

学习

沉淀

成长

分享

EIGRP

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课程目标

EIGRP协议基础

EIGRP基础配置

EIGRP协议基础

- EIGRP的协议特点
- EIGRP的三张表
- EIGRP数据包
- 初始路由发现
- EIGRP metric
- DUAL算法

EIGRP的协议特点

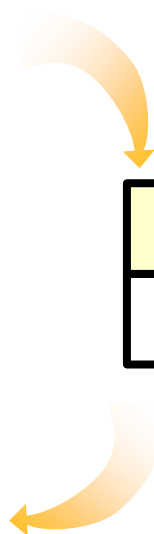
- CISCO私有的高级距离矢量协议；
- 无类路由协议，支持VLSM；
- DUAL算法，EIGRP的核心，形成无环路由；
- 快速收敛，后继及可行后继；
- 低路由更新开销，支持组播及单播的方式发送协议数据；
- 支持自动及手工路由汇总；
- 支持等价及非等价负载均衡；
- 支持多种网络层协议（IP、IPX、Appletalk，etc.）。

EIGRP的三张表

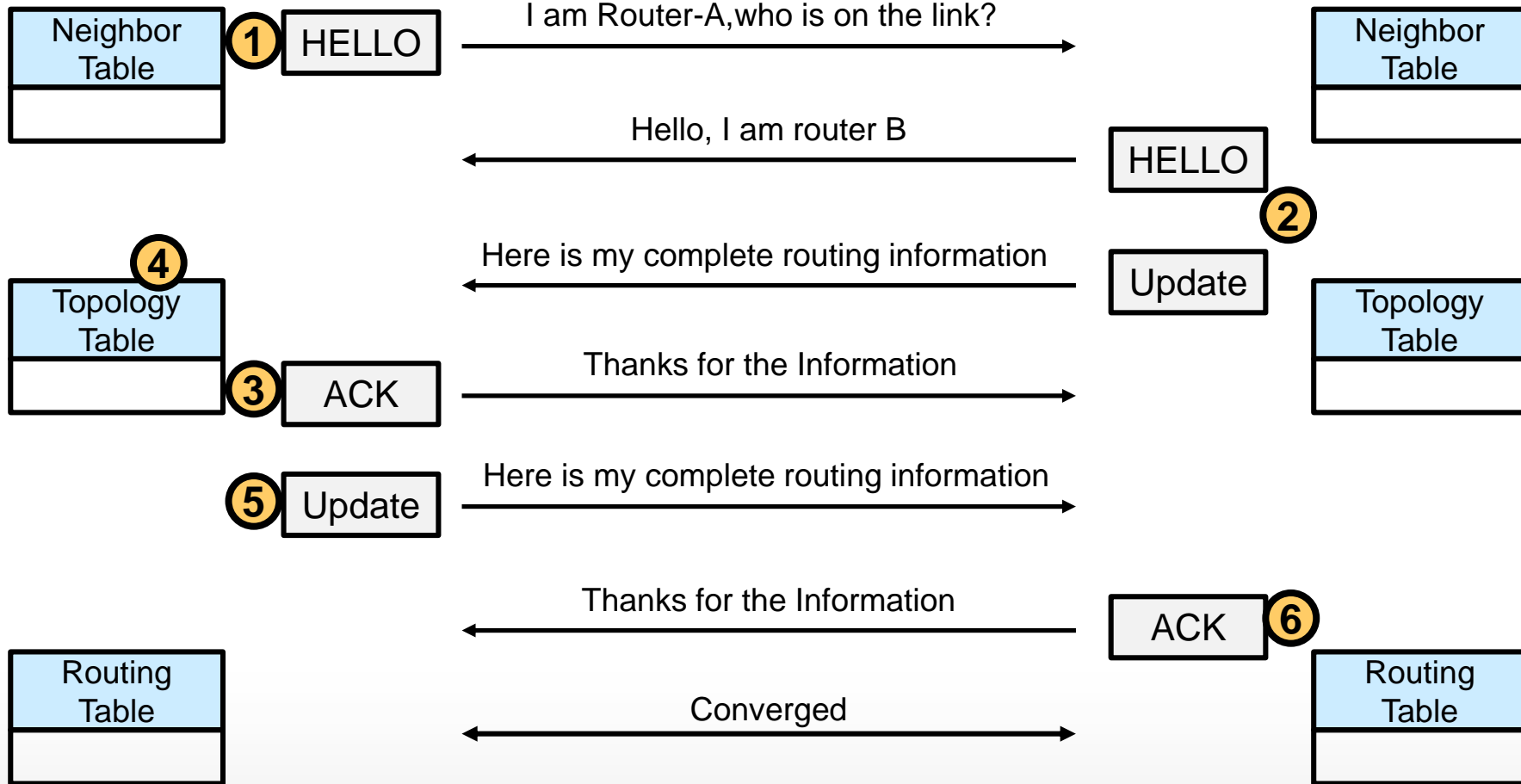
IP EIGRP Neighbor Table	
Next-hop Router	Interface

IP EIGRP Topology Table	
Destination 1	

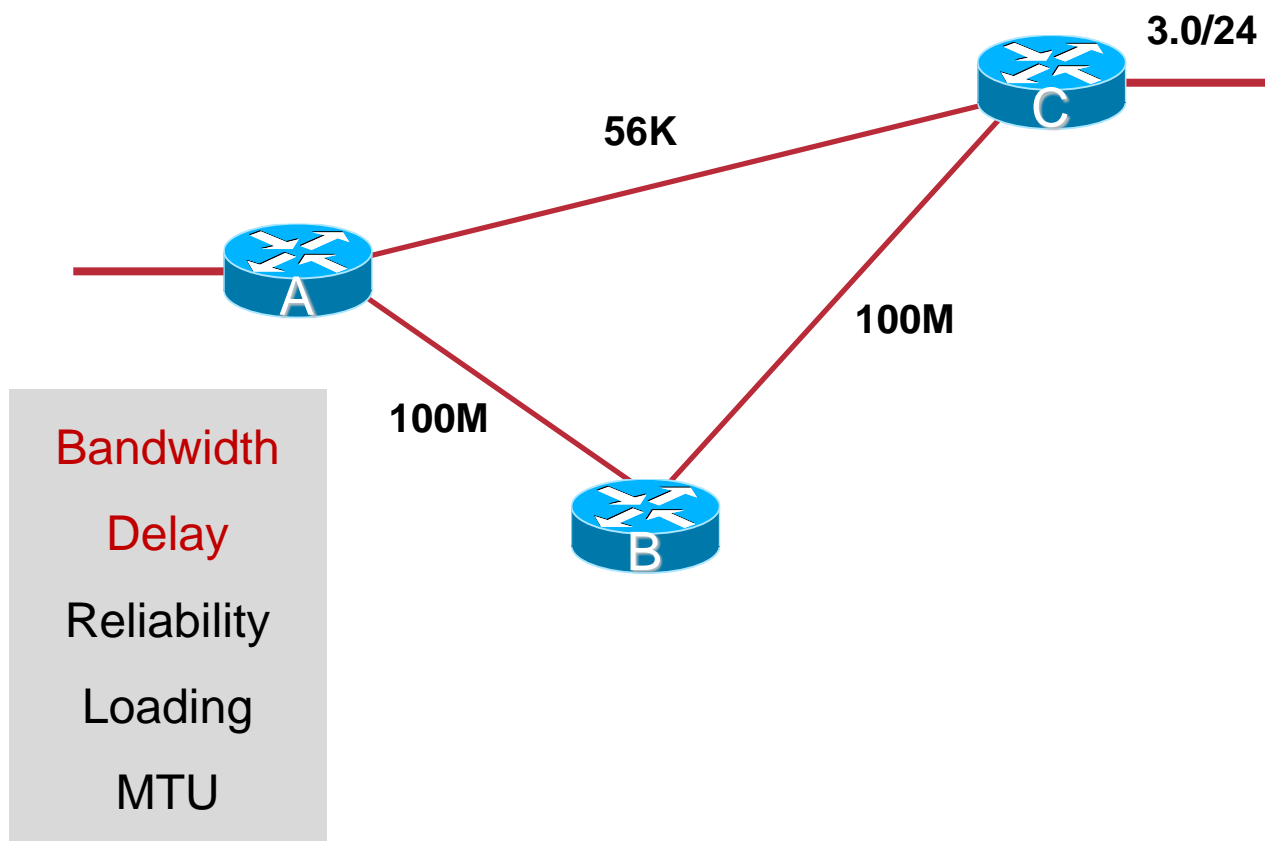
IP EIGRP Routing Table	
Destination 1	



初始路由发现



EIGRP的Metric



EIGRP的Metric

R1#show ip route

Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, * - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C 192.168.12.0/24 is directly connected, FastEthernet1/0

C 192.168.13.0/24 is directly connected, Serial0/0

D 3.0.0.0/8 **[90/158720]** via 192.168.12.2, 00:01:10, FastEthernet1/0

D 192.168.23.0/24 **[90/30720]** via 192.168.12.2, 00:01:23, FastEthernet1/0

EIGRP的Metric计算

$$\mathbf{BW} = \frac{10^7}{\text{接口最小带宽kbit/s}} \times 256 \text{ (kbit/s)}$$

接口最小带宽指的是沿着路由学习过来的方向所有入站接口带宽中最小值

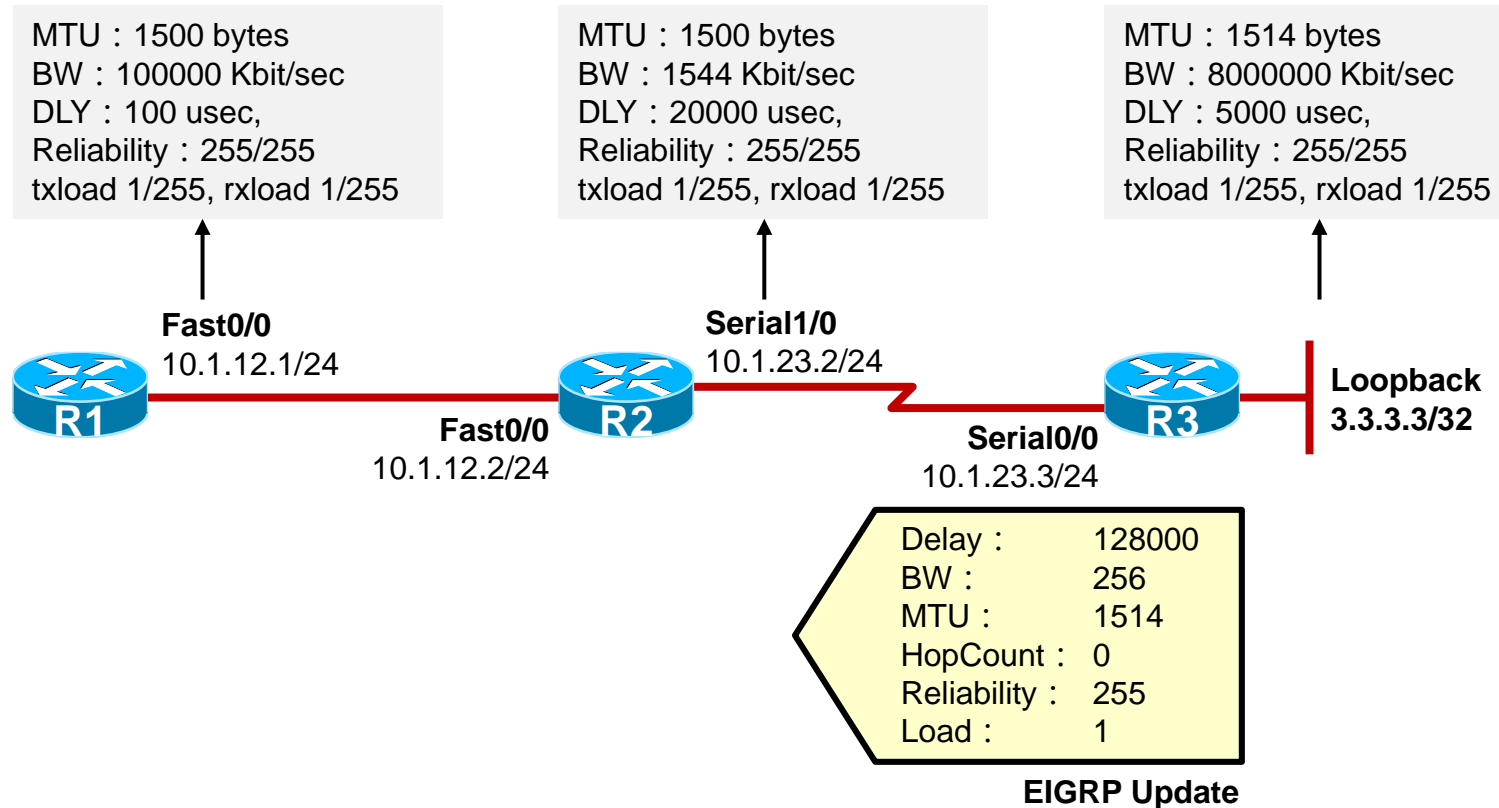
$$\mathbf{DLY} = \frac{\text{延迟(us)}}{10} \times 256 \text{ (us)}$$

沿着路由学习过来的方向所有入站接口的延迟累加

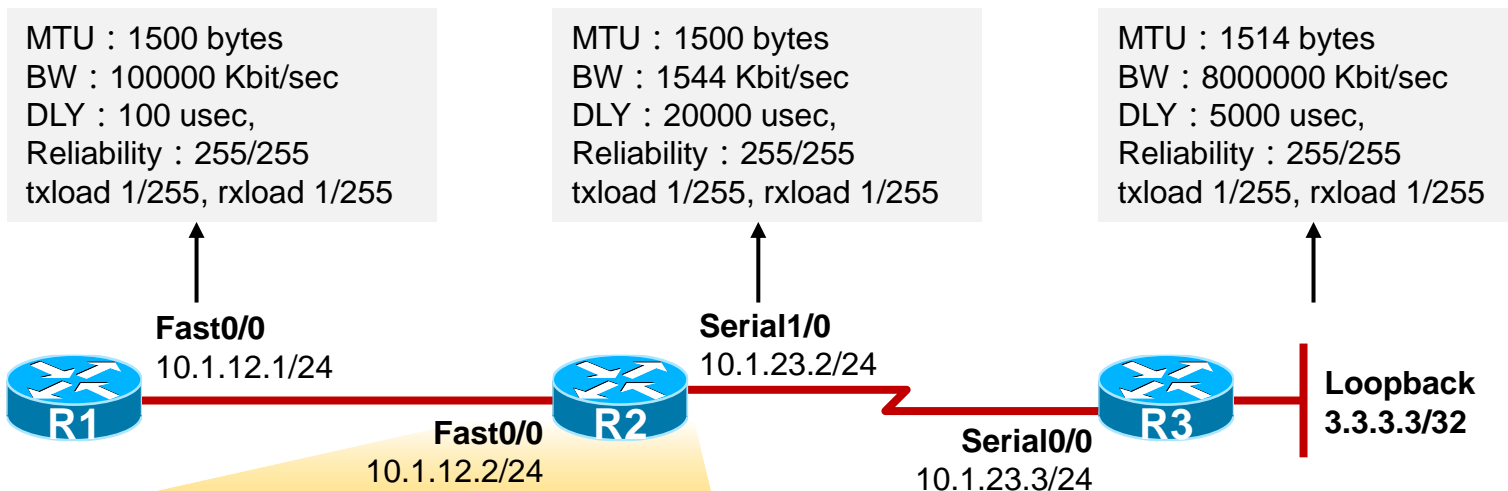
$$\mathbf{Metric} = \left[K1 \times \mathbf{BW} + \frac{K2 \times \mathbf{BW}}{256\text{-LOAD}} + K3 \times \mathbf{DLY} \right] \times \left[\frac{K5}{\text{RELIA} + K4} \right]$$

- 默认 $K1 = 1, K2 = 0, K3 = 1, K4 = 0, K5 = 0$
- EIGRP路由metric默认为 **延迟+带宽**

EIGRP的Metric计算



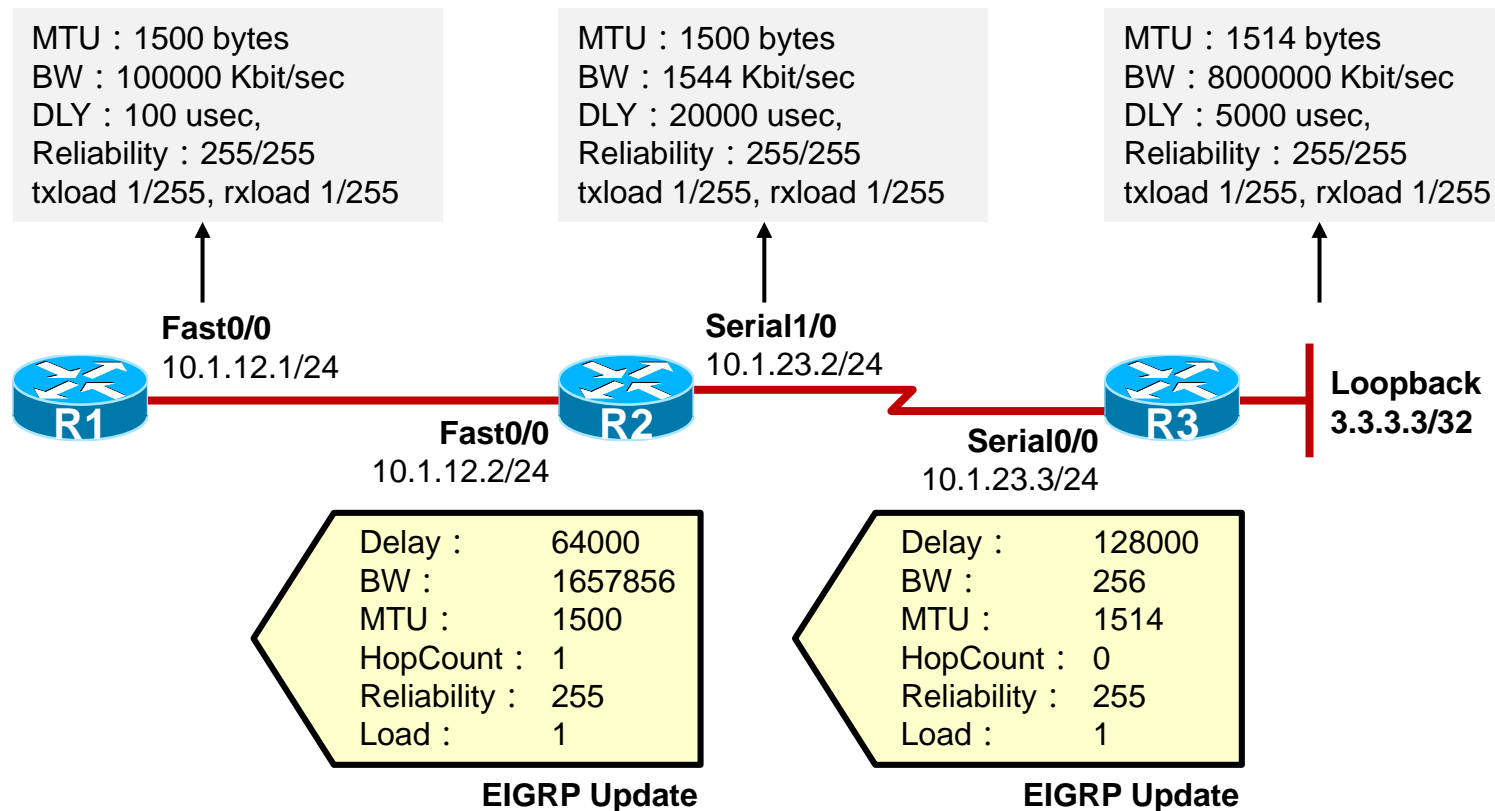
EIGRP的Metric计算



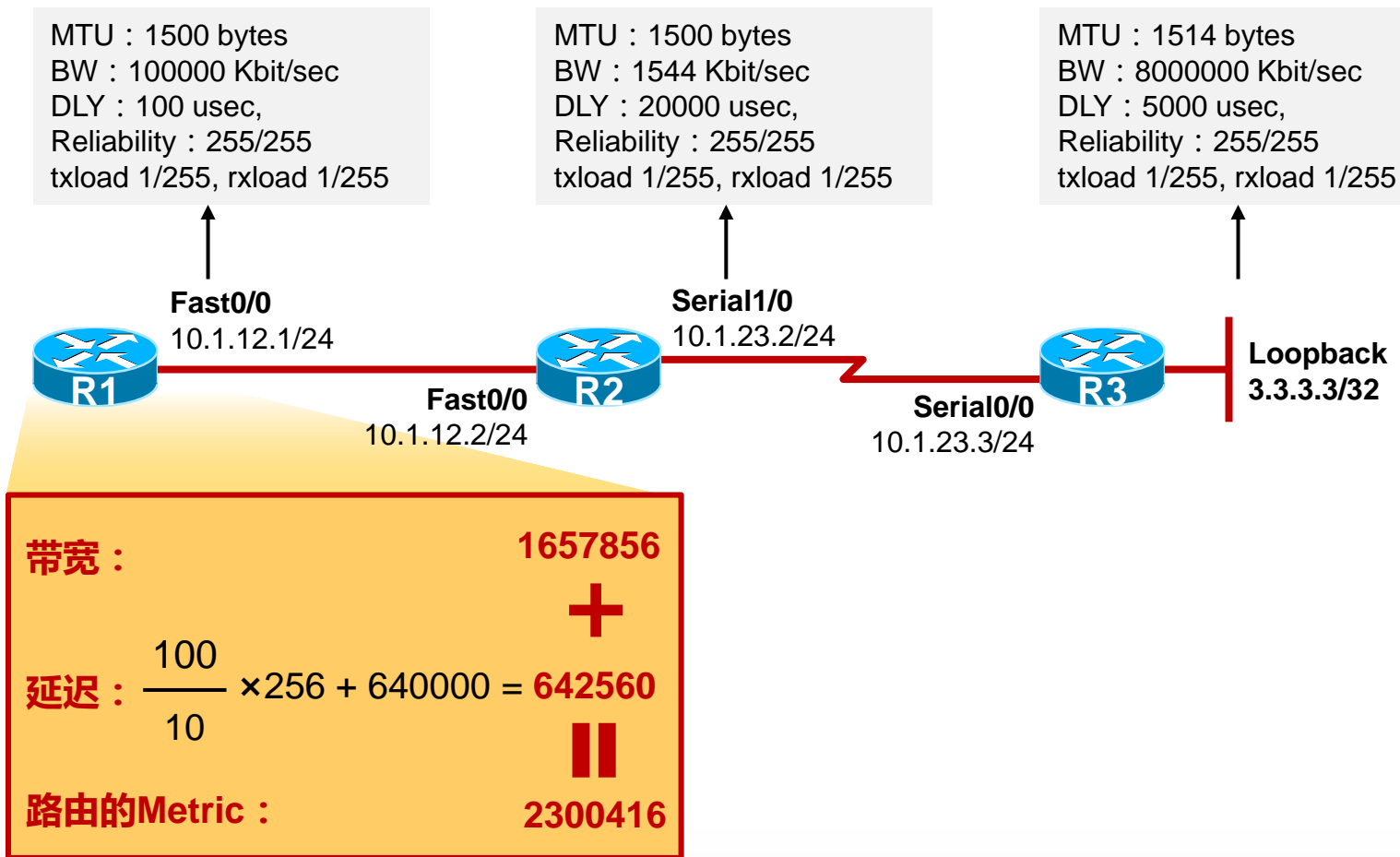
带宽 : $\frac{10^7}{1544} \times 256 = 1657856$
延迟 : $\frac{20000}{10} \times 256 + 128000 = 640000$
路由的Metric : $1657856 + 640000 = 2297856$

Delay : 128000
 BW : 256
 MTU : 1514
 HopCount : 0
 Reliability : 255
 Load : 1
EIGRP Update

EIGRP的Metric计算



EIGRP的Metric计算

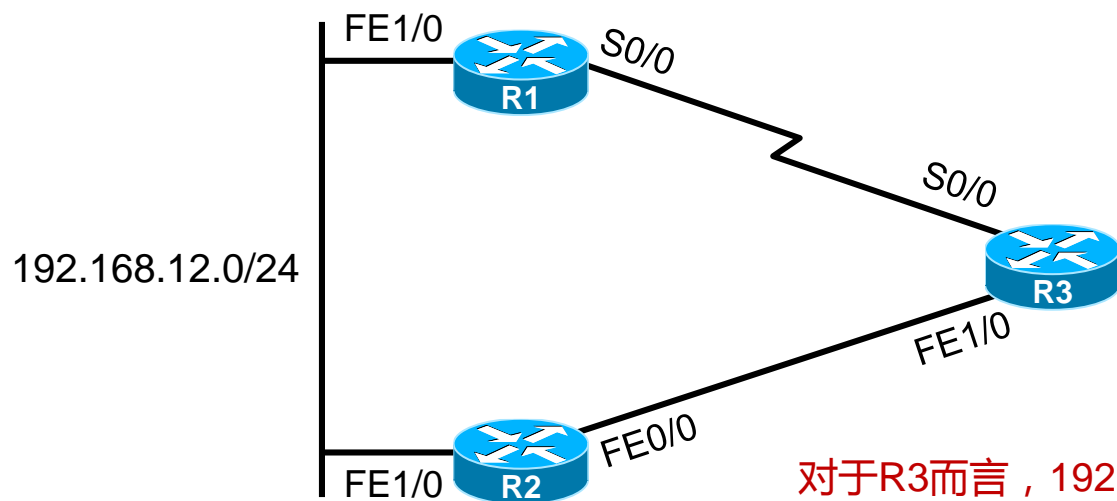


DUAL算法

- Diffusing Update Algorithm , 简称DUAL , 扩散更新算法
- 用于计算最佳无环路径和备用路径
- 特点：
 - 无环拓扑
 - 可立即使用的无环备用路径
 - 快速收敛
 - 低带宽利用率 (通过限定更新实现)

Successor, Fessible Successor

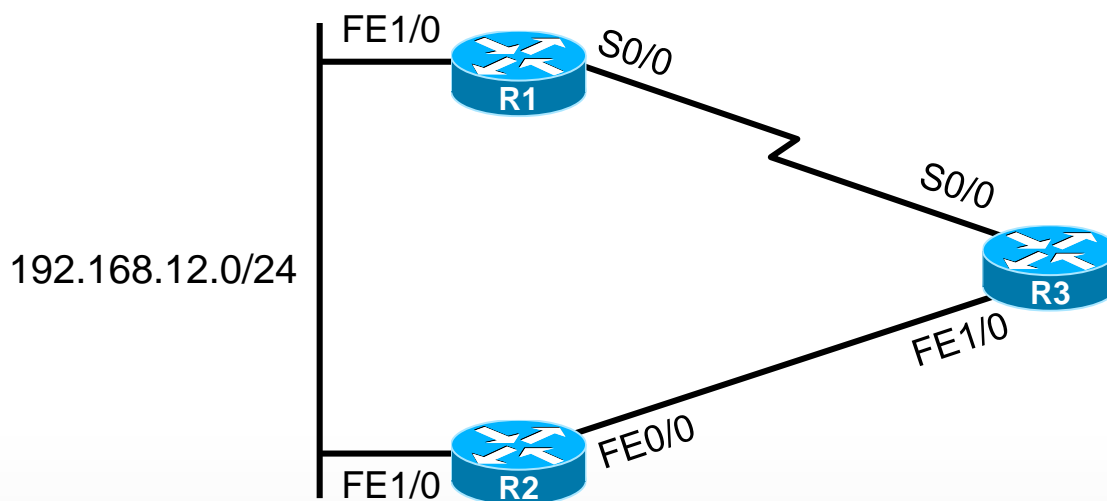
- **Successor 后继**：被实际选中作为到达目标网络所使用的下一跳路由器。
- **Fessible Successor 可行后继**：到达该目标网络的备份下一跳路由器（必须满足FC）。



对于R3而言，192.168.12.0/24路由的Successor是R2

Feasible Distance, Advertised Distance

- **Advertised Distance 通告距离**：邻居到达目标网络的度量值。
- **Feasible Distance 可行距离**：邻居到达目标网络的度量值（AD）加上本路由器到达该邻居的度量值。
- **Feasible Condition 可行性条件**：邻居到达目标网络的度量值（AD）小于本路由器的FD时，则认为该邻居通告的路径满足FC。



后继、可行后继路由器、FD及AD

R3#show ip eigrp topology

IP-EIGRP Topology Table for AS(1) / ID (192.168.23.3)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
r - reply Status, s - sia Status

后继Successor

P 192.168.12.0/24, 1 successors, FD is 30720
via 192.168.23.2 (**30720** / **28160**), FastEthernet1/0

可行后继FS

via 192.168.13.1 (2172416 / 28160), Serial0/0

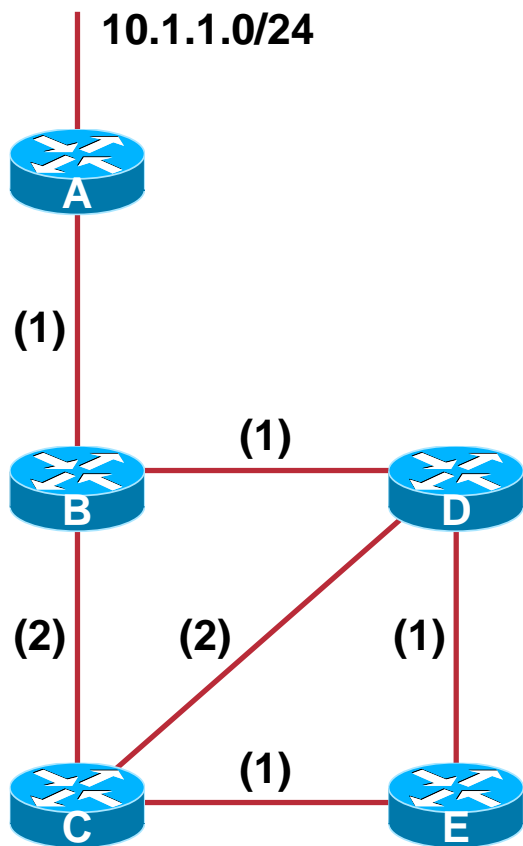
FD

后继Successor

R3#show ip route

D 192.168.12.0/24 [90/30720] via 192.168.23.2, 00:10:23, FastEthernet1/0

DUAL算法



C的拓扑表

	FD	AD	
(1.0)	3		(FD)
via B	3	1	(Successor)
via D	4	2	(FS)
via E	4	3	

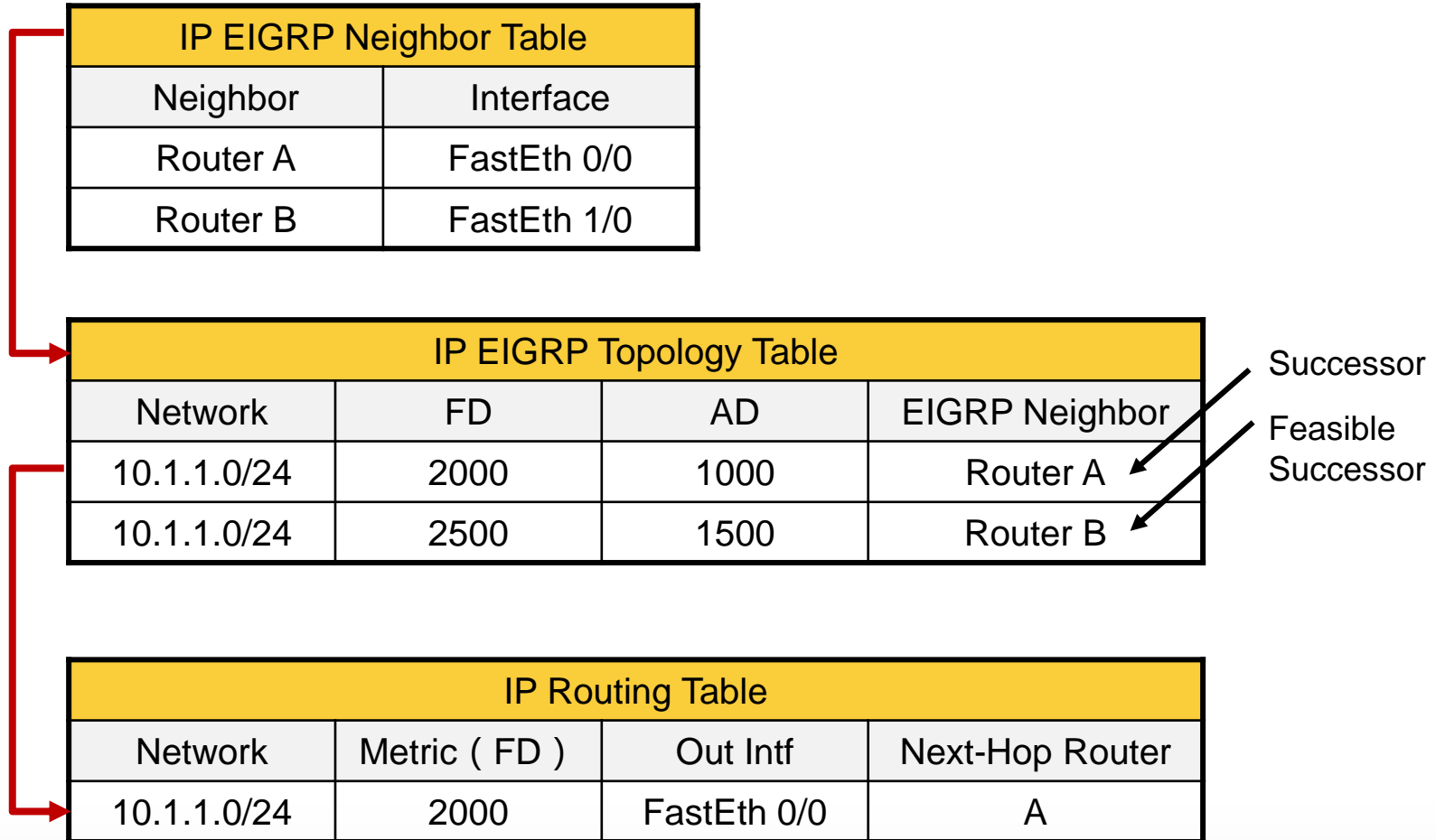
D的拓扑表

	FD	AD	
(1.0)	2		(FD)
via B	2	1	(Successor)
via C	5	3	

E的拓扑表

	FD	AD	
(1.0)	3		(FD)
via D	3	2	(Successor)
via C	4	3	

DUAL算法



EIGRP的配置及验证

基础配置

- 创建EIGRP进程，并进入路由进程的配置模式

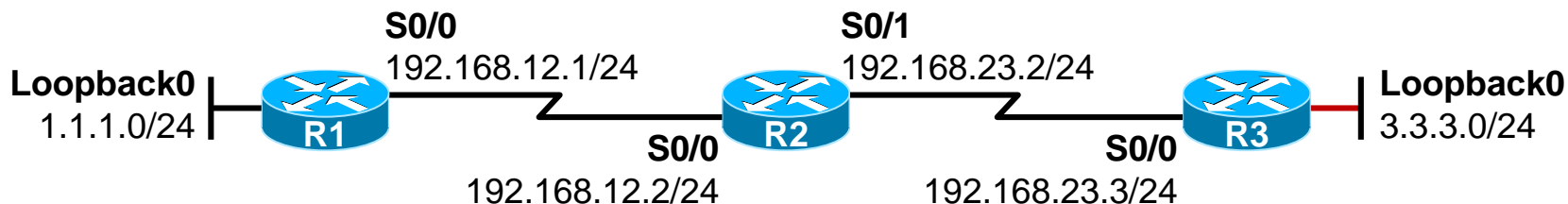
```
Router(config)# router eigrp autonomous-system-num
```

- 在指定的接口上激活EIGRP

```
Router(config-router)# network network [wildcard-mask]
```

- 如果不加通配符掩码，则自动识别为主类通告，也就是如果键入network 10.1.1.0，实际为network 10.0.0.0

基础配置示例



R1

```
router eigrp 1
 network 1.0.0.0
 network 192.168.12.0
```

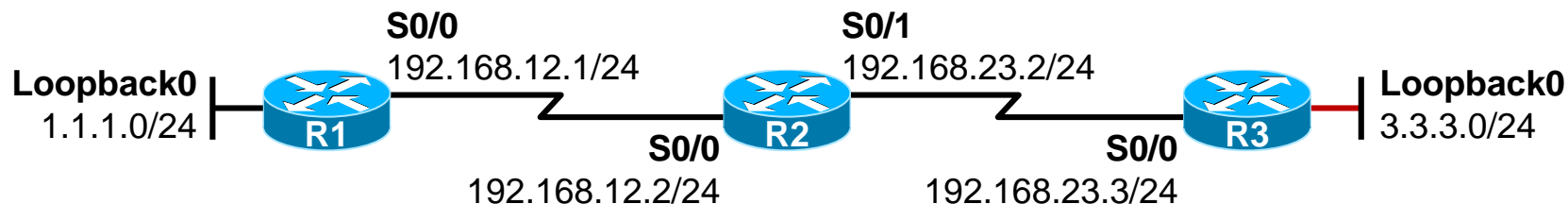
R2

```
router eigrp 1
 network 192.168.12.0
 network 192.168.23.0
```

R3

```
router eigrp 1
 network 192.168.23.0
 network 3.0.0.0
```

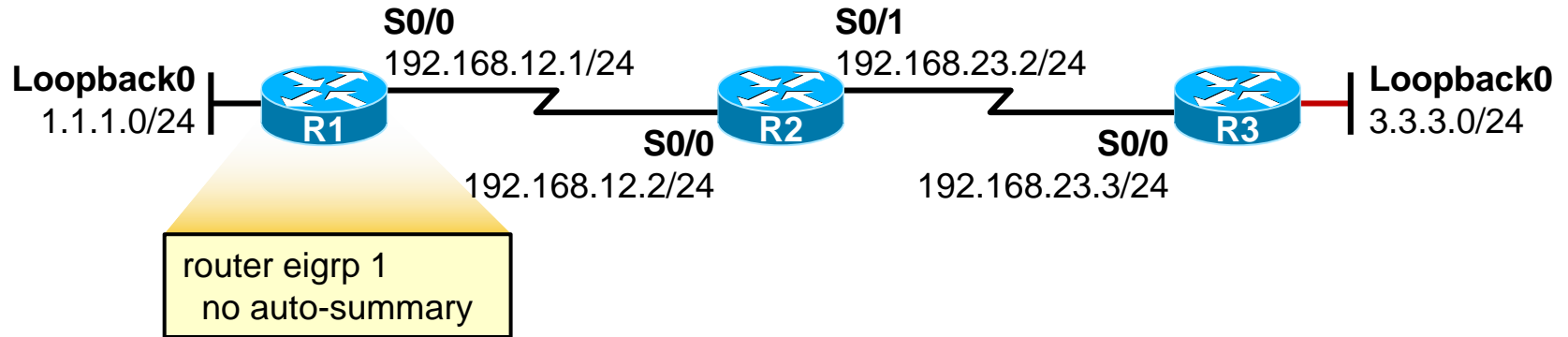
基础配置示例



```
R2#show ip route
```

- C 192.168.12.0/24 is directly connected, Serial0/0
- D 1.0.0.0/8 [90/2297856] via 192.168.12.1, 00:00:58, Serial0/0**
- D 3.0.0.0/8 [90/2297856] via 192.168.23.3, 00:00:39, Serial0/1**
- C 192.168.23.0/24 is directly connected, Serial0/1

基础配置示例（关闭自动汇总）



R2#show ip route

C 192.168.12.0/24 is directly connected, Serial0/0

1.0.0.0/24 is subnetted, 1 subnets

D 1.1.1.0 [90/2297856] via 192.168.12.1, 00:00:06, Serial0/0

D 3.0.0.0/8 [90/2297856] via 192.168.23.3, 00:00:39, Serial0/1

C 192.168.23.0/24 is directly connected, Serial0/1

查看及排错

Router#show ip eigrp neighbors	Displays the neighbors discovered by IP EIGRP
Router#show ip eigrp topology	Displays the IP EIGRP topology table
Router#show ip route eigrp	Displays current EIGRP entries in the routing table
Router#show ip protocols	Displays the parameters and current state of the active routing protocol process
Router#show ip eigrp traffic	Displays the number of IP EIGRP packets sent and received

查看及排错

Router#debug eigrp packet	Displays all types of EIGRP packets, both sent and received
Router#debug eigrp neighbor	Displays the EIGRP neighbor interaction
Router#debug ip eigrp route	Displays advertisements and changes EIGRP makes to the routing table
Router#debug ip eigrp summary	Displays a brief report of the EIGRP routing activity
Router#show ip eigrp events	Displays the different categories of EIGRP activity, including route calculations

EIGRP负载均衡

- **等价负载均衡**

- 所谓的等代价路径指的到达同一个目的地度量值相等的路径。
- **默认最多支持4条**等价路径之间进行流量负载，最大可为16条，命令：
Maximum-paths ?

- **非等价负载均衡**

- EIGRP也能在度量值不同的多条路径之间执行流量负载。

EIGRP非等价负载均衡

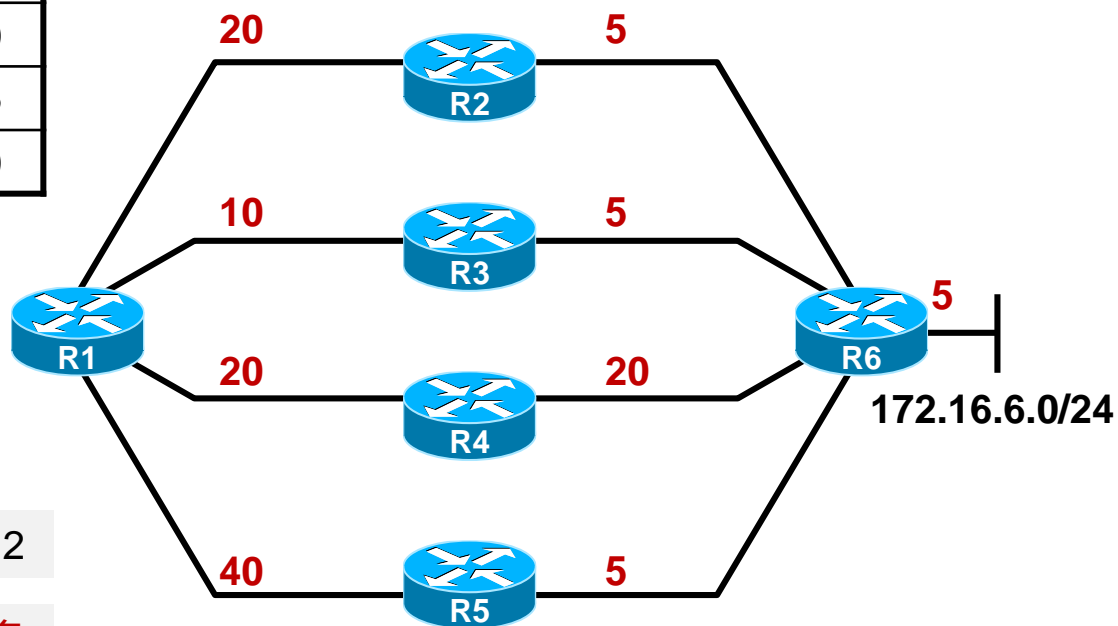
```
Router(config-router)# Variance multiplier
```

- multiplier默认值为1，范围1~128。
- EIGRP在多条路径上执行非等价负载均衡的条件：
 - 路由必须是无环的（即满足FC条件： $AD < FD_{min}$ ）
 - $FD \leq FD_{min} \times multiplier$
- 注：variance不指定最大路径，而指定一个基数（用于乘积计算）。

EIGRP非等价负载均衡

R1的拓扑数据库

Network	Neighbor	FD	AD
6.0/24	R2	30	10
	R3	20	10
	R4	45	25
	R5	50	10



```
Router(config-router)# Variance 2
```

- R1将使用R2及R3进行不等价负载均衡；流量比例为：2/5 : 3/5

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Thank You

