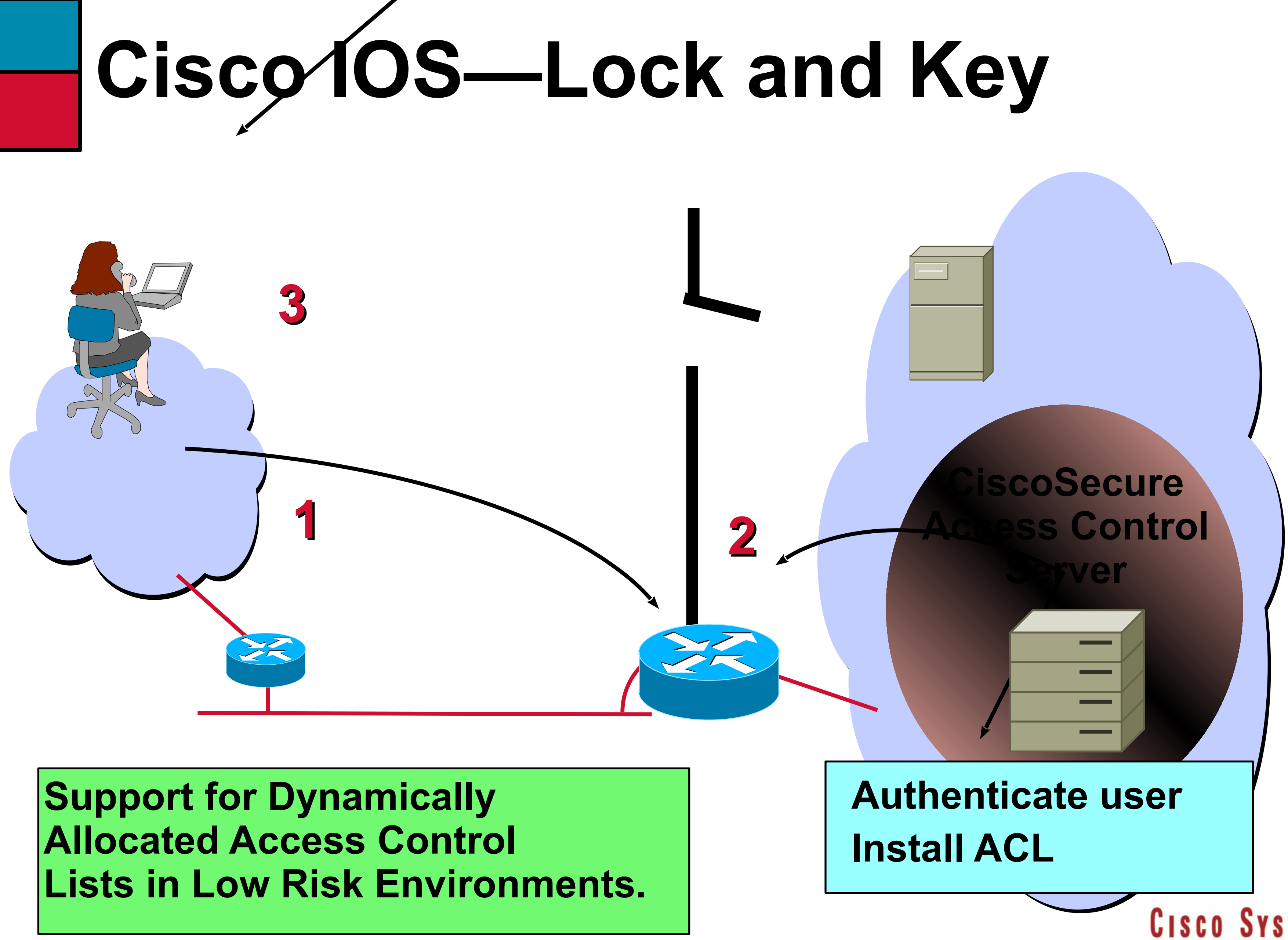
Graphical User Interface

Limited SMTP commands are allowed to pass through the Cisco Centri

More Mechanisms to Enforce Your Security Policy

- Cisco IOS Lock and Key
- Hot Standby Router Protocol
- Spanning Tree Bridging
- Local Director
- Distributed Director

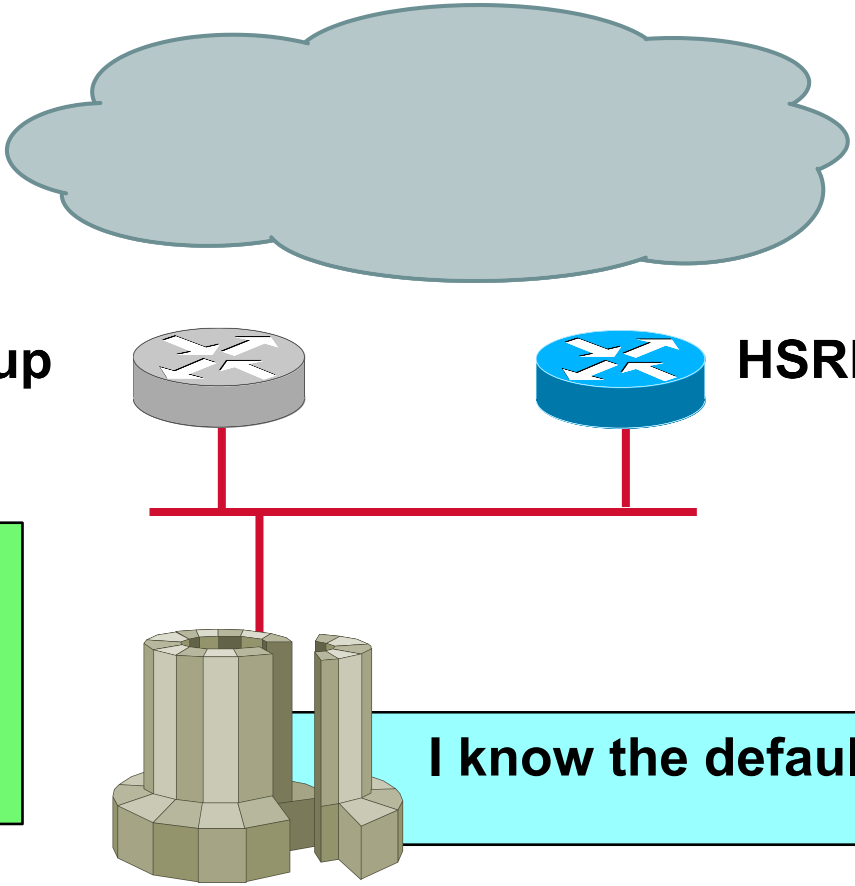
Cisco IOS—Lock and Key



Support for Dynamically Allocated Access Control Lists in Low Risk Environments.

Authenticate user
Install ACL

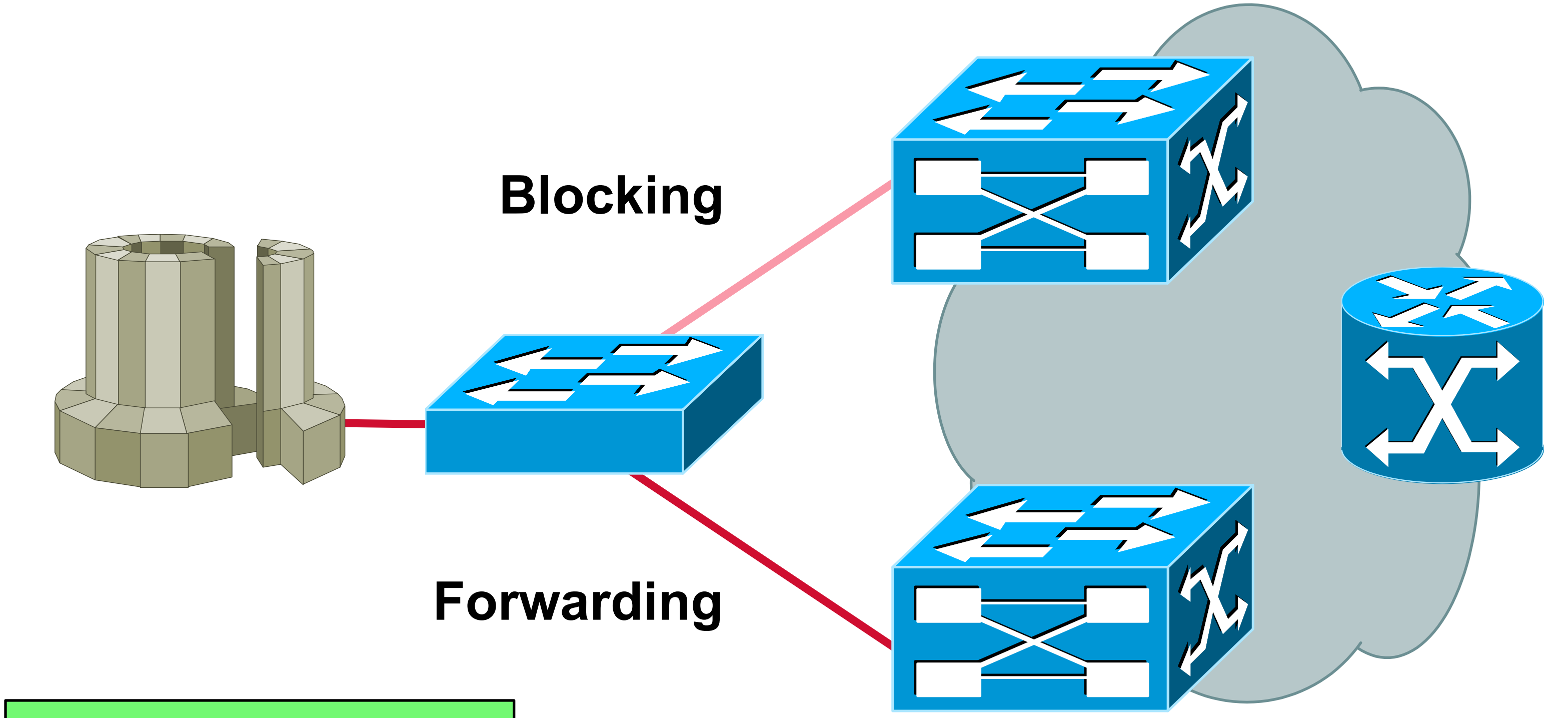
Hot Standby Router Protocol



Maintain a network link to a vital resource.

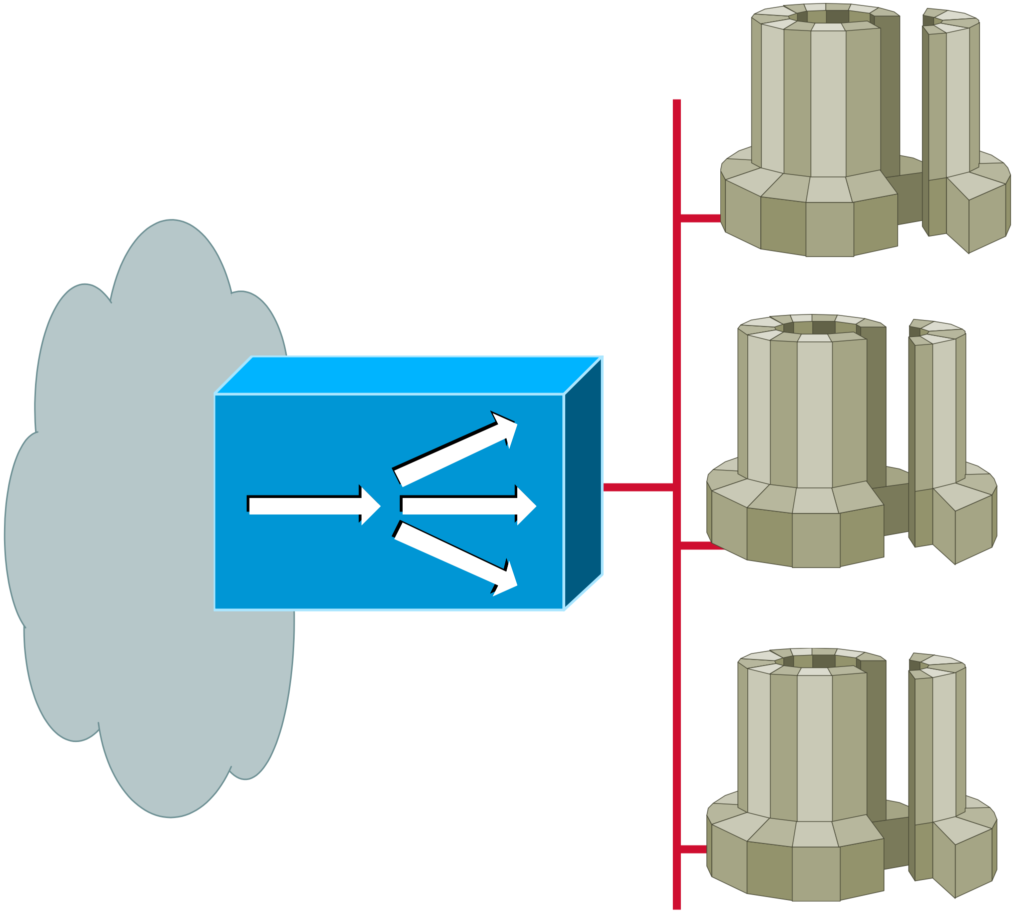
I know the default gateway

Spanning Tree Bridging



Maintain a network link to a vital resource

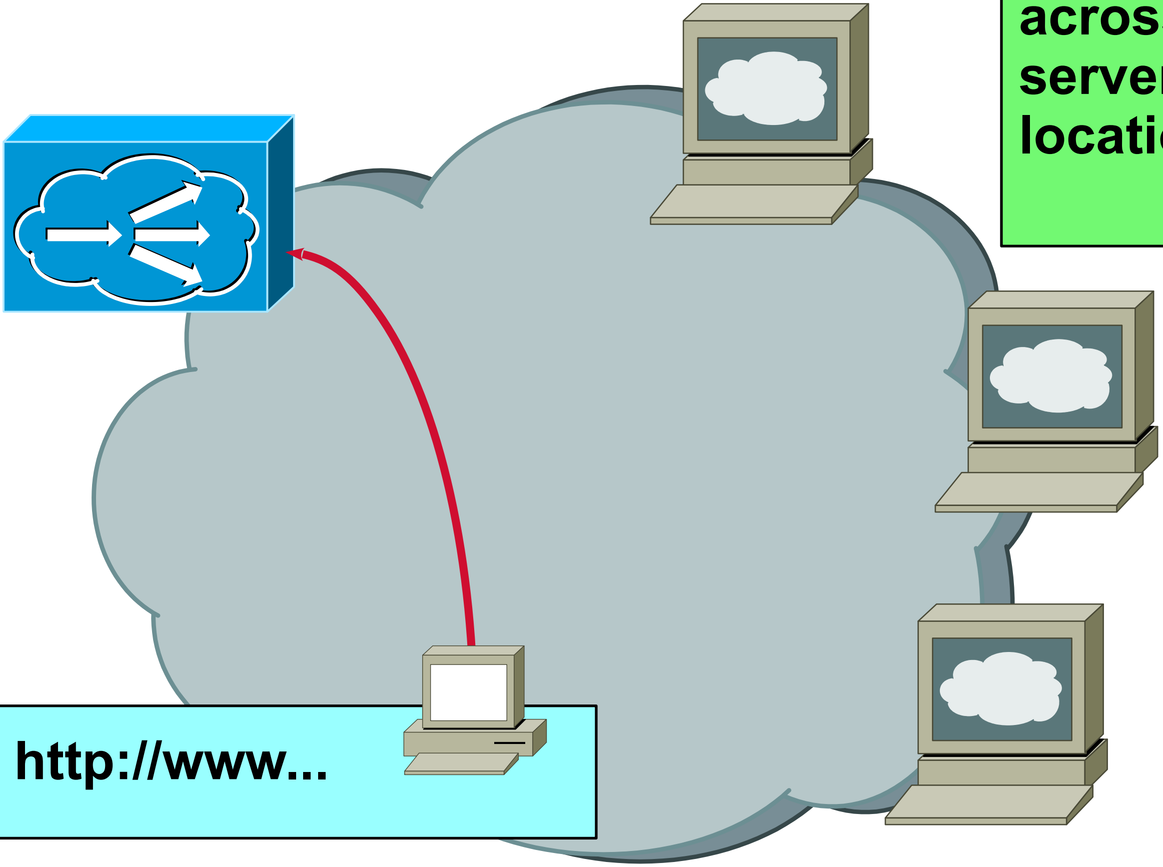
Local Director



Spread out a vital network service across multiple servers

Distributed Director

Spread out a vital network service across multiple servers in diverse locations



Where is http://www...

Switch Port Security

```
Console> set port security 3/1 enable 01-02-03-04-05-06
Console> set port security 3/2 enable
Console>
```

```
Console> show port 3
Port  Status    Vlan   Level    Duplex  Speed    Type
----  --------  ----   ------   ------  -----    ------------
3/1   connect   1      normal   half     10      10 BASE-T
3/2   connect   1      normal   half     10      10 BASE-T

Port Security   Secure-Src-Addr    Last-Src-Addr       Shutdown
----  ---------  -----------------  -----------------   --------
3/1   enabled    01-02-03-04-05-06  01-02-03-04-05-06   No
3/2   enabled    05-06-07-08-09-10  10-11-12-13-14-15   Yes
Console>
```

Switch Access Security

```
Console> set ip permit 172.100.101.102
Console> set ip permit 172.160.161.0 255.255.192.0
Console> set ip permit enable
```

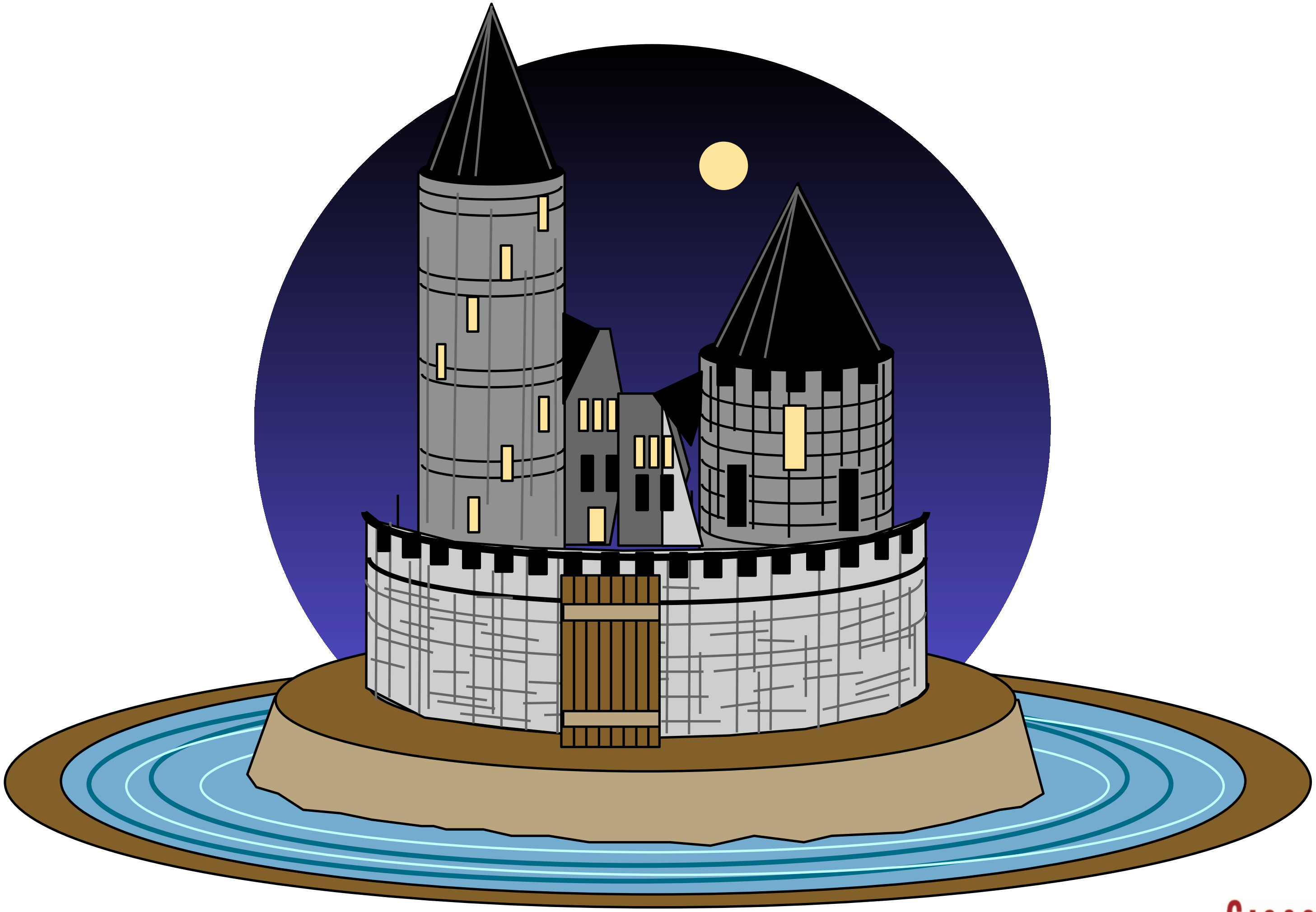
```
Console> show ip permit
IP permit list feature enabled.
Permit List              Mask
-----------------        ----------------
172.100.101.102
172.160.161.0            255.255.192.0
Denied IP Address        Last Accessed Time    Type
------------------       -----------------     -------
172.100.101.104          01/20/97,07:45:20     SNMP
172.187.206.222          01/21/97,14:23:05     Telnet
Console>
```

Intranet Protection Costs

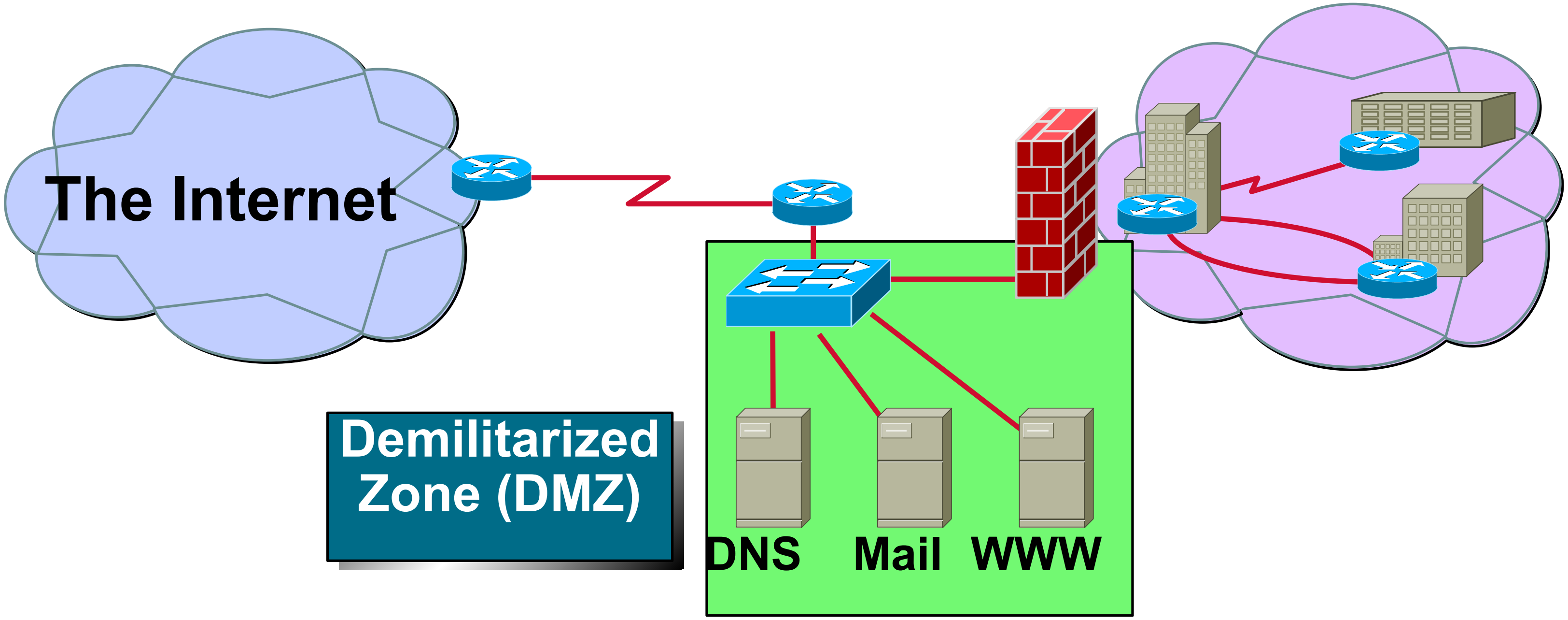
Versus:

- Loss
- Corruption
- Ease of Use

IV. Perimeter Protection



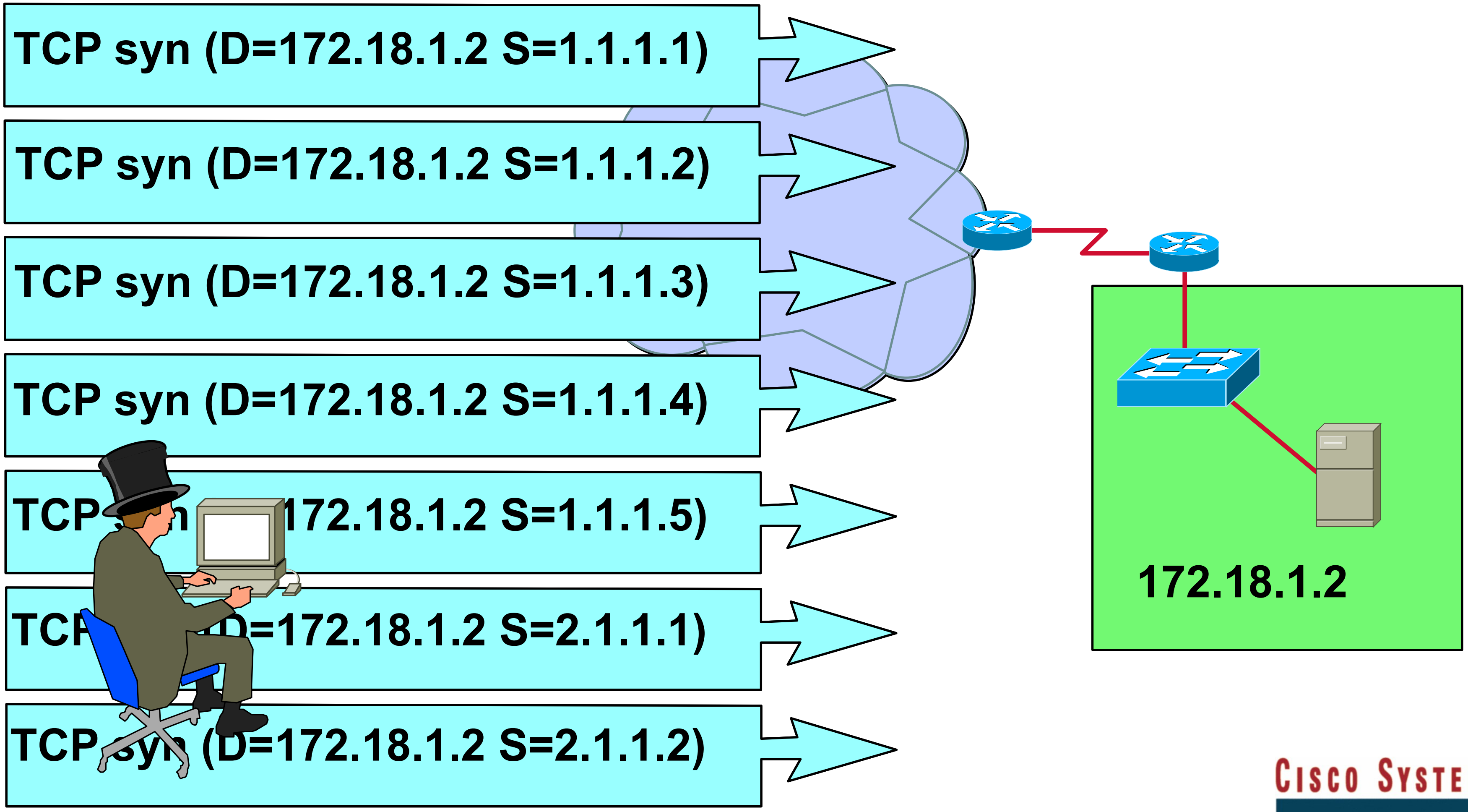
Firewall Protection



Use **access control lists** on the **screening router** to control traffic

Isolate each server from traffic with a switch

Syn Attack



TCP syn (D=172.18.1.2 S=1.1.1.1)

TCP syn (D=172.18.1.2 S=1.1.1.2)

TCP syn (D=172.18.1.2 S=1.1.1.3)

TCP syn (D=172.18.1.2 S=1.1.1.4)

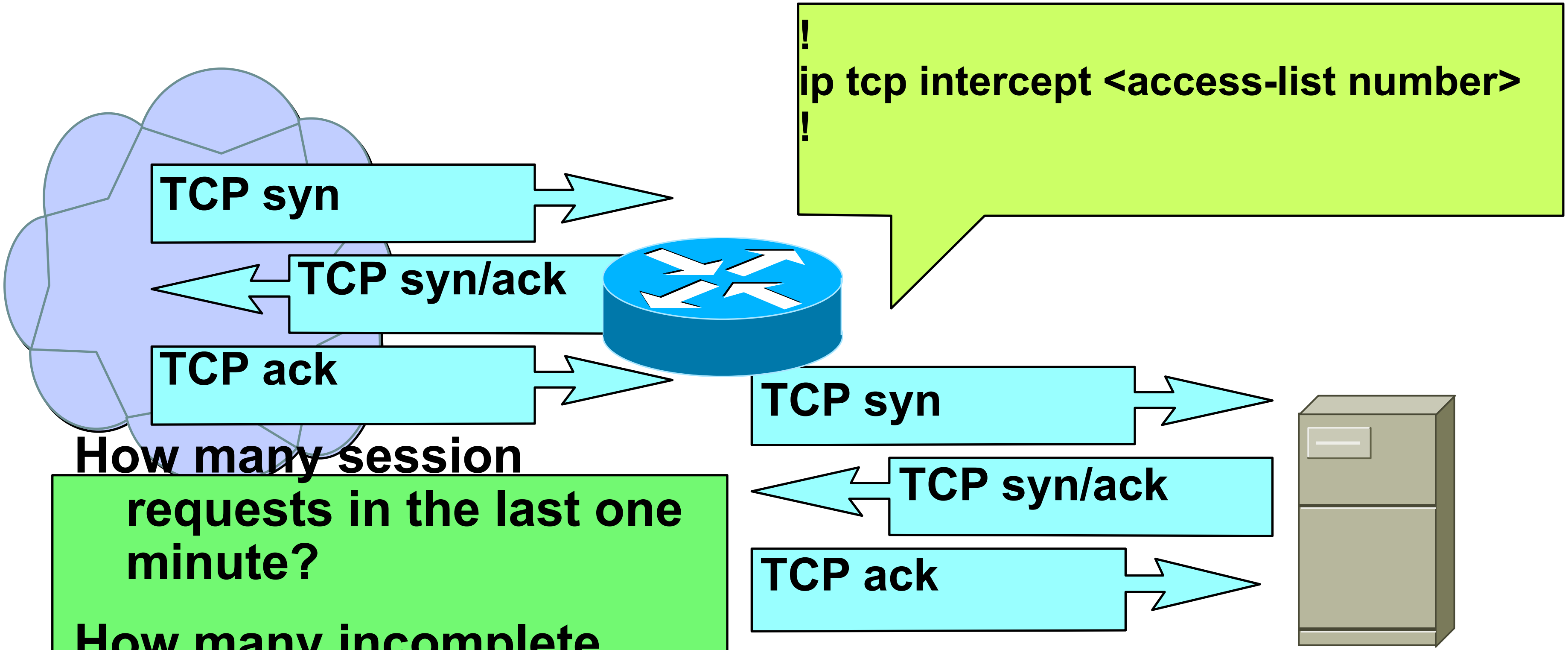
TCP syn (D=172.18.1.2 S=1.1.1.5)

TCP syn (D=172.18.1.2 S=2.1.1.1)

TCP syn (D=172.18.1.2 S=2.1.1.2)

172.18.1.2

Cisco IOS Syn Attack Defense



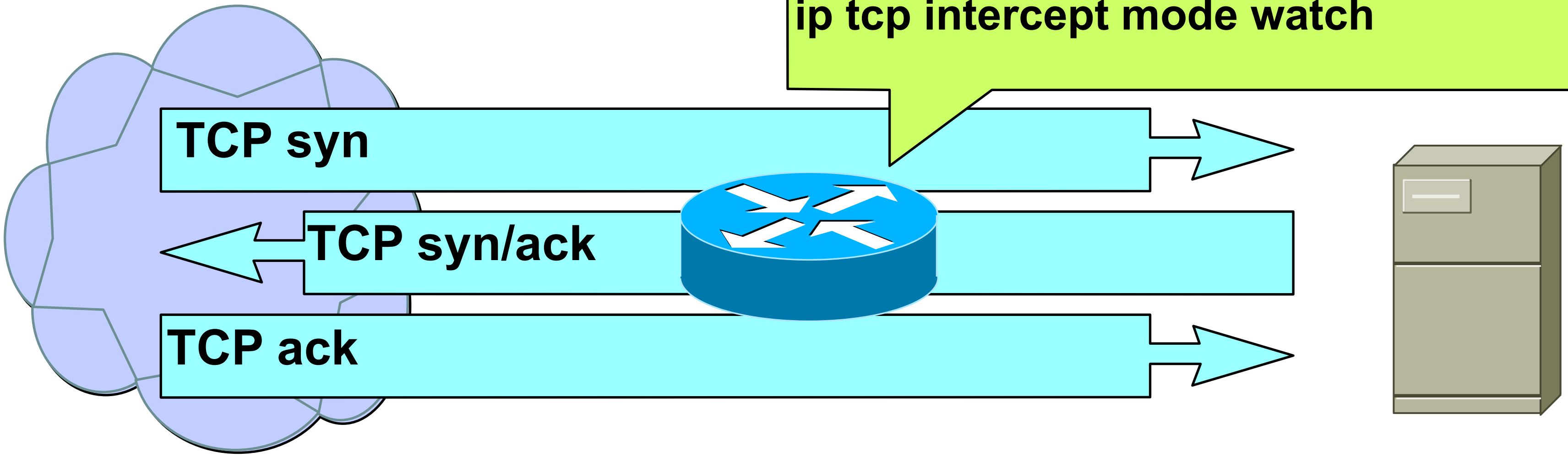
```
!
ip tcp intercept <access-list number>
!
```

How many session requests in the last one minute?

How many incomplete sessions are there?

Cisco IOS Syn Attack Defense

```
ip tcp intercept <access-list-number>
ip tcp intercept mode watch
```



How many session requests in the last one minute?

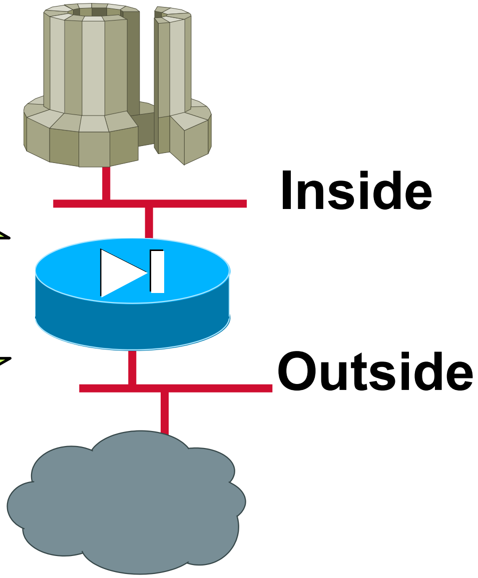
How many incomplete sessions are there?

How long do I wait for the final ack?

PIX—Syn Attack Defense

```
mailhost 172.17.1.12 10.1.1.2 [max_conns] [em_limit]
conduit 172.17.1.12 25 tcp 0.0.0.0  0.0.0.0
```

```
static 172.17.1.12 10.1.1.2 [max_conns] [em_limit]
conduit 172.17.1.12 23 tcp 0.0.0.0  0.0.0.0
```

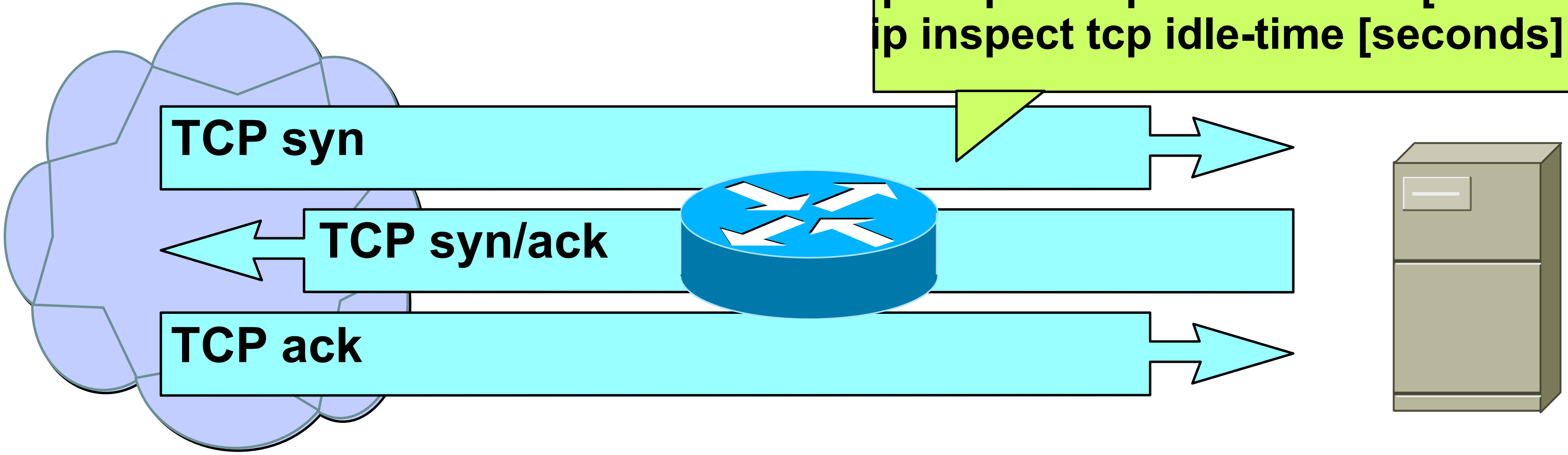


max_conns - the maximum number of TCP connections allowed

em_limit - the embryonic connection limit

Cisco IOS Firewall Feature Set
Syn Attack Defense

ip inspect tcp synwait-time [seconds]
ip inspect tcp finwait-time [seconds]
ip inspect tcp idle-time [seconds]



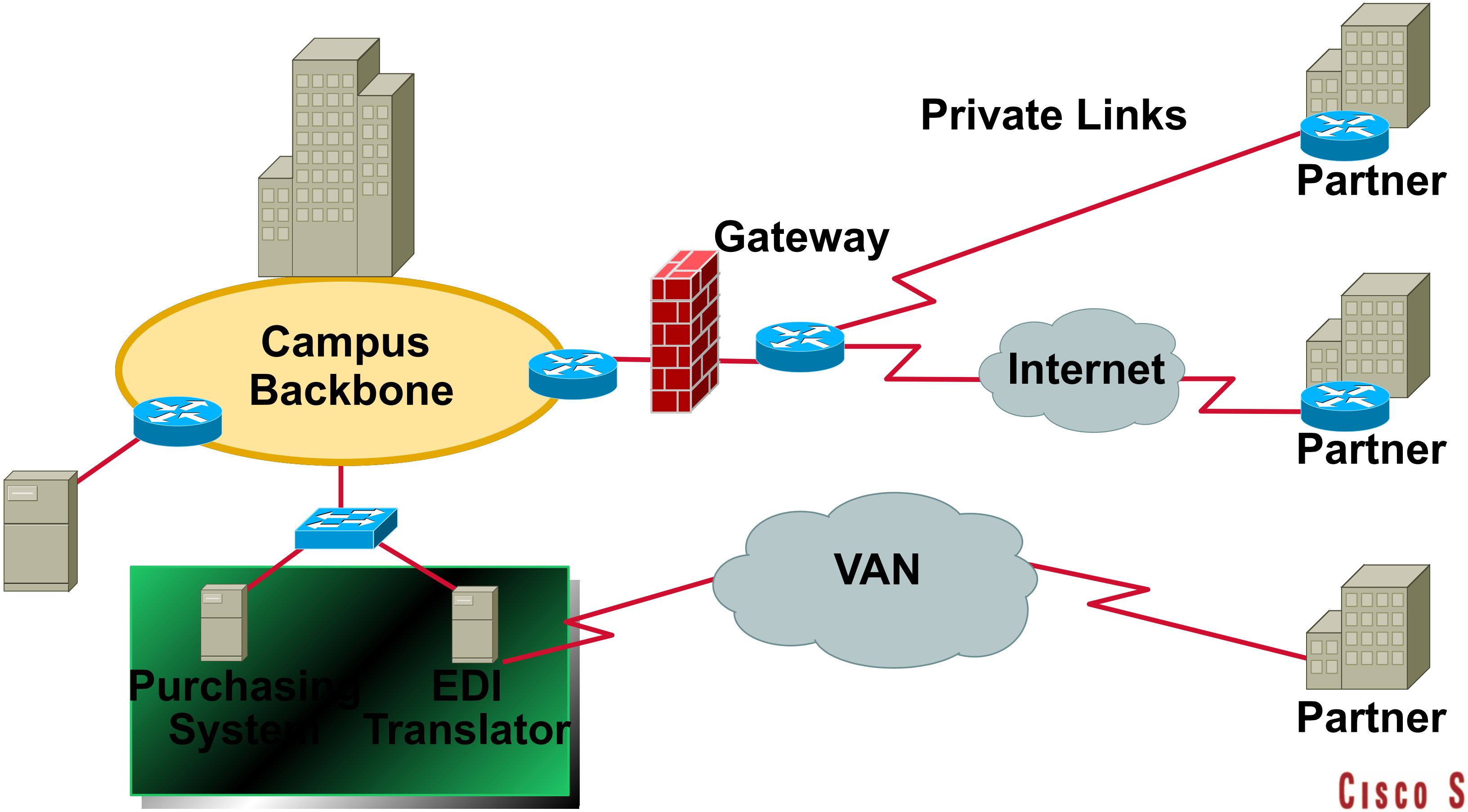
How many session requests in the last one minute?

How many incomplete sessions are there?

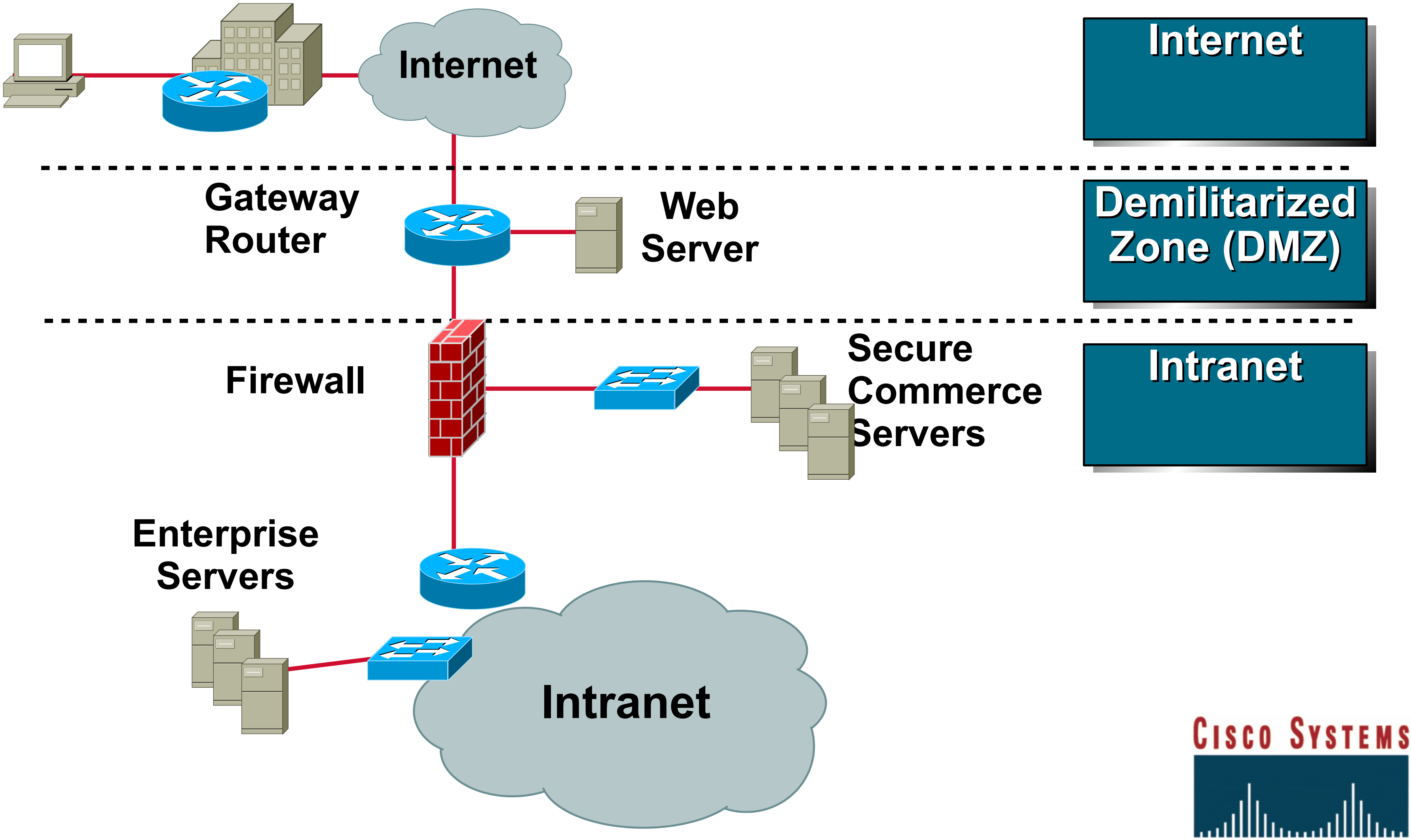
How long do I wait for the final ack?

Extranet Options

Virtual Private Networking



Electronic Commerce



Internet

Gateway Router

Web Server

Firewall

Secure Commerce Servers

Enterprise Servers

Intranet

Internet

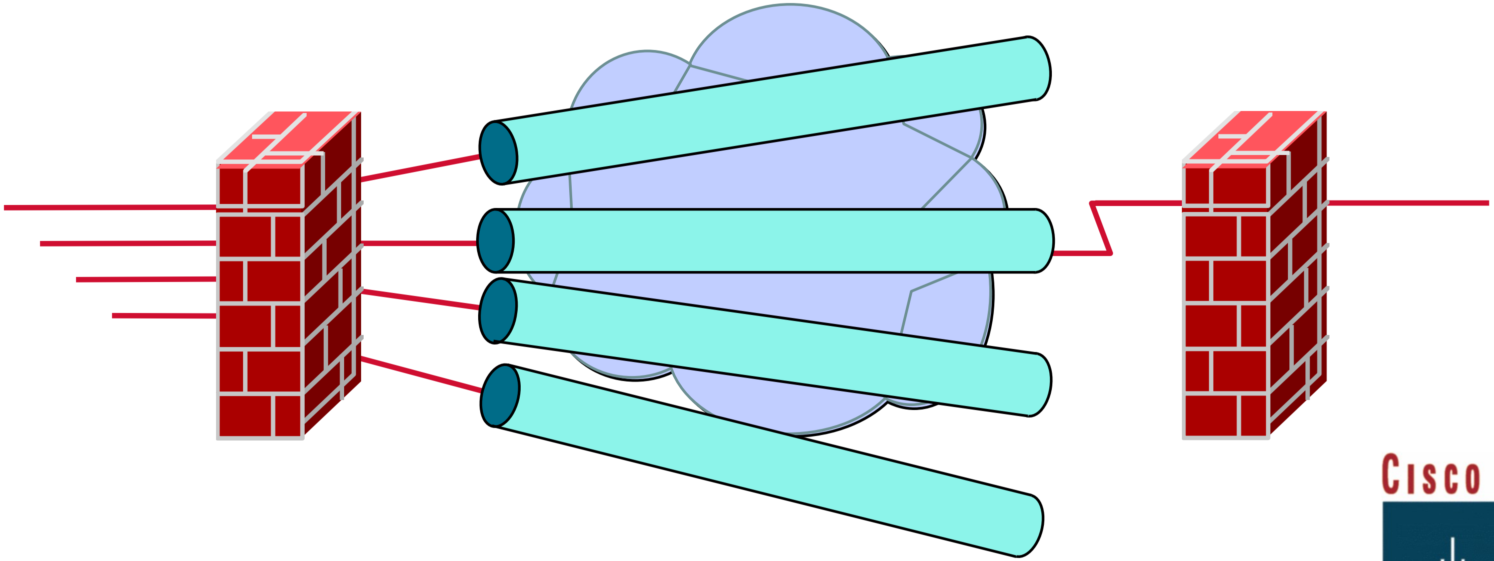
Demilitarized Zone (DMZ)

Intranet

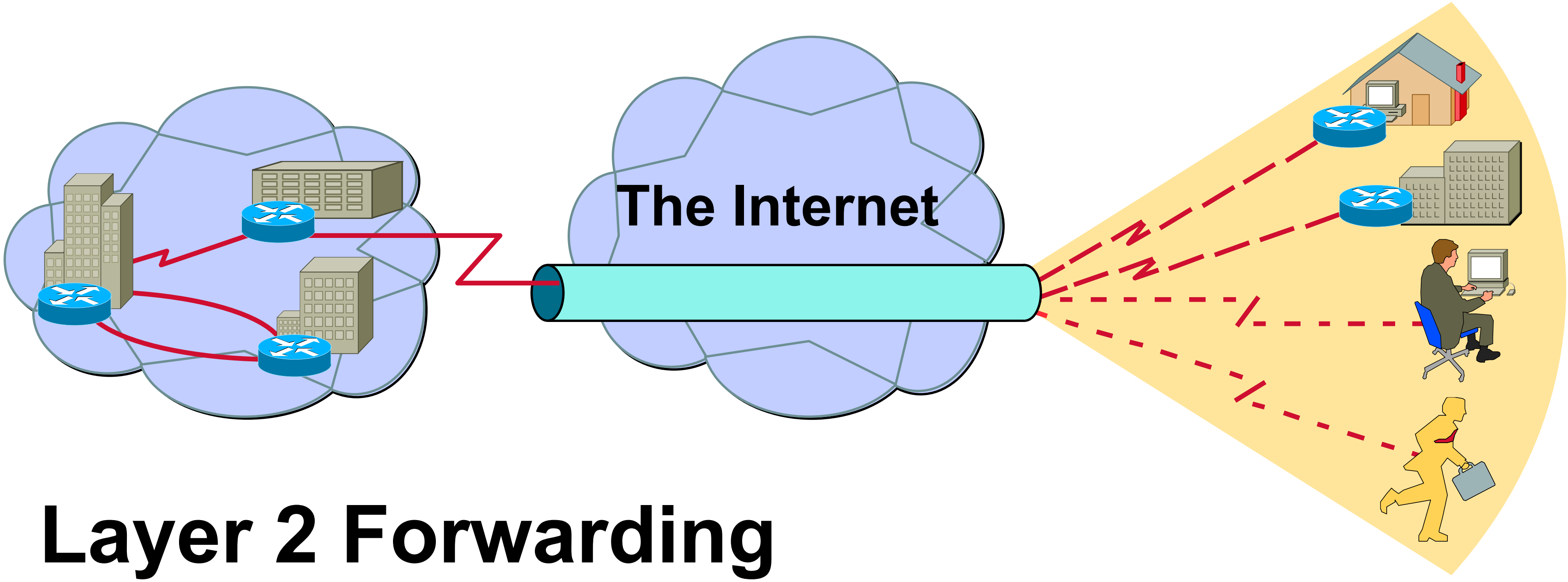
VPN Requirements

or

- Encryption for authentication, confidentiality and integrity
- Physical line separation via private lines or frame relay



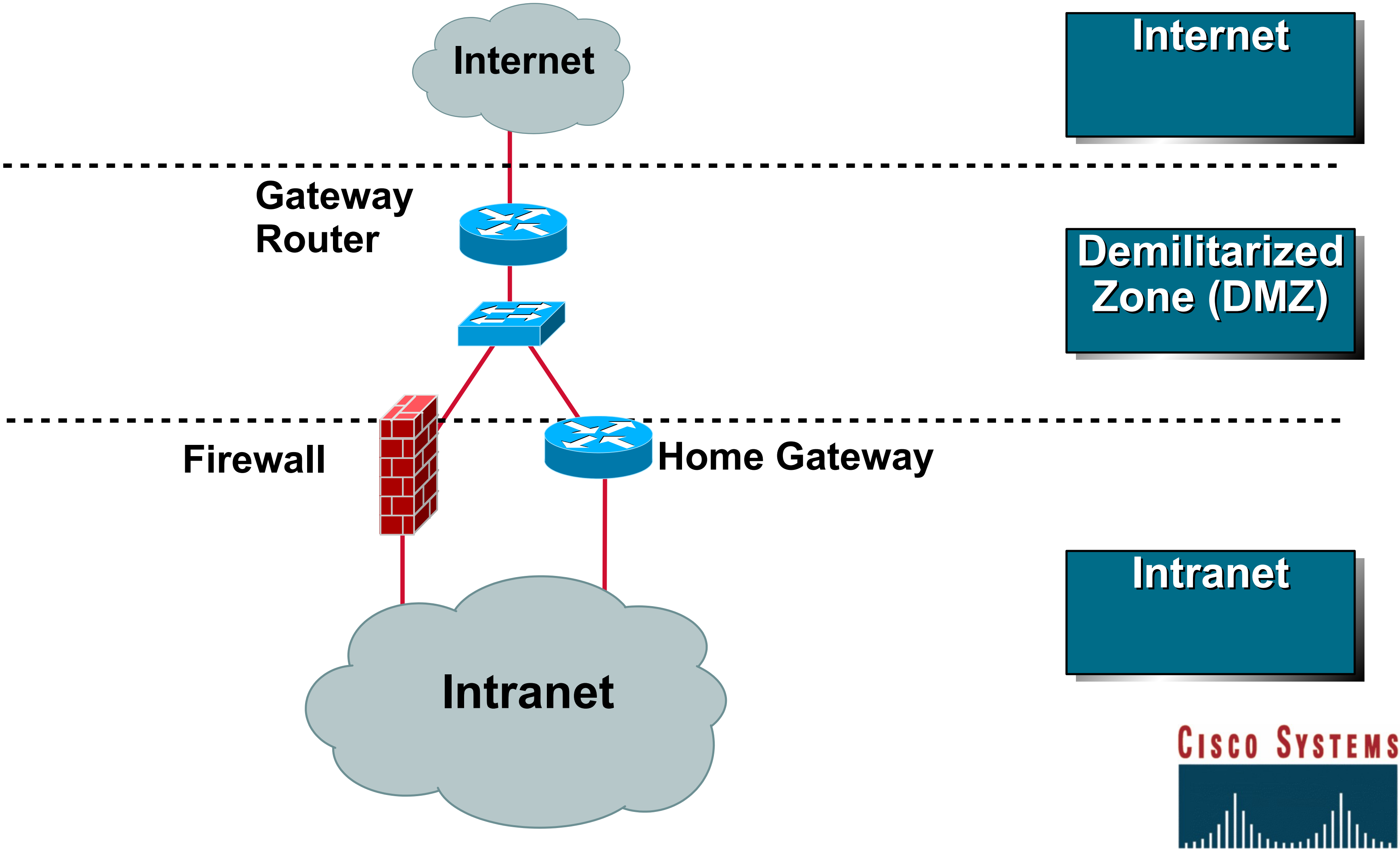
Virtual Private Dial Network



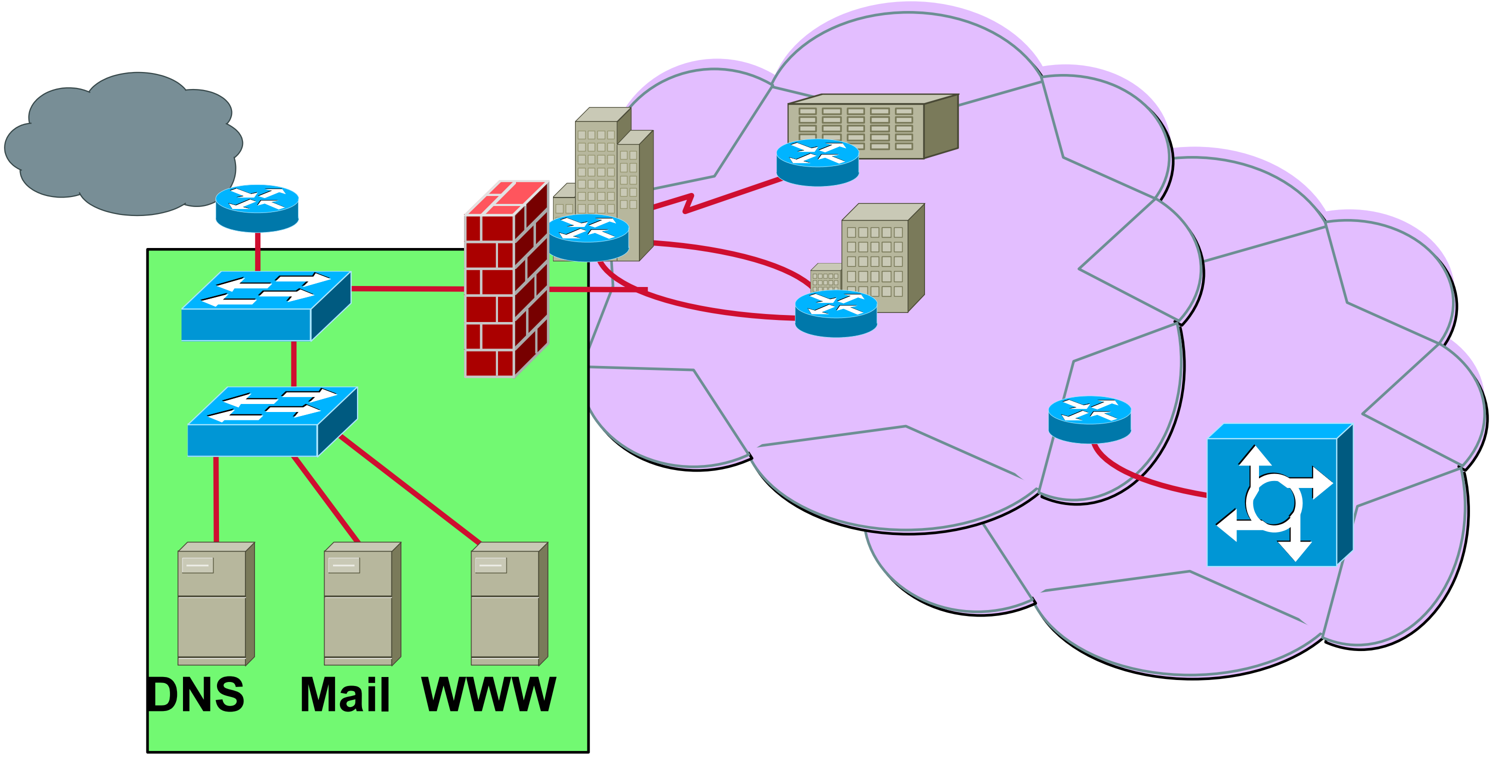
Layer 2 Forwarding

Layer 2 Tunnel Protocol

VPDN Entrance to the Enterprise

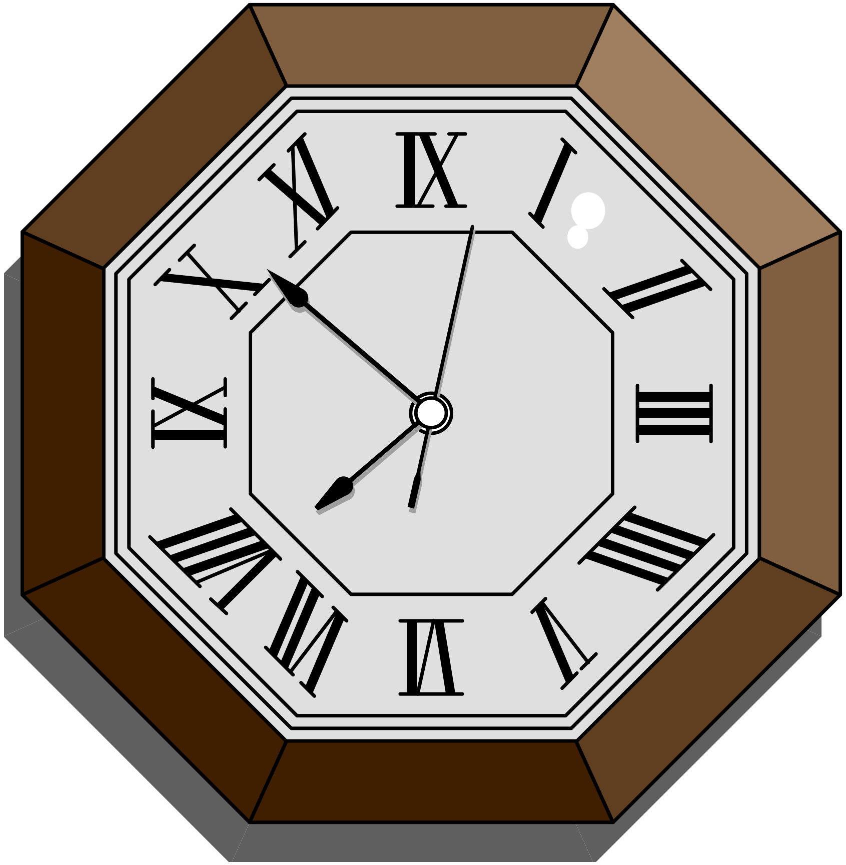


Dial Access Protection



Where to place the NAS?

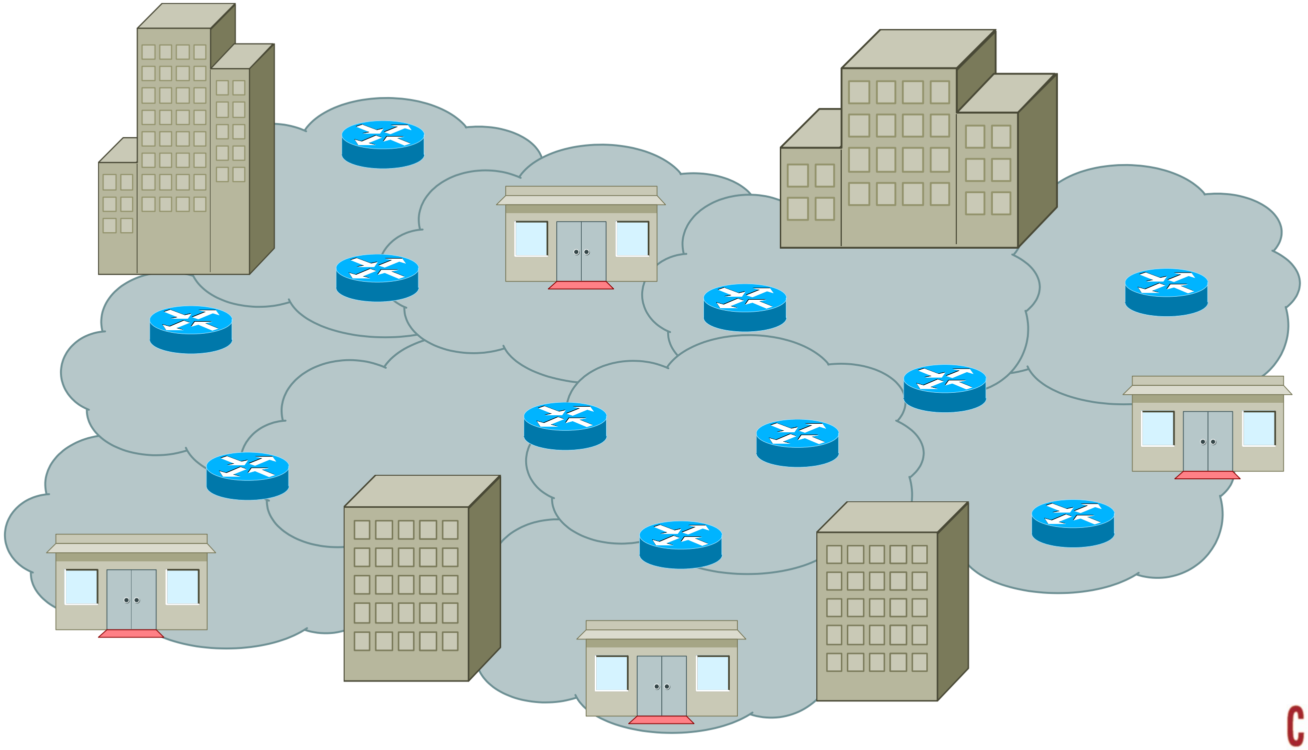
V. Network Security Sustainment



24 by 7

Dynamic Routing Protocols

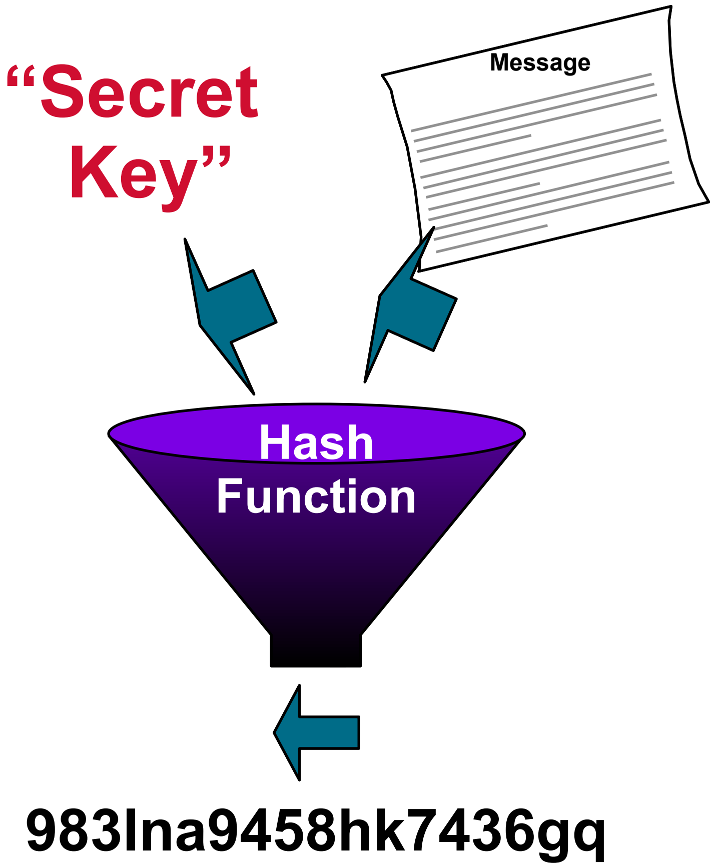
Path Redundancy to Route Around Failures



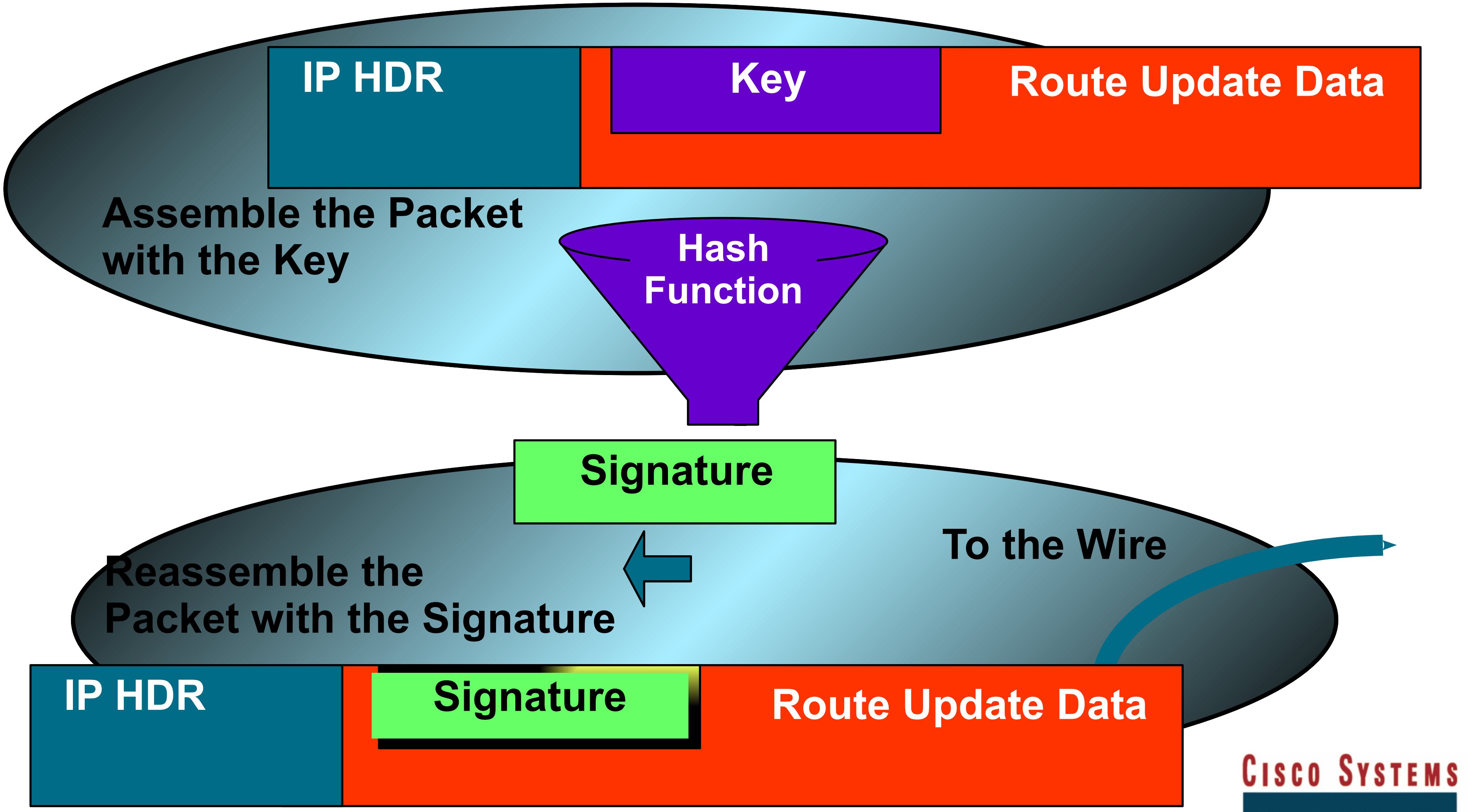
Keyed Hashing for Authentication and Integrity

Secret key and message are hashed together

Recomputation of digest verifies that the message originated with the peer and that the message was not altered in transit



Route Update Authentication and Integrity



Route Filtering

```
router rip
network 10.0.0.0
distribute-list 1 in
!
access-list 1 deny   0.0.0.0
access-list 1 permit 10.0.0.0  0.255.255.255
```

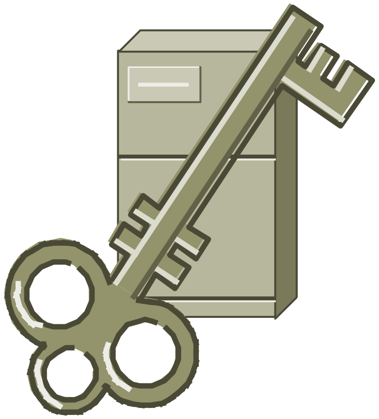
```
Router# sho ip proto
Routing Protocol is "rip"
 Sending updates every 30 seconds, next due in 12 seconds
 Invalid after 180 seconds, hold down 180, flushed after 240
 Outgoing update filter list for all interfaces is not set
 Incoming update filter list for all interfaces is 1
 Redistributing: rip
```

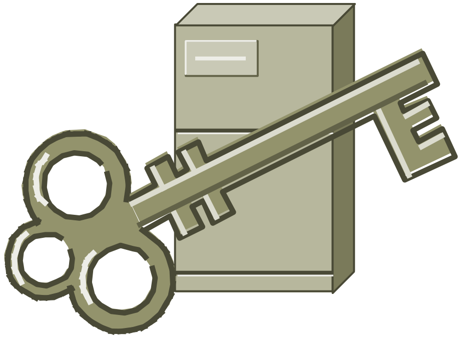
Secure Vital Services

Network Time Protocol Sources

Domain Name Servers

Certificate Authority

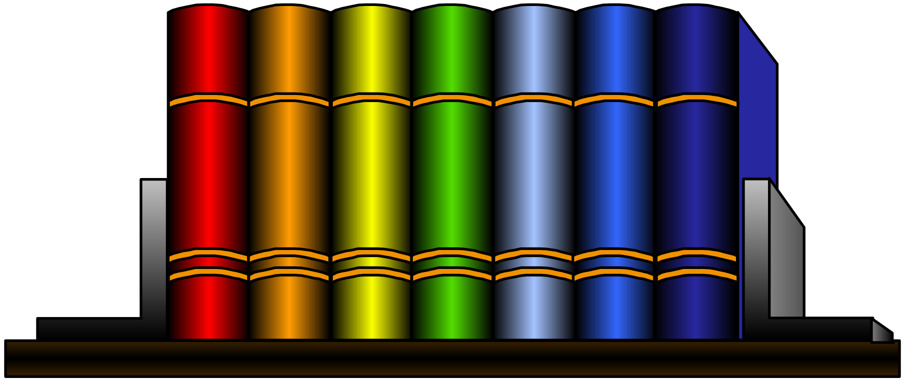




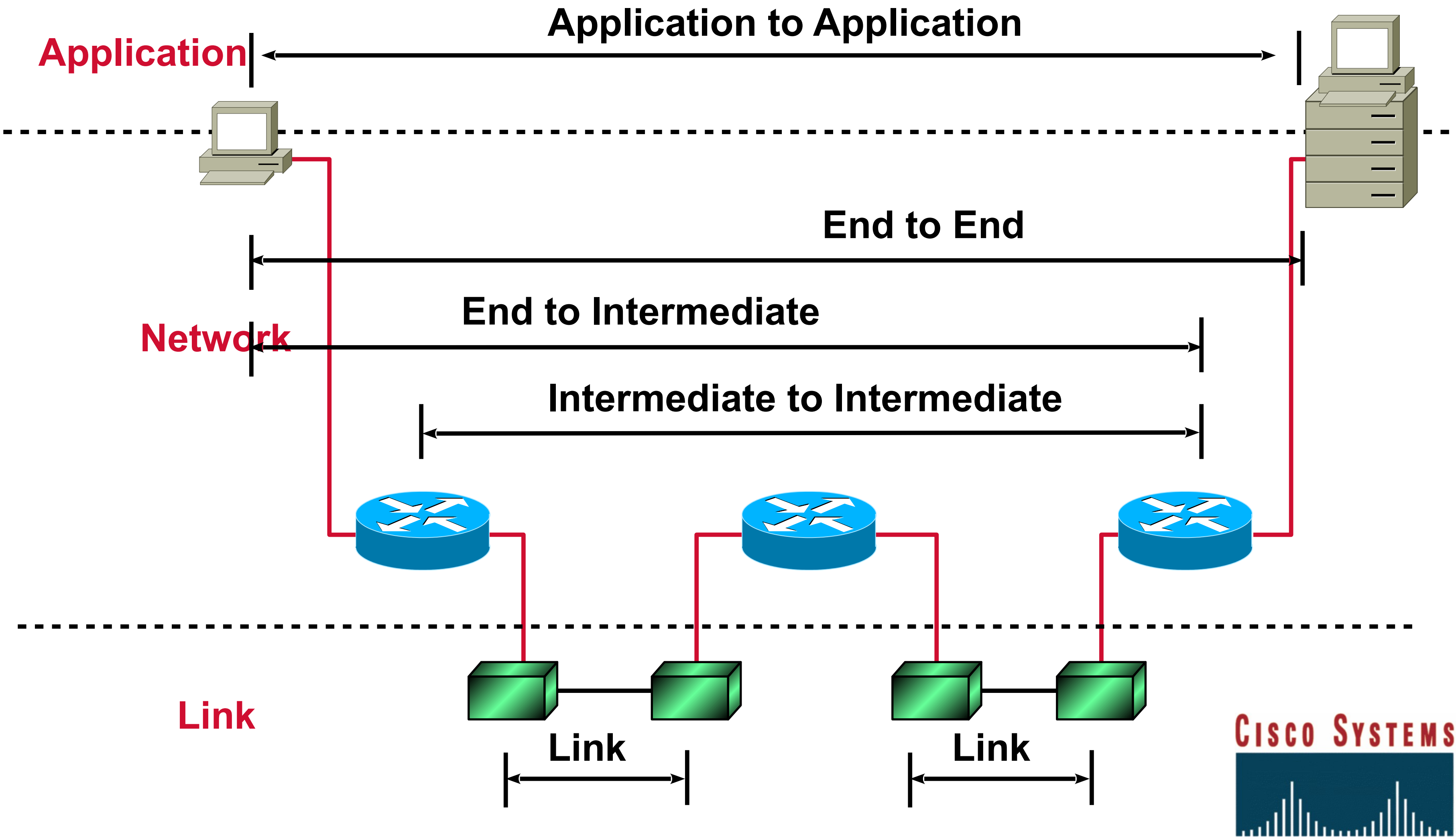
Multi-Level Security (TCSEC)

Not really needed in Enterprise Networks

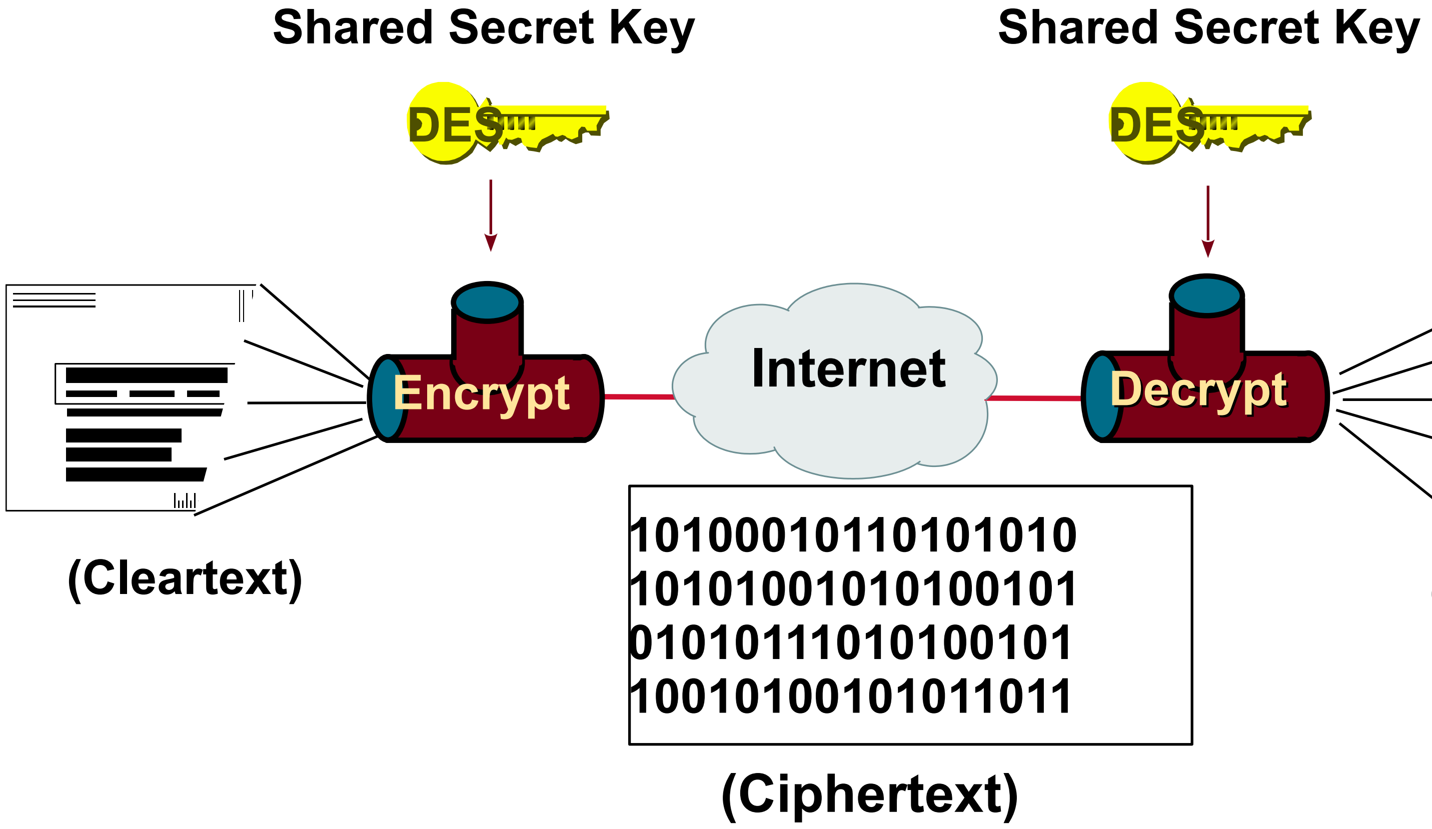
Difficult to implement (unless you're the military)



Session Protection through Encryption



Session Protection through Network Layer Encryption



Shared Secret Key

Shared Secret Key

DES

DES

Encrypt

Internet

Decrypt

(Cleartext)

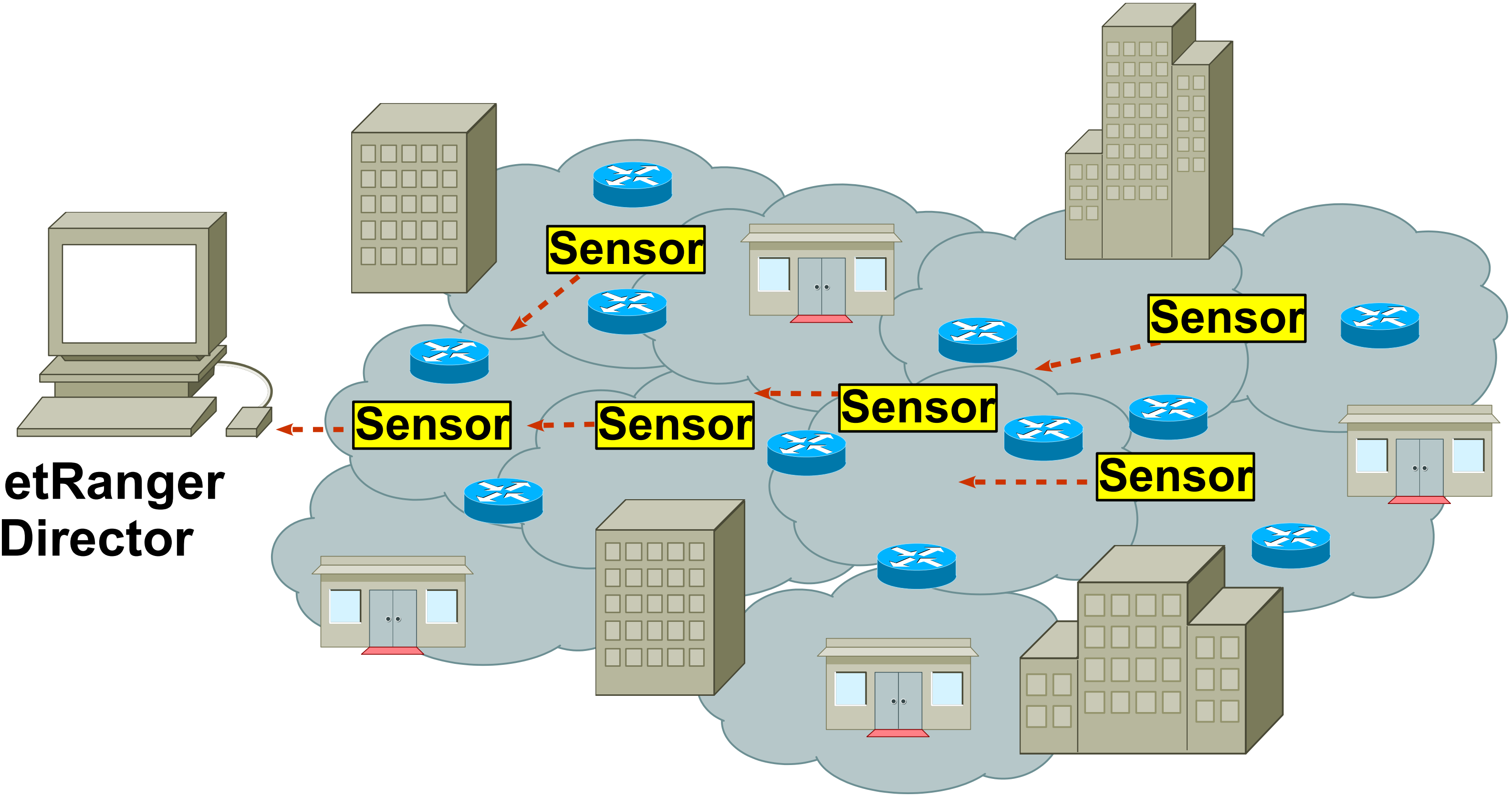
10100010110101010
10101001010100101
01010111010100101
10010100101011011

(Ciphertext)

(Cleartext)

IPSec—the IETF working group defining IP Security

NetRanger



Sensors watch for attacks or problems

NetRanger stops active attacks

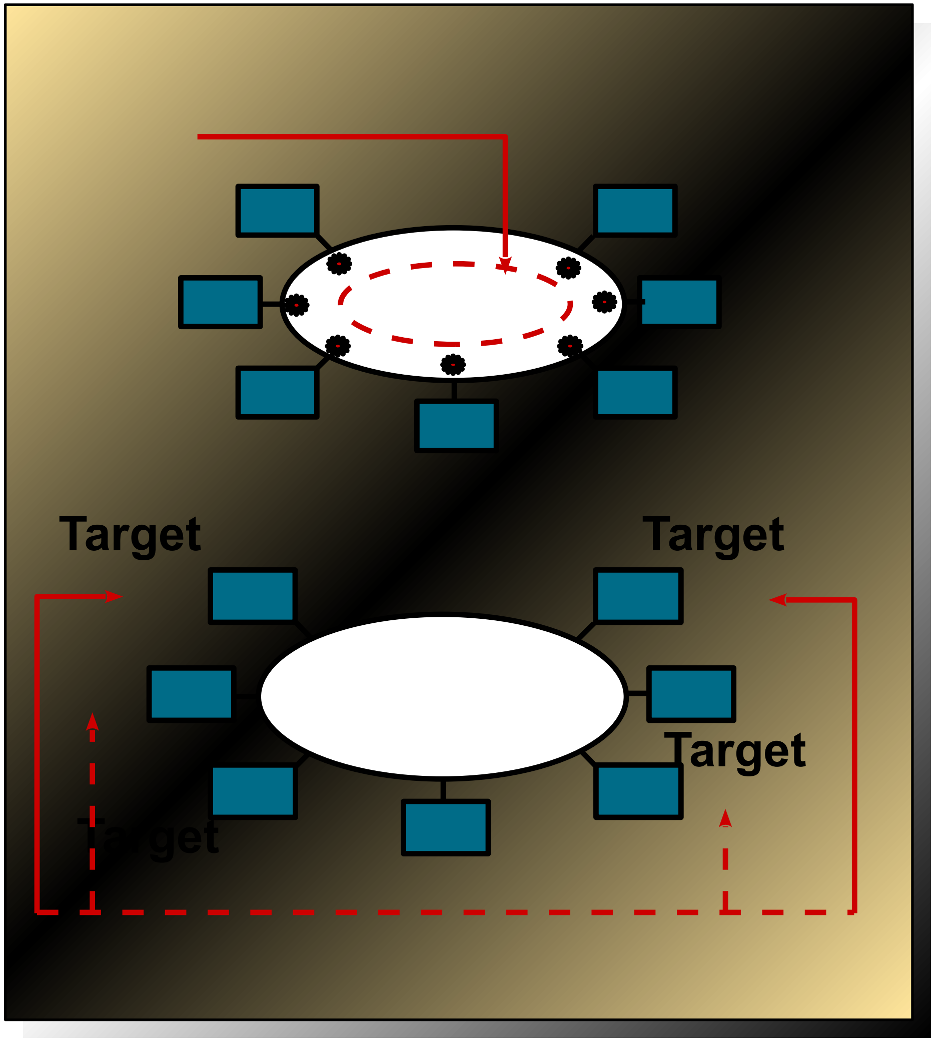
NetSonar Vulnerability Scanning

Network mapping

- Identify live hosts
- Identify services on hosts

Vulnerability scanning

- Analyze discovery data for potential vulnerabilities
- Confirm vulnerabilities on targeted hosts

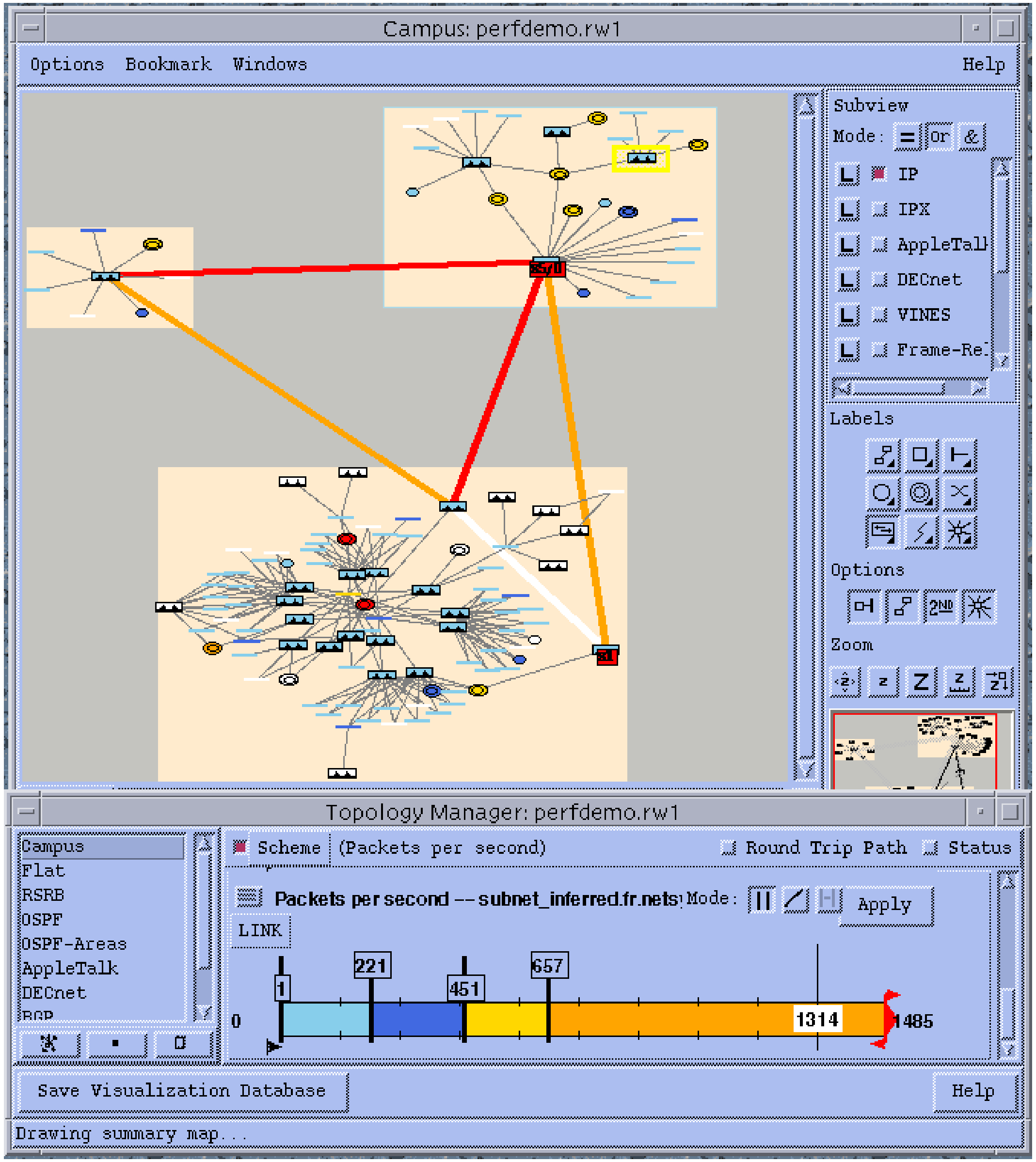


VI. Security Sustainment Validation

What steps can you take to make sure that your network will continue to be secure?

Modeling Tools

NetSys Modeling can verify the access controls in your network



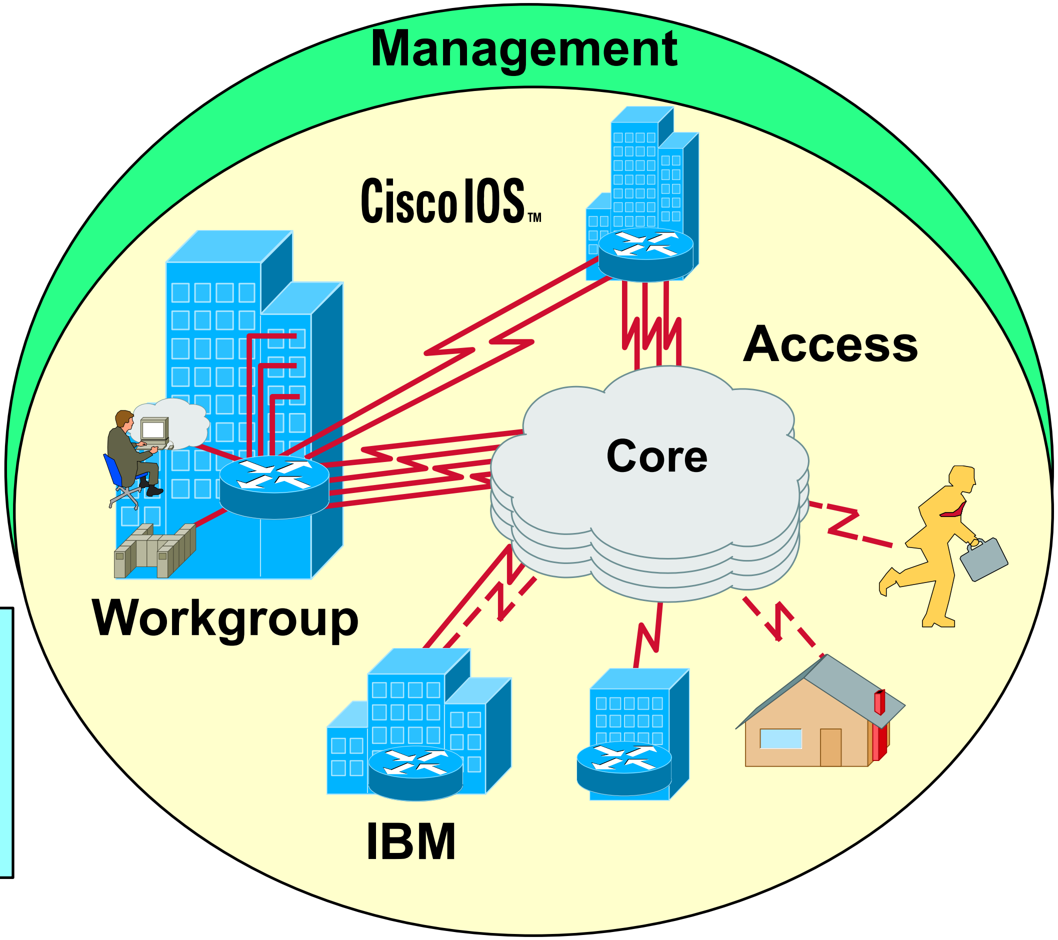
Drawing summary map...

Validating Your Policy through Network Management Systems

What to monitor?

What to measure?

Track and report trends that show how you are achieving your security goals



VII. Conclusions

For the want of a nail, the shoe was lost.
For the want of a shoe, the horse was lost.
For the want of a horse, the rider was lost.
For the want of a rider, the battle was lost.
For the want of a battle, the Kingdom was lost.
And all for the want of a horse shoe nail.

Smooth Sailing

“Security is a Foundation Service”

“By protecting the resources and the infrastructure, things will run properly”

Cisco Systems®

Empowering the Internet Generation$^{\text{SM}}$