



To Configure RIP OSPF & BGP using Packet Tracer

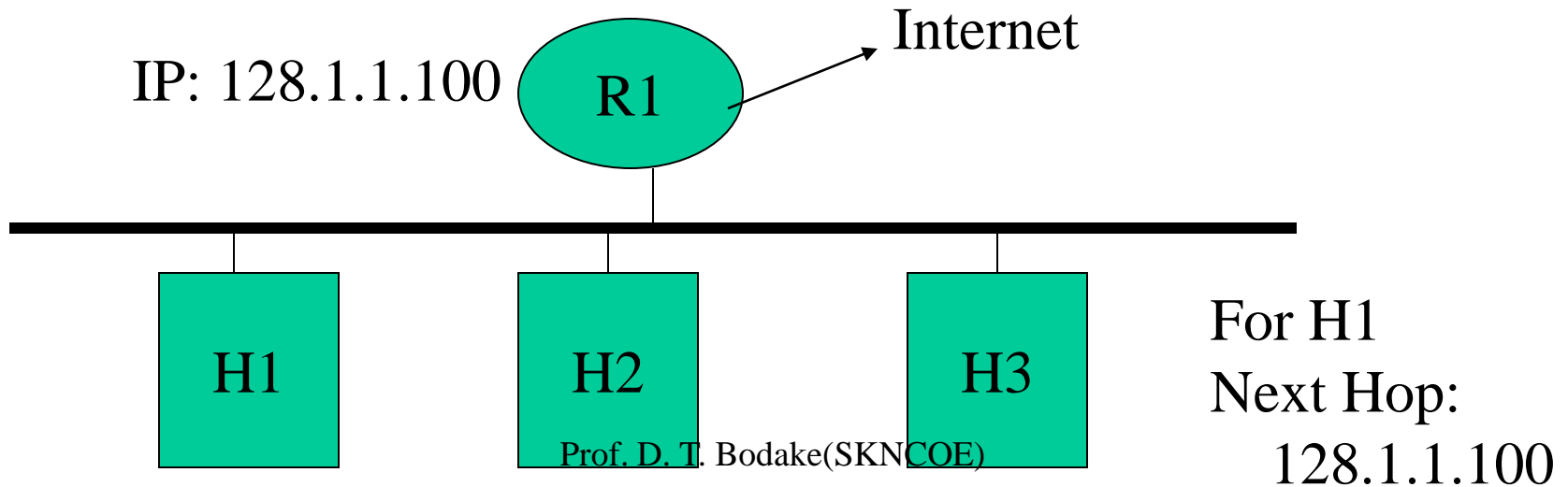
Learning Objectives

Upon completion of this lab, you will be able to:

- Cable a network according to the Topology Diagram.
- Perform basic configuration tasks on switch & router.
- Configure and activate interfaces.
- Configure RIP OSPF BGP routing on all routers.
- Verify RIP OSPF & BGP routing using **show** command.

Static Routing

- Typically used in hosts
 - Enter subnet mask, router (gateway), IP address
 - Perfect for cases with few connections, doesn't change much
 - E.g. host with a single router connecting to the rest of the Internet



Dynamic Routing

- Most routers use dynamic routing
 - Automatically build the routing tables
 - As we saw previously, there are two major approaches
 - Link State Algorithms
 - Distance Vector Algorithms
- First some terminology
- AS = Autonomous System
 - Contiguous set of networks under one administrative authority
 - Common routing protocol
 - E.g. University of Alaska Statewide, Washington State University
 - E.g. Intel Corporation
 - A connected network
 - There is at least one route between any pair of nodes

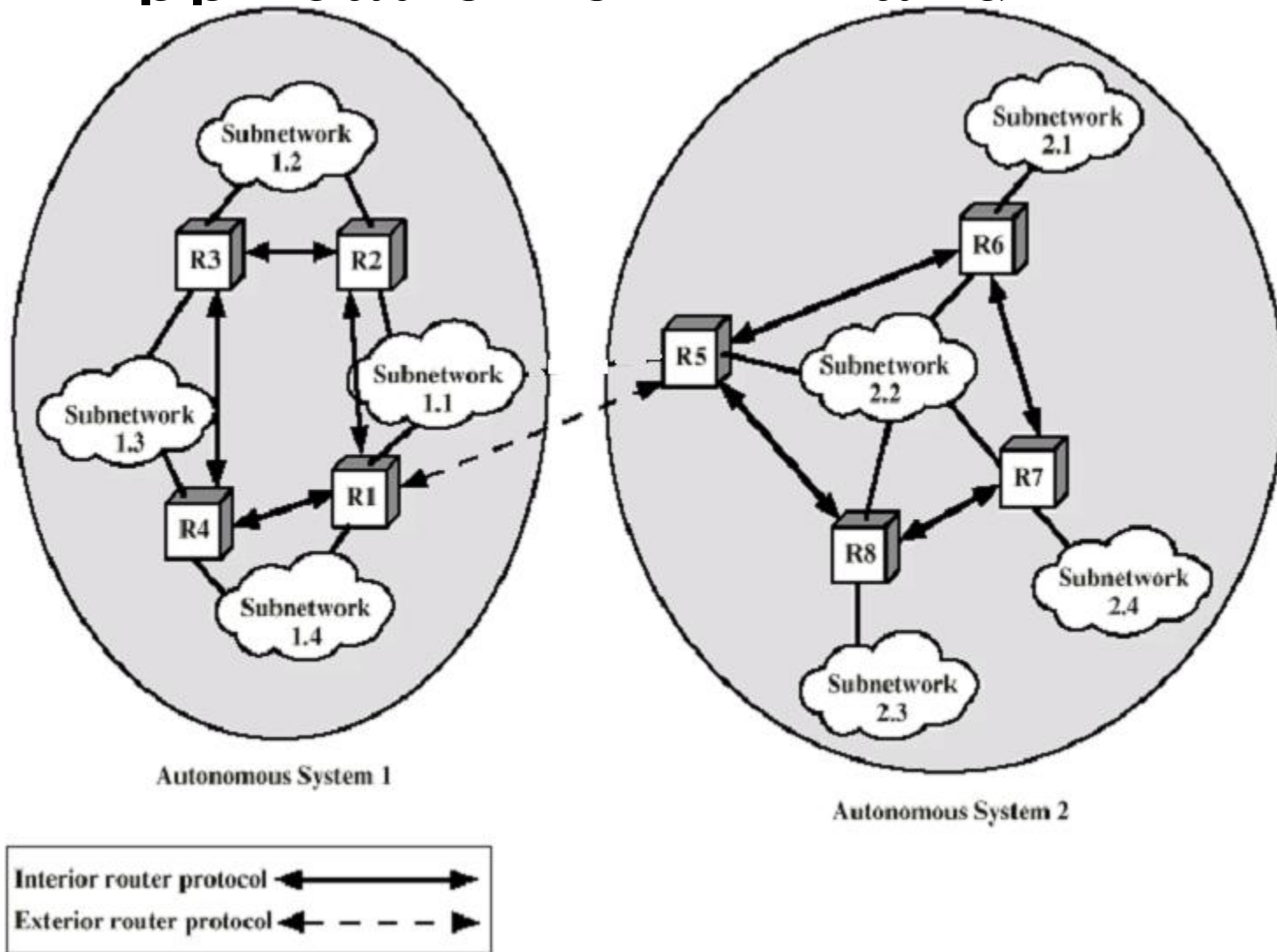
Routing in an AS

- IRP = Interior Routing Protocol
 - Also IGP ; Interior Gateway Protocol
 - Passes routing information between routers within AS
 - Can use routing metric, e.g. hop count or administrative cost
 - E.g. two paths from accounting to payroll, a 2 hop path for customers, and a 3 hop path for internal corporate
 - Shortest path violates corporate policy for internal employees, so administrator can override the actual cost to 4 hops
 - Customers still get the 2 hop path so they pick this route

Routing in an AS

- ERP = Exterior Routing Protocol
 - Also EGP; Exterior Gateway Protocol
 - Passes routing information between routers across AS
 - May be more than one AS in internet
 - Routing algorithms and tables may differ between different AS
 - Finds a path, but can't find an optimal path since it can't compare routing metrics via multiple AS

Application of IRP and ERP



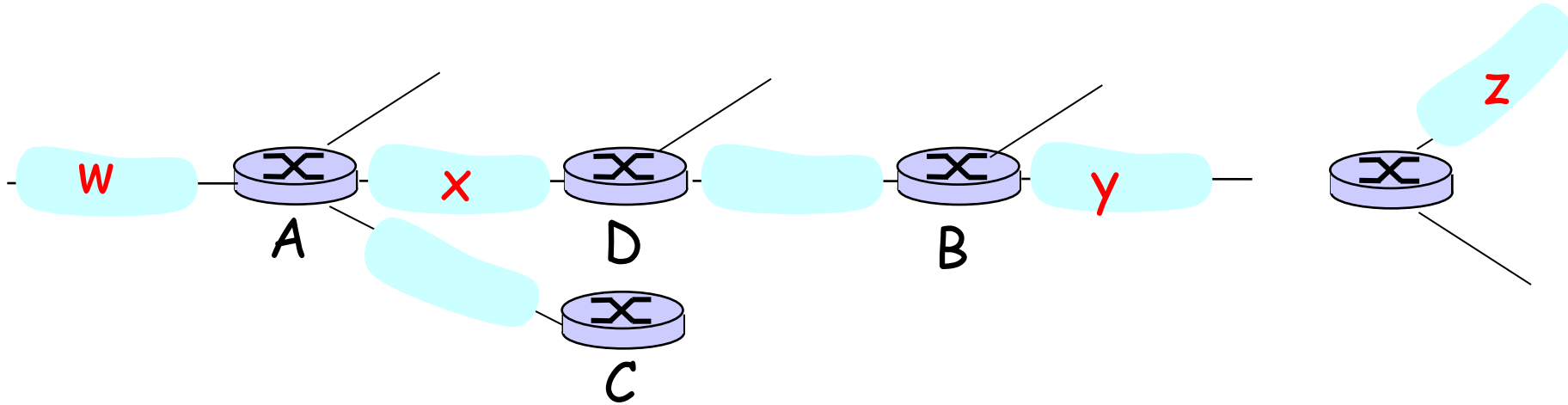
Intra-AS Routing

- Also known as Interior Router Protocols (IRP) or Interior Gateway Protocols (IGP)
- Most common:
 - RIP: Routing Information Protocol
 - OSPF: Open Shortest Path First
 - IGRP: Interior Gateway Routing Protocol (Cisco proprietary)

RIP (Routing Information Protocol)

- Distance vector algorithm
- Open Standard Protocol
- Classful routing protocol
- Administrative Distance is 120
- Distance metric: # of hops (max = 15 hops)
- Distance vectors: exchanged every 30 sec via Response Message (also called **advertisement**)
- Each advertisement: route to up to 25 destination nets

RIP (Routing Information Protocol)



Destination Network	Next Router	Num. of hops to dest.
W	A	2
Y	B	2
Z	B	7
X	--	1
...

Routing table in D

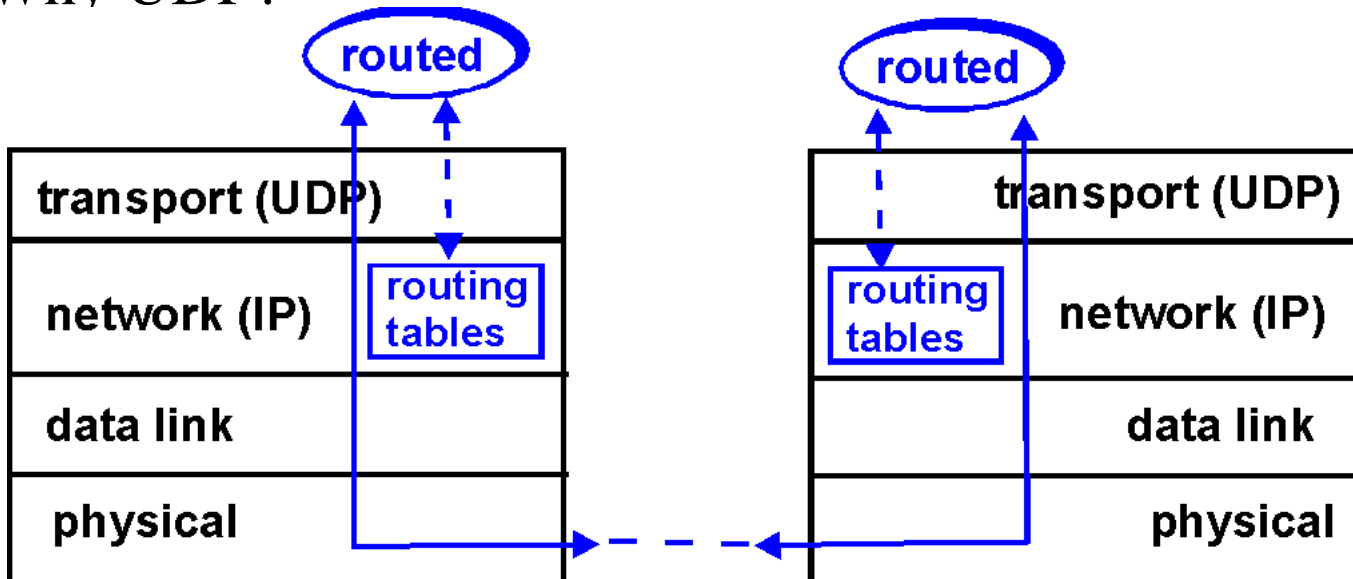
RIP: Link Failure and Recovery

If no advertisement heard after 180 sec → neighbor/link declared dead

- routes via neighbor invalidated
- new advertisements sent to neighbors
- neighbors in turn send out new advertisements (if tables changed)
- link failure info quickly propagates to entire net

RIP Table processing

- RIP routing tables managed by **application-level** process called route-d (daemon)
- advertisements sent in UDP packets, periodically repeated
 - Why UDP?



RIP Table example (continued)

Router: *giroflée.eurocom.fr* via: netstat -rn

Destination	Gateway	Flags	Ref	Use	Interface
-----	-----	-----	-----	-----	-----
127.0.0.1	127.0.0.1	UH	0	26492	lo0
192.168.2.	192.168.2.5	U	2	13	fa0
193.55.114.	193.55.114.6	U	3	58503	le0
192.168.3.	192.168.3.5	U	2	25	qaa0
224.0.0.0	193.55.114.6	U	3	0	le0
default	193.55.114.129	UG	0	143454	

- Three attached class C networks (LANs)
- Router only knows routes to attached LANs
- Default router used to “go up”
- Route multicast address: 224.0.0.0
- Loopback interface (for debugging)

RIP

- Advantages
 - Simplicity ; little to no configuration, just start routed up
 - Passive version for hosts
 - If a host wants to just listen and update its routing table
- Packet Format
 - This is in the payload of a UDP packet

0	8	16	24	31
Command(1-5)		Version(2)	Must be Zero	
Family of Net 1		Route Tag for Net 1		
IP Address of Net 1				
Subnet Mask for Net 1				
Next Hop for Net 1				
Distance to Net 1				
Family of Net 2		Route Tag for Net 2		
IP Address of Net 2				
Prof. D. T. Bodake(SKNCOE)				
...				

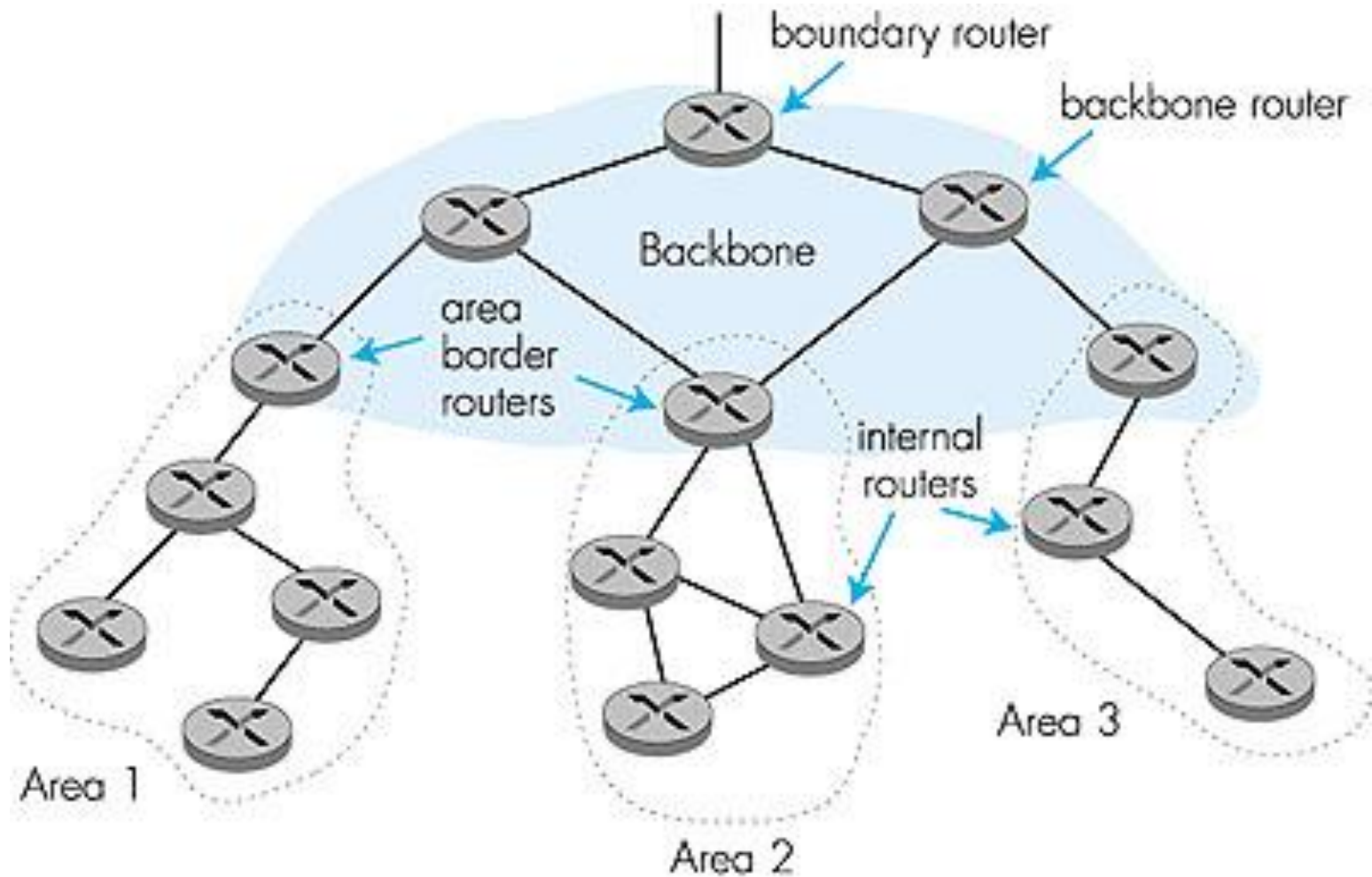
OSPF (Open Shortest Path First)

- “Open”: publicly available
 - RFC 2328
- Uses Link State algorithm
 - LS packet dissemination
 - Topology map at each node
 - Route computation using Dijkstra’s algorithm
- OSPF advertisement carries one entry per neighbor router
- Metric is cost
- Administrative Distance 110
- Conceived as a successor to RIP

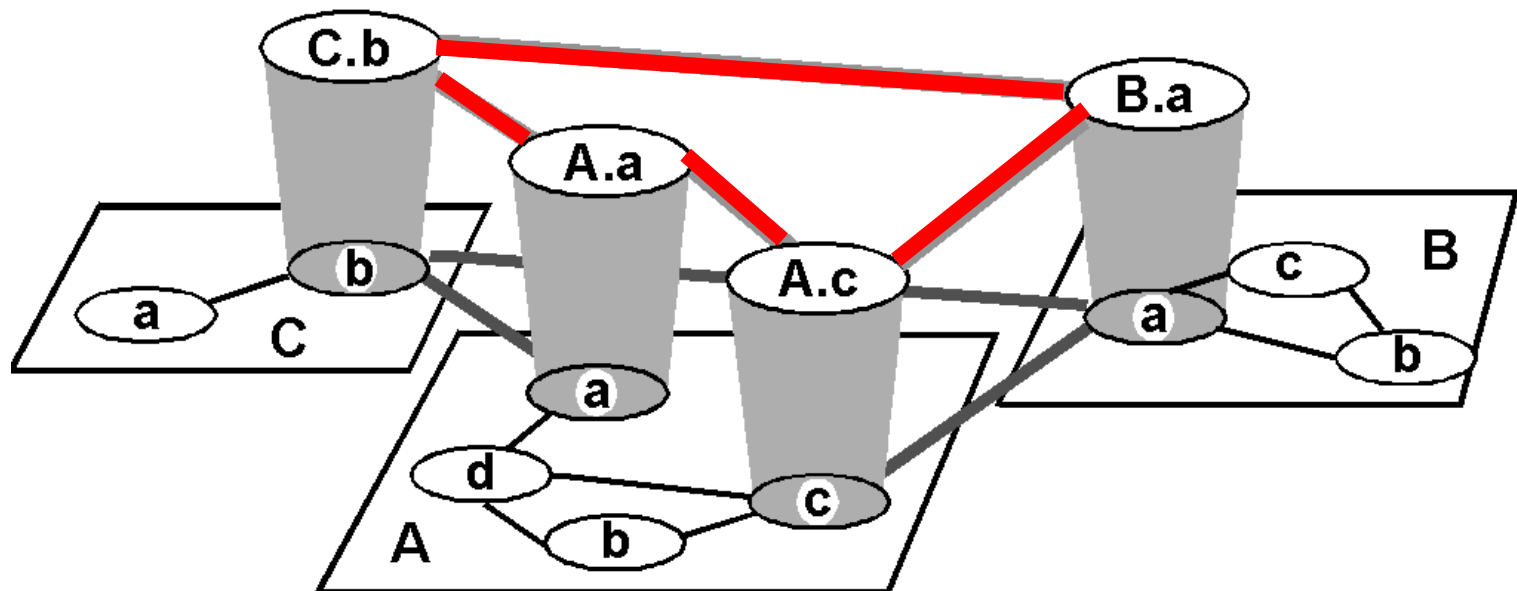
OSPF “advanced” features (not in RIP)

- Security: all OSPF messages authenticated (to prevent malicious intrusion); TCP connections used
- Multiple same-cost paths allowed (only one path in RIP)
- For each link, multiple cost metrics for different Type Of Service (e.g., satellite link cost set “low” for best effort; high for real time)
- Integrated uni- and multicast support:
 - Multicast OSPF (MOSPF) uses same topology data base as OSPF
- Hierarchical OSPF in large domains.

Hierarchical OSPF



Inter-AS routing / Exterior Route Protocols



Internet inter-AS/ERP routing: BGP

- BGP (Border Gateway Protocol): *the* de facto standard
 - Version 4 the current standard
- **Path Vector** protocol:
 - similar to Distance Vector protocol
 - each Border Gateway broadcast to neighbors (peers) *entire path* (i.e, sequence of ASs) to destination

BGP Terminology

- **Autonomous System:** A collection of networks under a single administrative domain
- **Inter-domain Routing:** Routing between the customer and the service provider
- **Internal Routing:** Uses IGP protocol (RIP OSPF) to exchange routing information inside the AS
- **External Routing:** Uses EGP protocol(BGP) to exchange routes between AS
- **IBGP:** When BGP is used inside an AS
- **EBGP:** When BGP is used between AS

Autonomous System

- AS is a collection of networks under a single technical administration
 - 16 bit numbers
 - Ranging from 1 to 65535
 - Private AS: 64512-65535
 - 1-64511: IANA

Internet inter-AS routing: BGP

- BGP messages exchanged using TCP.
- BGP messages:
 - OPEN: opens TCP connection to peer and authenticates sender
 - UPDATE: advertises new path (or withdraws old)
 - KEEPALIVE keeps connection alive in absence of UPDATES; also ACKs OPEN request
 - NOTIFICATION: reports errors in previous msg; also used to close connection

Configurations

- **Task 1: Perform Basic Configurations.**
- Configure the router / switch hostname.
- Configure an EXEC mode password.
- Configure a message-of-the-day banner.
- Configure a password for console connections.
- Configure a password for VTY connections.

Configure and Activate Serial and Ethernet Addresses.

- **Step 1: Configure interfaces**
- Configure the interfaces on the routers with the IP addresses
- **Step 2: Verify IP addressing and interfaces.**
- Use the **show ip interface brief** command to verify that the IP addressing is correct and that the interfaces are active.
- When you have finished, be sure to save the running configuration to the NVRAM of the router.
- **Step 3: Configure Ethernet interfaces of PC**
- Configure the Ethernet interfaces of PC with the IP addresses and default gateways
- **Step 4: Test the PC configuration by pinging the default gateway from the PC.**

- **Configure Switch hostname as LOCAL-SWITCH**

- hostname LOCAL-SWITCH
- **Configure the message of the day as "Unauthorized access is forbidden"**
banner motd #
Unauthorized access is forbidden#
- **Configure the password for privileged mode access as "cisco". The password must be md5 encrypted**
- enable secret cisco
- **Configure password encryption on the switch using the global configuration command**
- service password-encryption
- **Configure CONSOLE access [...]**
- line con 0
- password ciscoconsole
logging synchronous
login

Configure TELNET access [...]

```
line vty 0 15
exec-timeout 8 20
password ciscotelnet
logging synchronous
login
history size 15
```

Configure the IP address of the switch as 192.168.1.2/24 and it's default gateway IP (192.168.1.1).

```
interface Vlan1
ip address 192.168.1.2 255.255.255.0
ip default-gateway 192.168.1.1
```

- **Router Configuration**

- enable
configure terminal
hostname RanetA
enable secret ranetenablepass
line con 0
password ranetenablepass
login
end

- configure terminal
ranetenablepass
configure terminal
line vty 0 4
password ranettelnetpass
exit
interface fastethernet 0/0
ip address 10.0.0.1 255.255.255.252
exit

```
interface fastethernet 0/1
ip address 192.168.0.254
255.255.255.192
exit
interface fastethernet 0/0
no shutdown
exit
interface fastethernet 0/1
no shutdown
exit
exit
exit
```

Configure RIP.

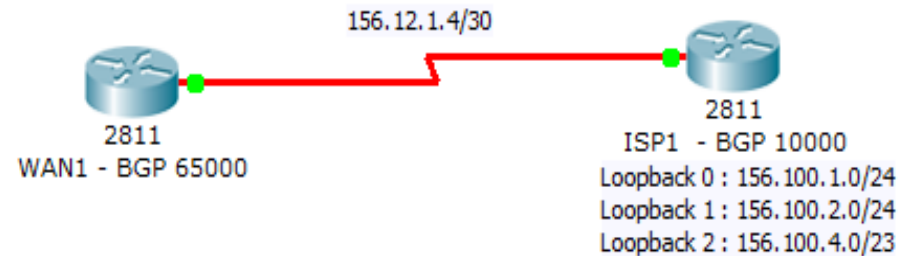
- **Step 1: Enable dynamic routing.**
- To enable a dynamic routing protocol, enter global configuration mode and use the **router** command.
- Enter **router ?** at the global configuration prompt to see a list of available routing protocols on your router.
- To enable RIP, enter the command **router rip** in global configuration mode.
- R1(config)#**router rip**
- R1(config-router)#
- **Step 2: Enter classful network addresses.**
- Once you are in routing configuration mode, enter the classful network address for each directly connected network, using the **network** command.
- R1(config-router)#**network 192.168.1.0**
- R1(config-router)#**network 192.168.2.0**

- Configure OSPF
- R1(config)# **router ospf 1**
- R1(config-router)# **network 10.10.30.0 0.0.0.255 area 0**
- R1(config-router)# **network 172.16.0.0 0.0.0.3 area 0**
- R1(config-router)# **network 192.168.0.0 0.0.0.255 area 0**

- **Configure BGP**
- IOS commands available in Packet Tracer 6.0
- Enable mode
 - show ip bgp
 - show ip bgp neighbors
 - show ip bgp summary
 - clear ip bgp *
- Router bgp mode
 - log-neighbor-changes
 - redistribute-internal
 - router-id A.B.C.D
 - exit
- neighbor A.B.C.D next-hop-self
- neighbor A.B.C.D remote-as <1-65535>
- network A.B.C.D
- network A.B.C.D mask A.B.C.D

- **Router WAN1 configuration :**
- interface Serial0/0/0
ip address 156.12.1.6 255.255.255.252
!
router bgp 65000
bgp log-neighbor-changes
no synchronization
neighbor 156.12.1.5 remote-as 10000
- **Router ISP1 configuration :**
- interface Loopback0
ip address 156.100.1.1 255.255.255.0
!
interface Loopback1
ip address 156.100.2.1 255.255.255.0
!
interface Loopback2
ip address 156.100.4.1 255.255.254.0
!
interface Serial0/0/0
ip address 156.12.1.5 255.255.255.252
clock rate 500000
!

Sample BGP network



router bgp 10000
bgp log-neighbor-changes
no synchronization
neighbor 156.12.1.6 remote-as 65000
network 156.100.4.0 mask 255.255.254.0
network 156.100.2.0 mask 255.255.255.0
network 156.100.1.0 mask 255.255.255.0