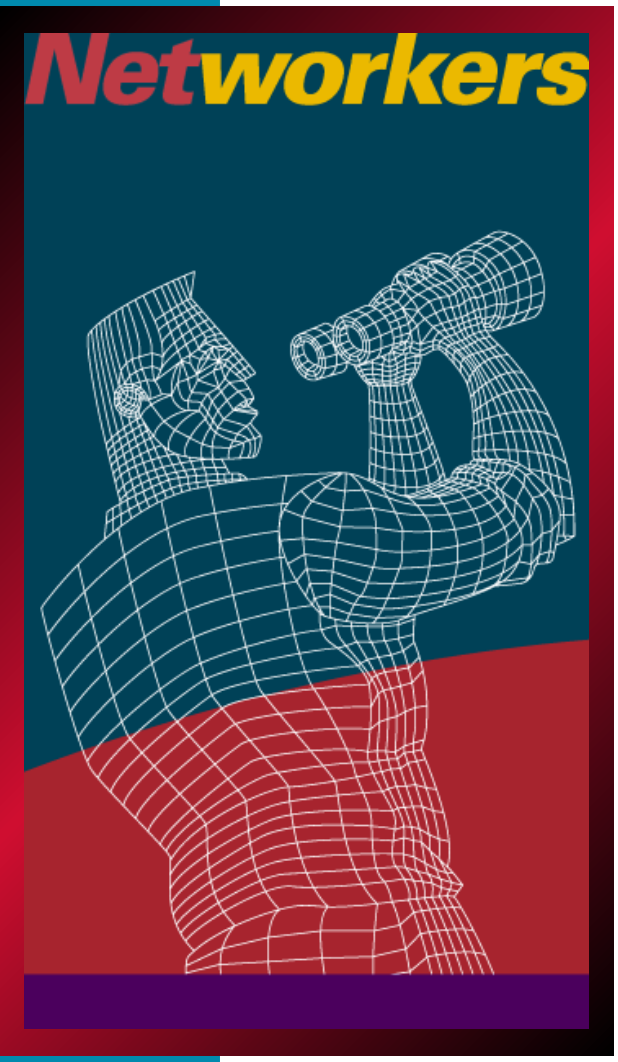


Designing Secure Enterprise Network Infrastructures

Cisco Systems

Infrastructure Security

CISCO SYSTEMS

Smooth Sailing

Maintain a written Policy

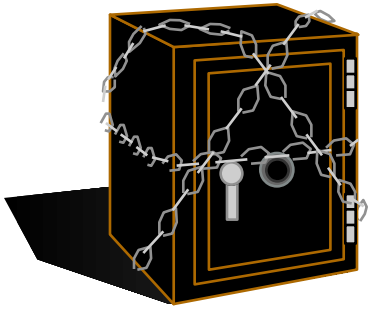
Cisco Systems

Elements of a Security Policy

Identity

Integrity

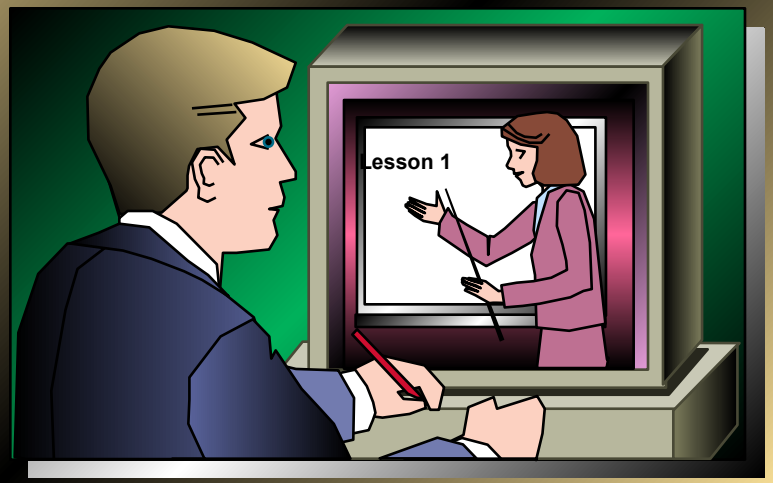
Audit

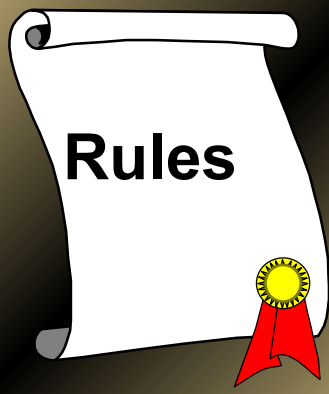


CISCO SYSTEMS

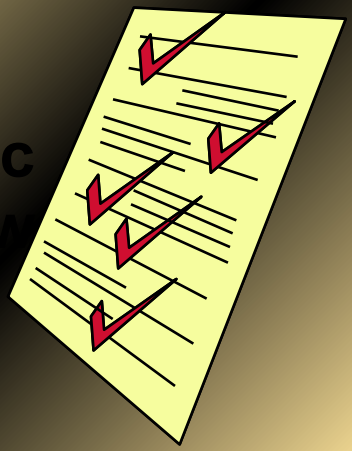
Procedures and Operations

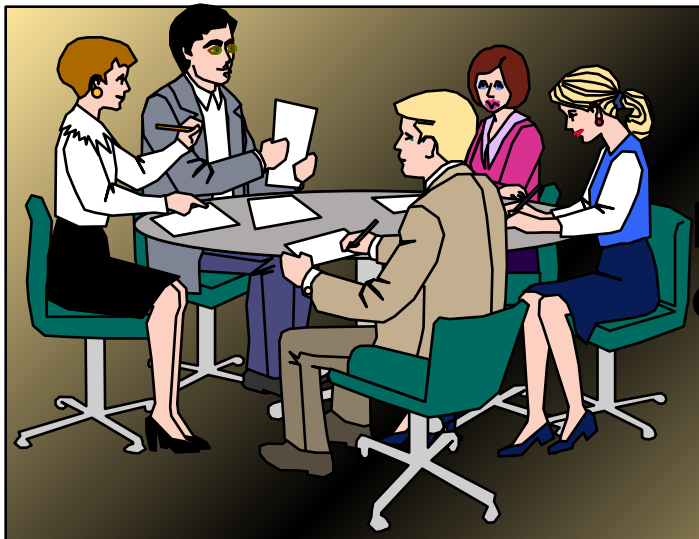
Training





Periodic Review





Delegation of Authority

Goals of the Session

Define what to protect—anything that could cause problems if it were to stop or malfunction

Decide how to protect it—good enough vs. absolute protection

Think about cost of protection vs. cost of loss or corruption

Agenda

I. Introduction

II. Router/Switch Self-Protection

III. Resource Protection

IV. Perimeter Protection

V. Network Security Sustainment

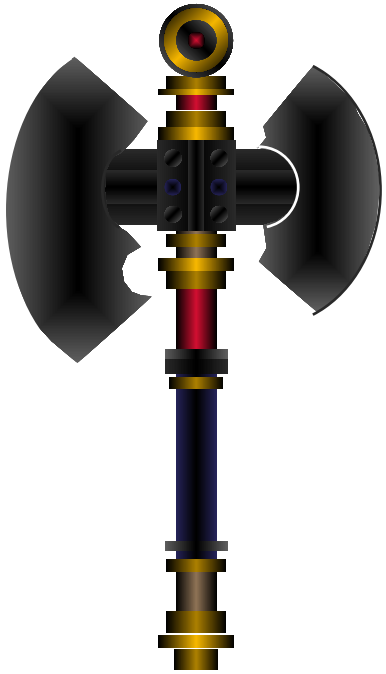
VI. Security Sustainment Validation

VII. Conclusions

II. Router/Switch Self-Protection

Threats

Avoidance Measures

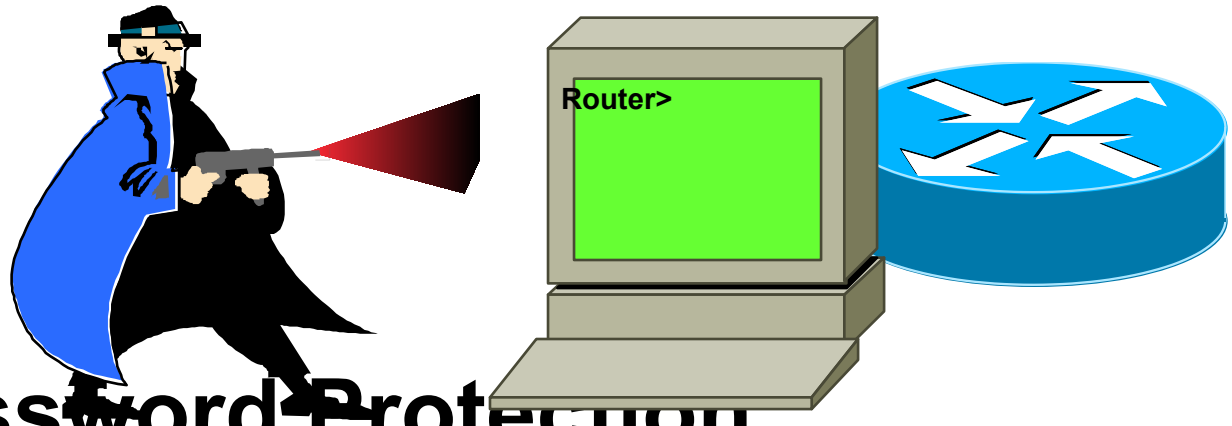


CISCO SYSTEMS

Intruder Attack Points

- The administrative interfaces
  - Console
  - Telnet
  - SNMP
- Overload the data interface
- Overload the processor

The Administrative Interface



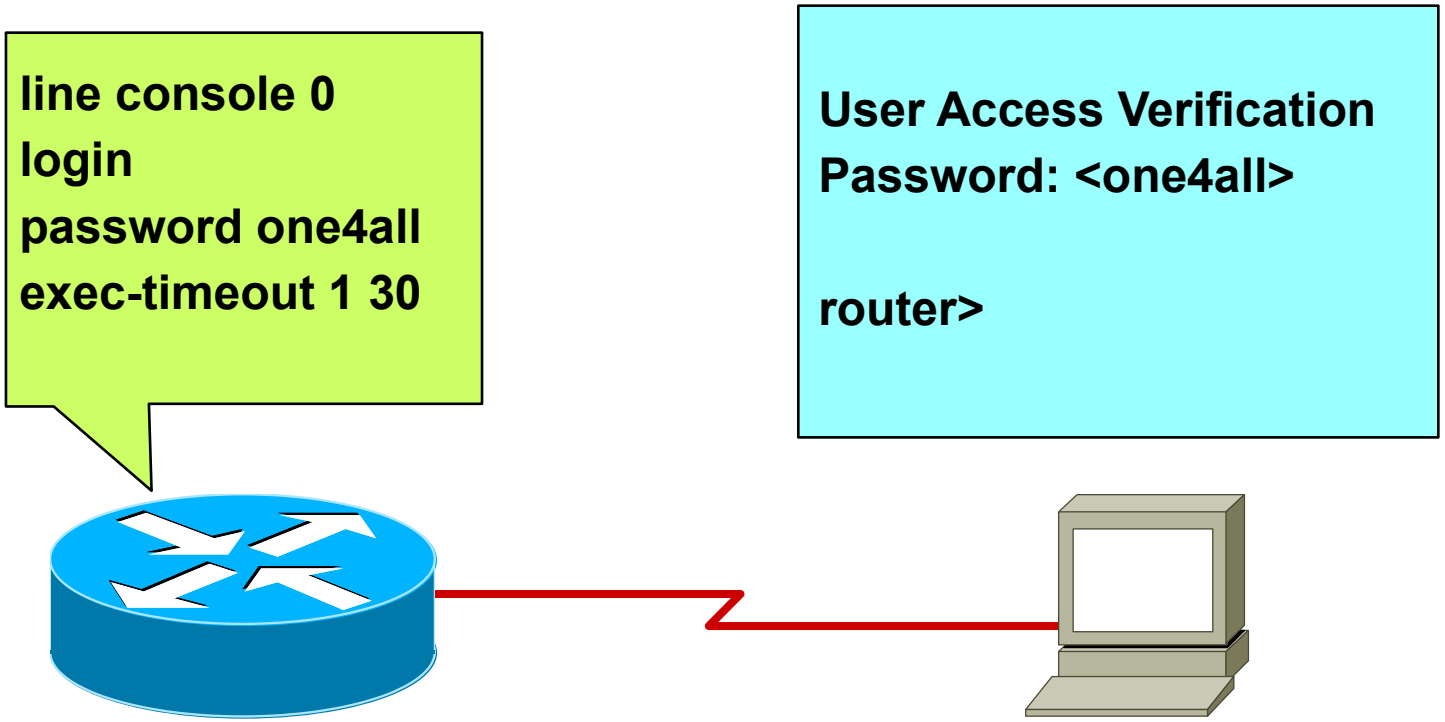
Password Protection

Password Encryption

Banners

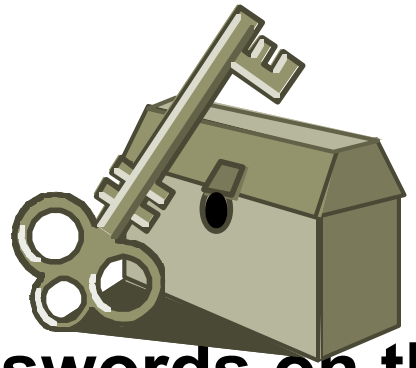
Select an appropriate login banner that tells who is allowed into the system

Native Passwords



The native passwords can be viewed by anyone logging in with the enabled password

Service Password-Encryption (7)

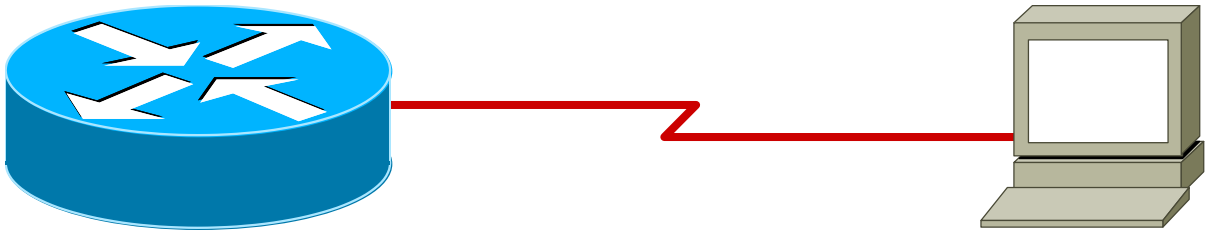


- Will encrypt all passwords on the Cisco IOS™ with Cisco-defined encryption type “7”
- Use “enable password 7 <password>” for cut/paste operations
- Cisco proprietary encryption method

Service Password-Encryption

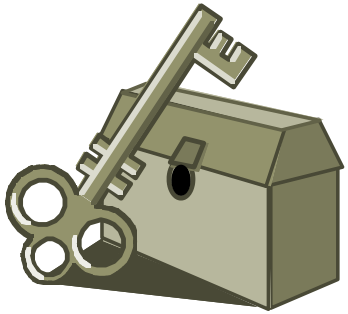
```
hostname Router
!
enable password one4all
!
```

```
service password-encryption
!
hostname Router
!
enable password 7 15181E00F
```



Cisco Systems

Enable Secret (5)



Uses MD5 to produce a one-way hash

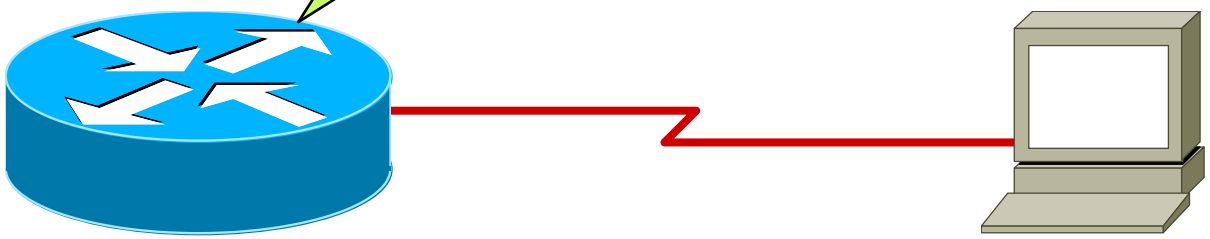
Cannot be decrypted

Use “enable secret 5 <password>” to cut/paste another “enable secret” password

Enable Secret (5)

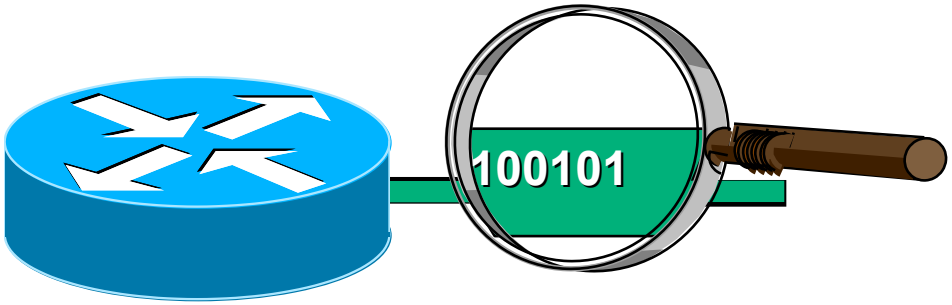
```
hostname Router
!
enable password 1forAll
```

```
!
hostname Router
!
enable secret 5 $1$hM3l$.s/DgJ4TeKdDkTVCJplBw1
```

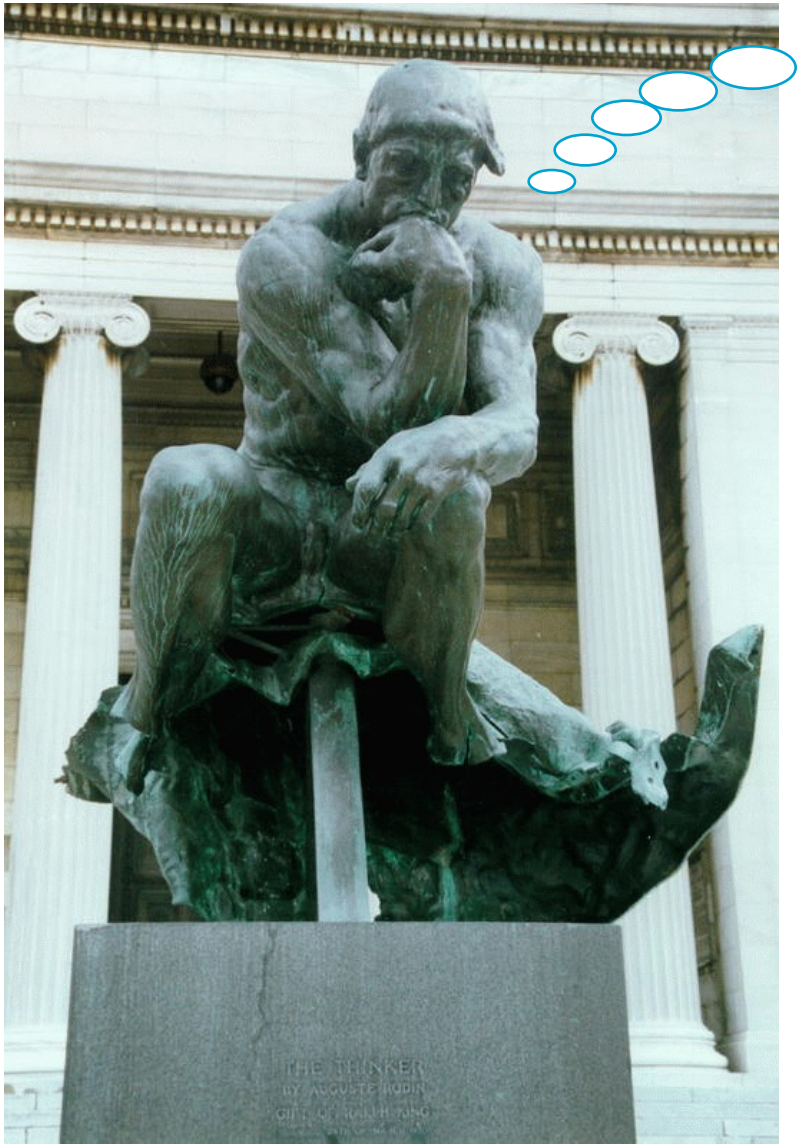


Password of Caution

Even passwords that are encrypted in the configuration are not encrypted on the wire as an administrator logs into the router



Use Good Passwords



hmm…, How about "Pancho"?

Do not use passwords that can be easily guessed

CISCO SYSTEMS

Authentication Mechanisms

- Local Password
- Kerberos
- TACACS+
- RADIUS
- One-time Passwords

Cisco IOS TACACS+ Authentication

```
version 11.2
!
service password-encryption
!
hostname Router
!
aaa new-model
aaa authentication login billy tacacs+ enable
aaa authentication login bobby tacacs+ local
enable secret 5  $1$hM3l$.s/DgJ4TeKdDk…
!
username bill password  7  030E4E050D5C
!
```

Encrypts passwords with encryption (7).

Define list “billy” to use TACACS+ then the enable password

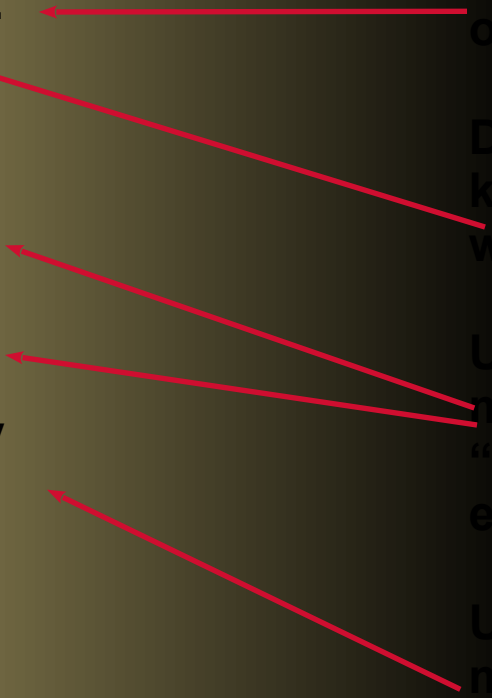
Define list “bobby” to use TACACS+ then the local user and password

“enable secret” overrides the (7) encryption

Define a local user and password for “bill”

Cisco IOS TACACS+ Authentication

```
tacacs-server host 10.1.1.2
tacacs-server key <key>
!
line con 0
login authentication billy
line aux 0
login authentication billy
line vty 0 4
login authentication bobby
length 29
width 92
!
end
```



Defines the IP address of the TACACS+ server

Defines the "encryption" key for communicating with the TACACS+ server

Uses the authentication mechanisms listed in "billy" —TACACS+ then enable password

Uses the authentication mechanisms listed in "billy" —TACACS+ then a local user/password

Cisco Systems

PIX TACACS+ Authentication

```
PIX Version 4.0.7
enable password BjeuCKspwqCc94Ss encrypted
passwd nU3DFZzS7jF1jYc5 encrypted
tacacs-server host 10.1.1.2 <key>
aaa authentication telnet outbound 0.0.0.0 0.0.0.0 tacacs+
aaa authentication ftp outbound 0.0.0.0 0.0.0.0 tacacs+
aaa authentication http outbound 0.0.0.0 0.0.0.0 tacacs+
no snmp-server location
no snmp-server contact
telnet 10.1.1.2 255.255.255.255
mtu outside 1500
mtu inside 1500
: end
[OK]
```

Telnet Password

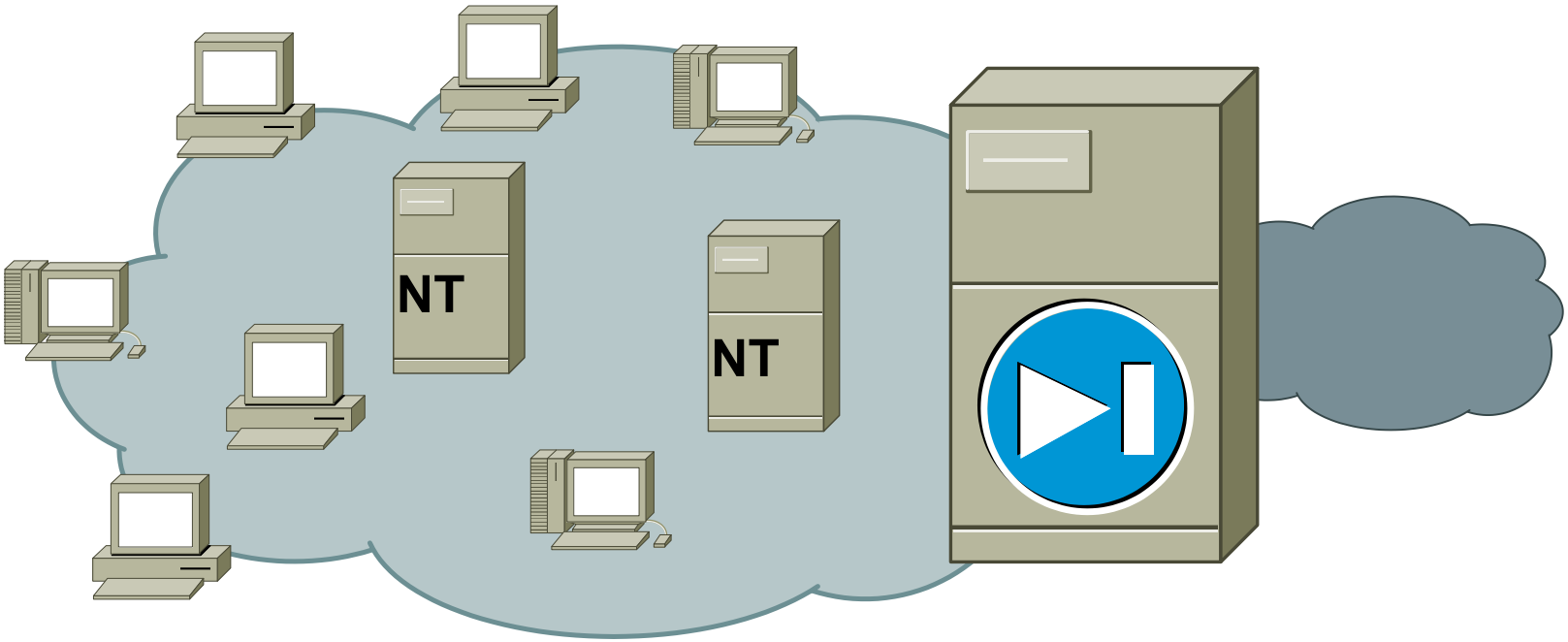
Enable Password

Defines the IP address of the TACACS+ server and the key

Defines the services that require authentication

Defines the device that can Telnet into the PIX

Centri Authentication



Security policies are associated with Windows NT users

Cisco Systems

Enable Authentication

- Cisco IOS—Can use the same authentication mechanisms for "enable" as the "login" starting in Cisco IOS 11.3
- PIX—Will start using additional authentication mechanisms for the Console and "enable"

Encrypted Telnet Sessions

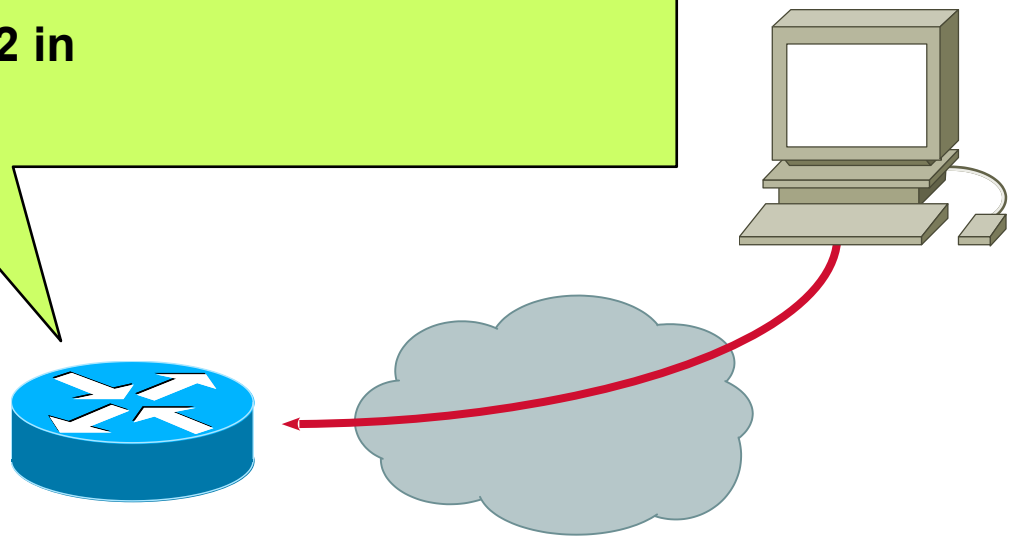
- Kerberos v5
- Strong Authentication within the session
- Relies heavily upon DNS and NTP

One-Time Passwords

- May be used with TACACS+ or RADIUS
- The same “password” will never be reused by an authorized administrator
- Key Cards—CryptoCard token server included with CiscoSecure
- Support for Security Dynamics and Secure Computing token servers in Cisco Secure

Restrict Telnet Access

```
access-list 12 permit 172.17.55.0 0.0.0.255
line vty 0 4
access-class 12 in
```

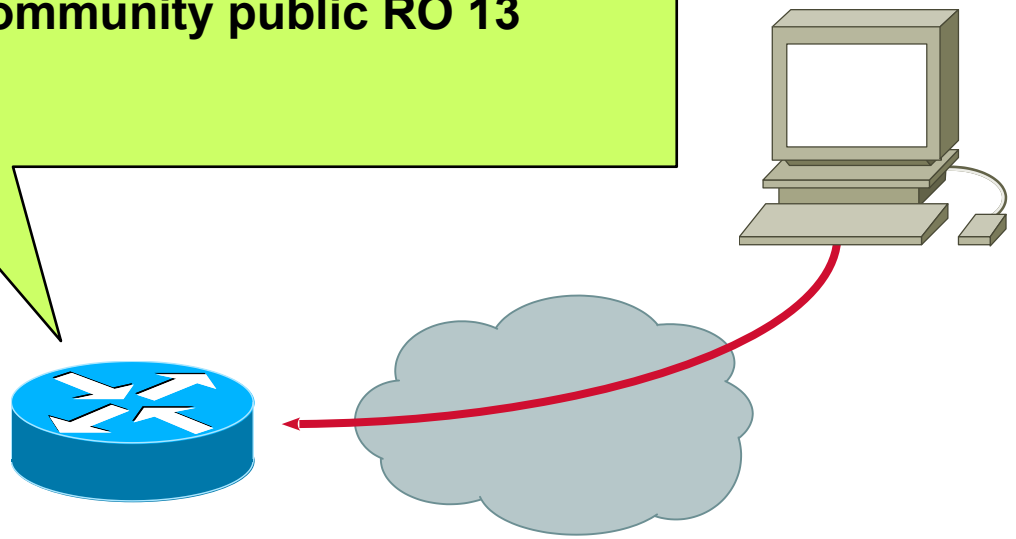


CISCO SYSTEMS

SNMP Access Control

RO—Read Only
RW—Read + Write

```
access-list 13 permit 192.85.55.12
access-list 13 permit 192.85.55.19
snmp-server community public RO 13
```



SNMP

- Version one sends cleartext communitystrings and has no policy reference
- Version two addresses some of the known security weaknesses of SNMP version one
- Version three is being worked on

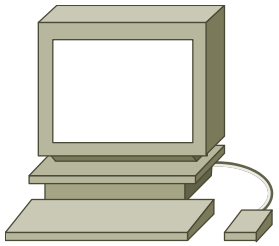
Identification Protocol

The Identification Protocol (Auth) can be enabled for sessions to the router

Telnet Router (D=23, S=4909)

Auth—who's using (D=23, S=4909)

Auth— (D=23, S=4909) is Chris



Telnet (D=23, S=4909) proceed

RFC 1413: Identification Protocol

"The information returned by this protocol is at most as trustworthy as the host providing it..."

Resource Deprivation Attacks

```
version 11.2
!
no service udp-small-servers
no service tcp-small-servers
!
```

Echo (7)

Discard (9)

Daytime (13)

Chargen (19)

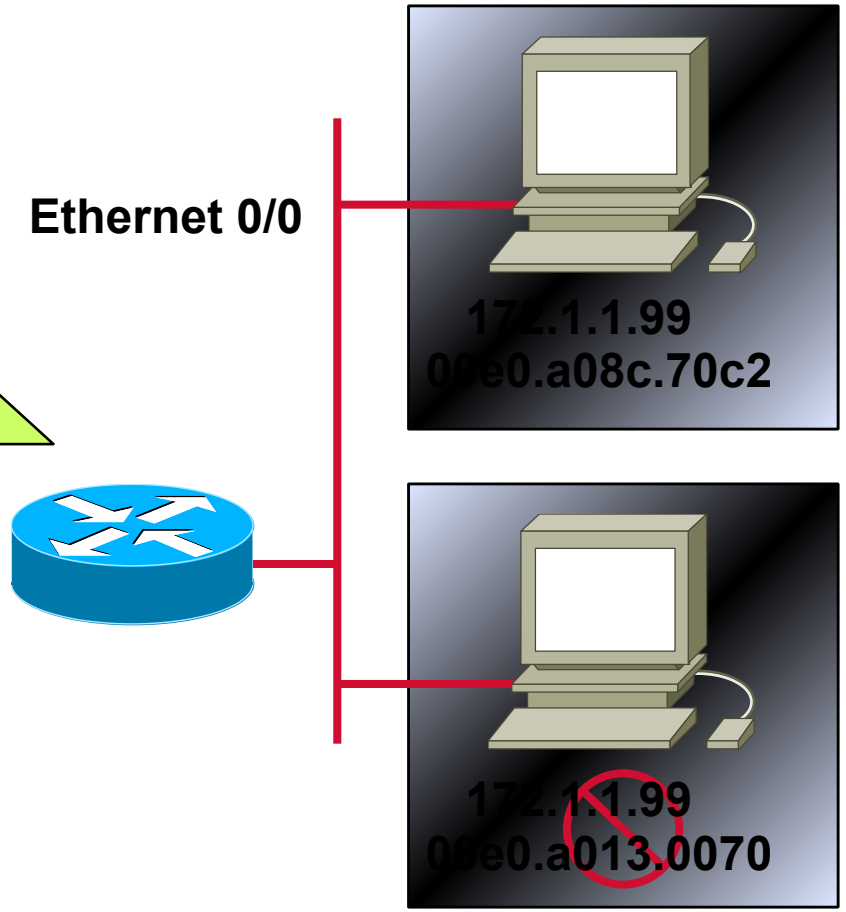
Resource Deprivation Attacks

```
version 11.2
!
no service finger
no service udp-small-servers
no service tcp-small-servers
!
```

Finger (79)

ARP Control

```
!
arp 172.1.1.99 00e0.a08c.70c2 arpa
!
interface ethernet 0/0
ip address 172.1.1.100 255.255.0.0
!
```



Administrator Authorization Levels

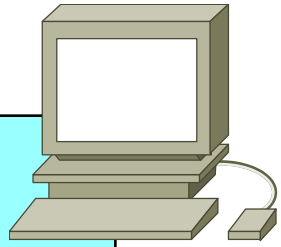
- Sixteen administrative levels that can be used to delegate authority
- Cisco IOS commands can be associated with a level

```
privilege exec level 9 show
enable secret level 9 <AllinOne>
enable secret 5 <OneinAll>
```

```
Router# show priv
Current privilege level is 15
Router# disable
Router>enable 9
Password:
Router# show priv
Current privilege level is 9
Router#
```

Cisco Systems

Audit Trail—Cisco IOS Syslog



```
unix% tail cisco.log
 Feb 17 21:48:26 [10.1.1.101.9.132] 31: *Mar  2 11:51:55 CST:
    %SYS-5-CONFIG_I: Configured from console by vty0 (10.1.1.2)
unix% date
 Tue Feb 17 21:49:53 CST 1998
unix%
```

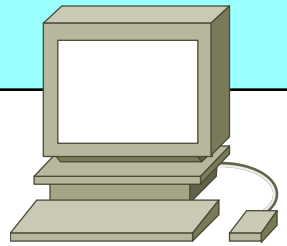
```
version 11.2
service timestamps log datetime localtime show-timezone
!
logging 10.1.1.2
```

```
Router>sho clock
*11:53:44.764 CST Tue Mar 2 1993
Router>
```

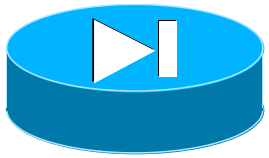
CISCO SYSTEMS

Audit Trail—PIX Syslog

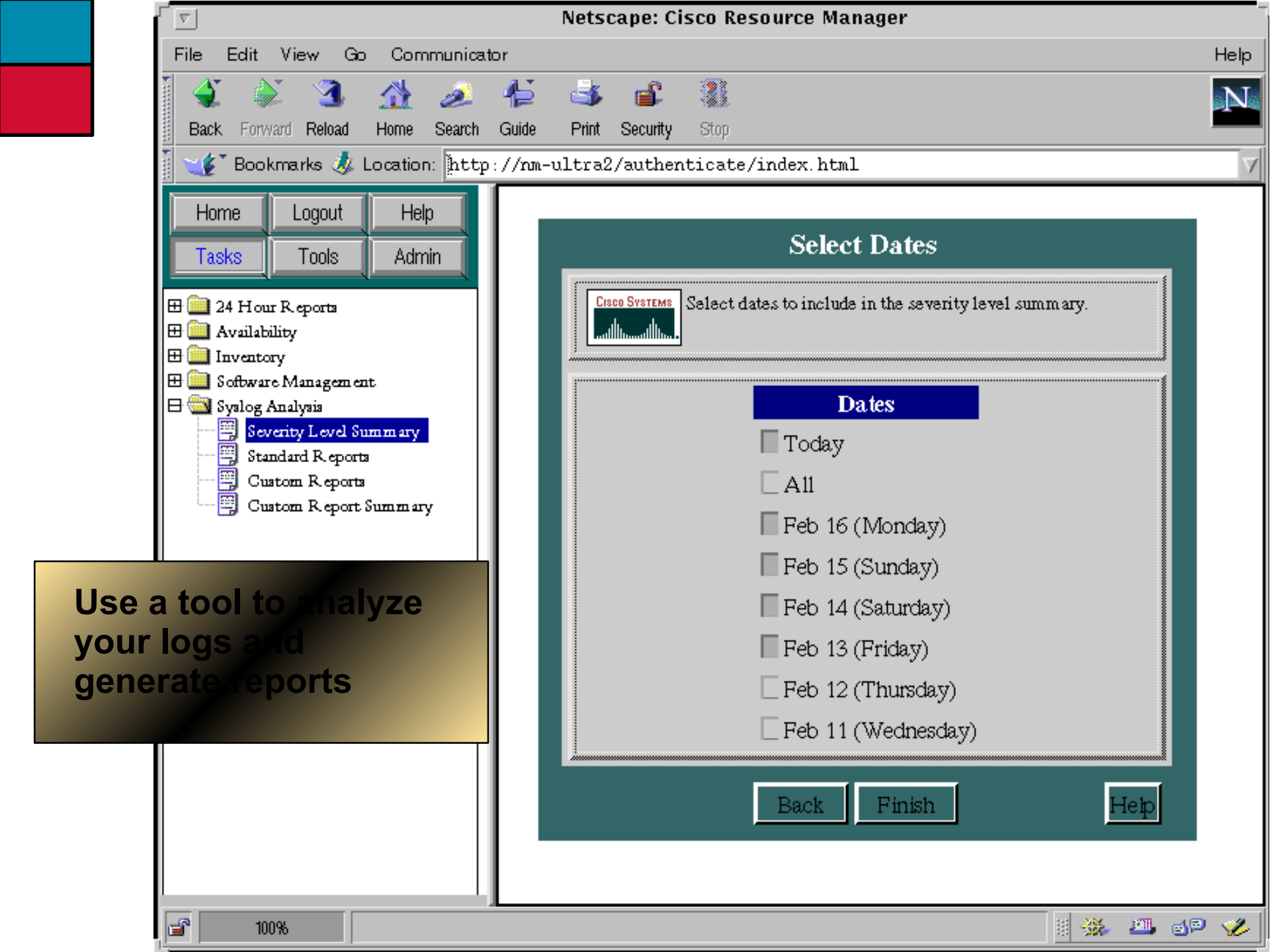
```
unix% tail pix.log
Feb 20 07:46:25 [10.1.1.1.2.2]  Begin configuration: reading from terminal
Feb 20 07:46:29 [10.1.1.1.2.2]  111005 End configuration: OK
Feb 20 07:46:32 [10.1.1.1.2.2]  111001 Begin configuration: writing to memory
Feb 20 07:46:32 [10.1.1.1.2.2]  111004 End configuration: OK
unix%
```



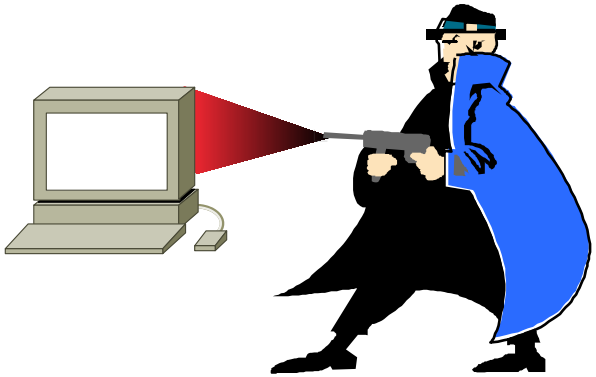
```
PIX Version 4.0.7
enable password zS7kFj3ZL2VDF3uN encrypted
passwd zS7kFj3ZL2VDF3uN encrypted
hostname mypix
no failover
names
syslog output 20.6
no syslog console
syslog host 10.1.1.2
```



CISCO SYSTEMS


Netscape: Cisco Resource Manager
File Edit View Go Communicator Help
Back Forward Reload Home Search Guide Print Security Stop
Bookmarks Location: http://nm-ultra2/authenticate/index.html
Home Logout Help
Tasks Tools Admin
24 Hour Reports
Availability
Inventory
Software Management
Syslog Analysis
Severity Level Summary
Standard Reports
Custom Reports
Custom Report Summary
Select Dates
Cisco Systems
Select dates to include in the severity level summary.
Dates
Today
All
Feb 16 (Monday)
Feb 15 (Sunday)
Feb 14 (Saturday)
Feb 13 (Friday)
Feb 12 (Thursday)
Feb 11 (Wednesday)
Back
Finish
Help
100%
Use a tool to analyze your logs and generate reports

III. Resource Protection



Individual Resources

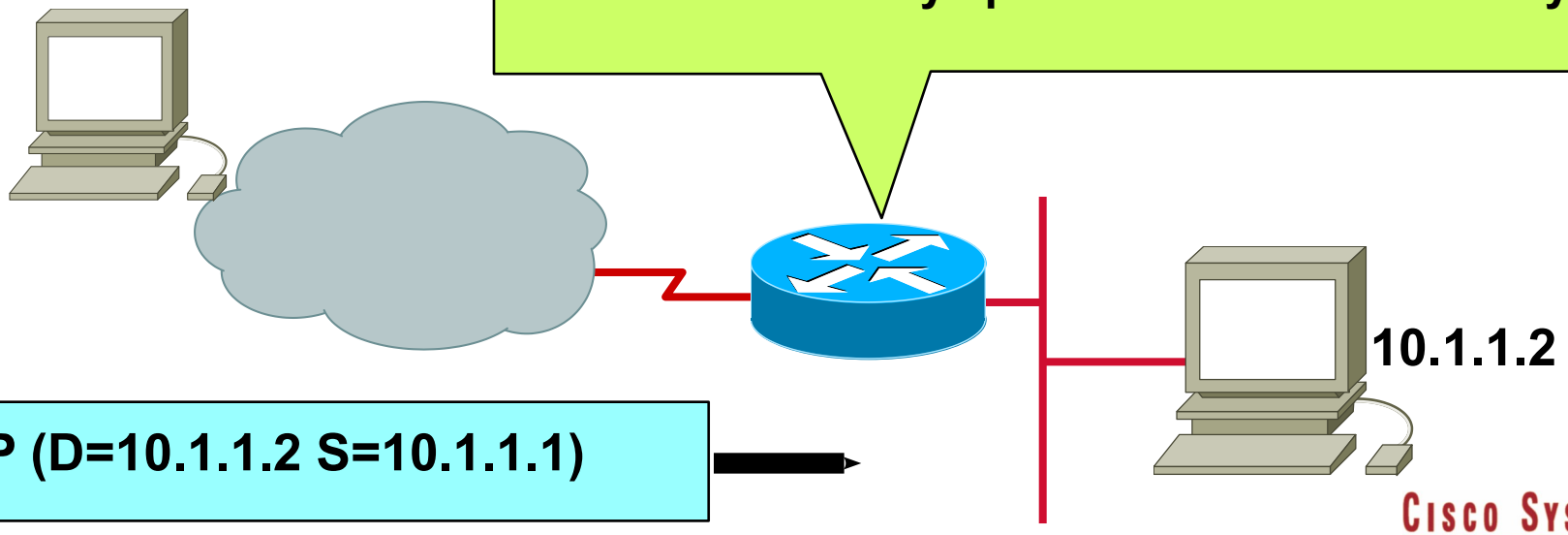
Threats

Avoidance measures

Spoofing

```
interface Serial 1
ip address 172.26.139.2 255.255.255.252
ip access-group 111 in
no ip directed-broadcast
!
interface ethernet 0/0
ip address 10.1.1.100   255.255.0.0
no ip directed-broadcast
!
Access-list 111 deny  ip 127.0.0.0 0.255.255.255 any
Access-list 111 deny  ip 10.1.0.0   0.0.255.255 any
```

172.16.42.84



IP (D=10.1.1.2 S=10.1.1.1)

ICMP Filtering

Extended Access List:

access-list 101 permit icmp any any <type> <code>

no ip unreachables (IOS will not send)

no ip redirects (IOS will not accept)

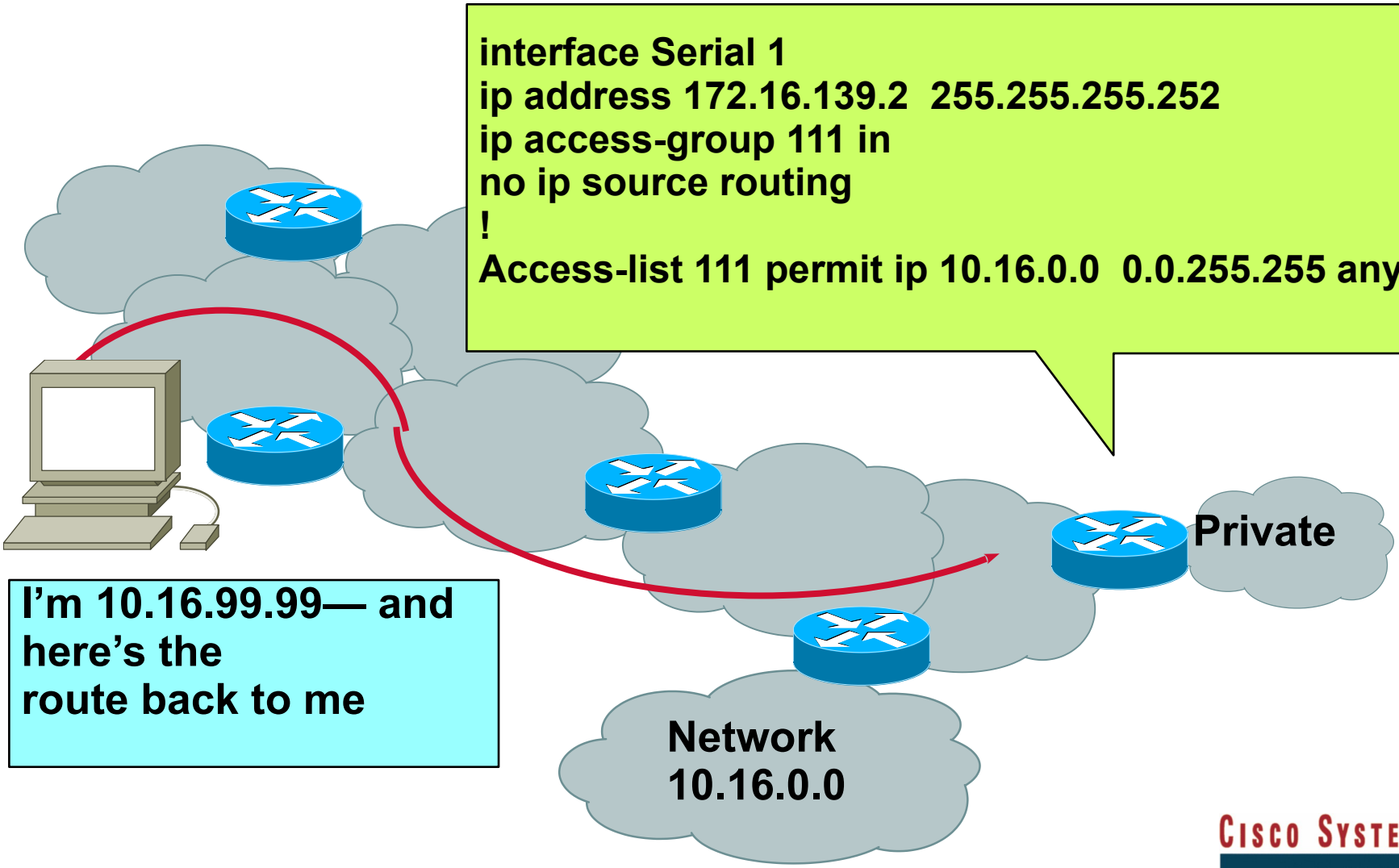
Summary of Message Types

- 0 Echo Reply
- 3 Destination Unreachable
- 4 Source Quench
- 5 Redirect
- 8 Echo
- 11 Time Exceeded
- 12 Parameter Problem
- 13 Timestamp
- 14 Timestamp Reply
- 15 Information Request
- 16 Information Reply

ICMP Codes are not shown

RFC 792: INTERNET CONTROL MESSAGE PROTOCOL

Source Routing



RFC 792: Internet protocol

CISCO SYSTEMS

Choose “next talk” to continue viewing this presentation

(The length of this presentation made it necessary to split it in two parts. In all other cases, “next talk” takes you to the next presentation.)