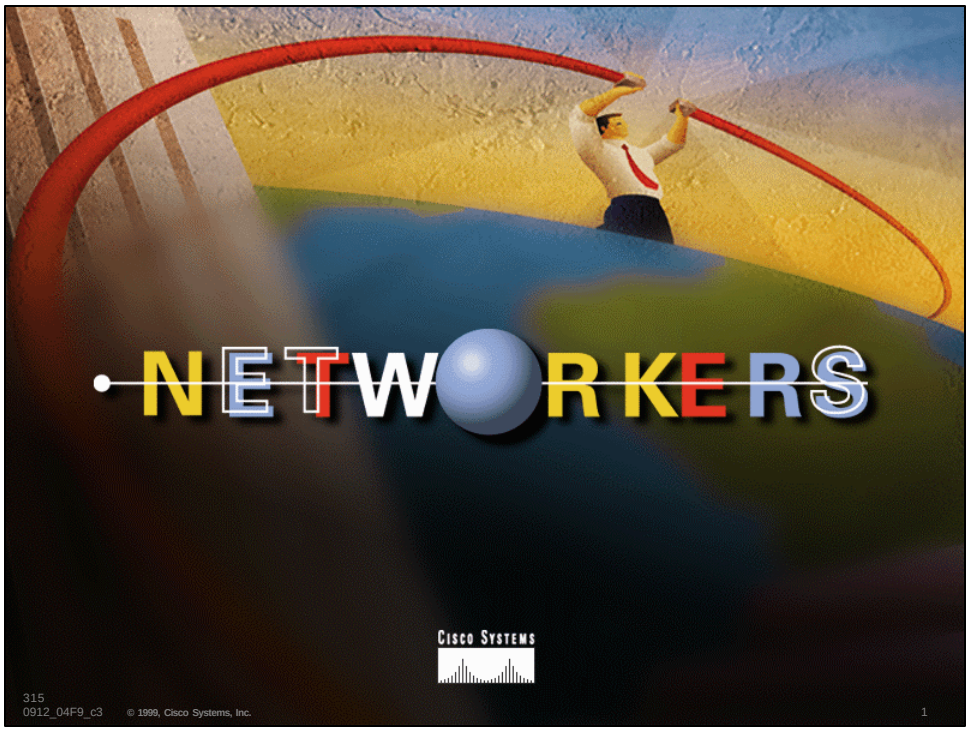


Agenda

- Troubleshooting
- New features

Troubleshooting

- Neighbor stability
- Stuck-in-active routes
- High CPU
- Troubleshooting tools

Neighbor Process—Review

- **Multicast hellos**
  - **224.0.0.10**
- **Neighbor timers**
  - **Hello Interval—5 or 60 sec.**
  - **Hold time—15 or 180 sec.**

Neighbor Process—Review

RTRA#show ip eigrp neighbors

IP-EIGRP neighbors for process 1

H	Address	Interface	Hold (sec)	Uptime	SRTT (ms)	RTO	Q Cnt	Seq Num
2	10.1.1.1	Et0	12	6d16h	20	200	0	233
1	10.1.4.3	Et1	13	2w2d	87	522	0	452
0	10.1.4.2	Et1	10	2w2d	85	510	0	314

Common Neighbor Stability Problems

- Physical link up/down
- Hold timer expiration
- Retry limit exceeded
- Manual changes (sort of)
- Stuck-in-active routes

Physical Link Up/Down

- Interface reports the link down to EIGRP
- EIGRP takes down the neighbors through this interface
- Look in the logs for line up/down

Hold Timer Expiration

- Hold time passed in Hello packet
- If hold time expired, EIGRP packet not seen for hold time
- Usually, means multicast Hellos are missed
- Typically caused by congestion or physical errors

Retry Limit Exceeded

- Reliable packet was not acknowledged
- Packet retransmitted based on RTO (6 X SRTT)

  Exponential backoff

  Max. RTO of 5000 ms, min of 200 ms

Retry Limit Exceeded (Cont.)

- **Actual timeout is 16 retransmits or hold time, whichever is longer**
  - **16 retransmits takes between 50 seconds and 80 seconds**
  - **For low-speed NBMA, holdtime is the deciding factor**

Retry Limit Exceeded (Cont.)

```
RTRA#show ip eigrp neighbors
IP-EIGRP neighbors for process 1
H   Address         Interface   Hold Uptime   SRTT   RTO  Q  Seq
                                (sec)         (ms)       Cnt Num
2   10.1.1.1        Et0          12 6d16h       20   200  0  233
1   10.1.4.3        Et1          13 2w2d        87   522  0  452
0   10.1.4.2        Et1          10 2w2d        85   510  0  314
```

Manual Changes (Sort Of)

- MTU changed
- Summary changed
- Route filter changed

Neighbor Stability Problems (Cont.)

- Stuck-in-active routes
  - Often very complex problems
  - Will be covered in later section

Troubleshooting Tools for Neighbor Problems

```
RouterA#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
RouterA(config) #router eigrp 1
RouterA(config-router) #eigrp log-neighbor-changes
RouterA(config-router) #logging buffered 10000
RouterA(config) #service timestamps log datetime msec
RouterA(config) #^Z
RouterA#
```


Log-Neighbor-Changes Messages

Neighbor 10.1.1.1 (Ethernet0) is down: peer restarted
Neighbor 10.1.1.1 (Ethernet0) is up: new adjacency
Neighbor 10.1.1.1 (Ethernet0) is down: holding time expired
Neighbor 10.1.1.1 (Ethernet0) is down: retry limit exceeded
Neighbor 10.1.1.1 (Ethernet0) is down: route filter changed
Neighbor 10.1.1.1 (Ethernet0) is down: interface delay changed
Neighbor 10.1.1.1 (Ethernet0) is down: interface bandwidth changed
Others, but not often...

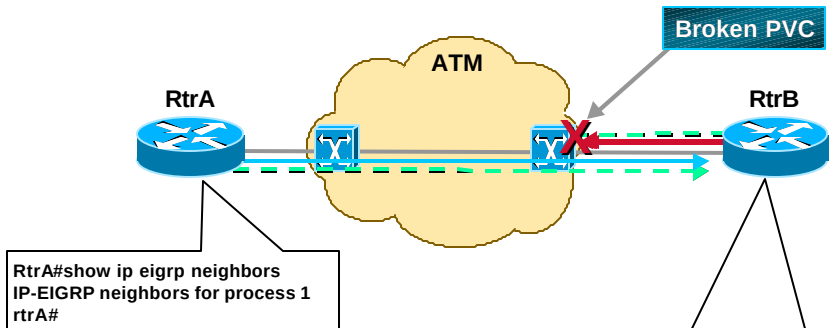
Troubleshooting Tools for Neighbor Problems (Cont.)

```
rp-esc-2621b#debug eigrp packet hello
EIGRP Packets debugging is on (HELLO)
*Mar 16 19:08:38.521: EIGRP: Sending HELLO on Serial1/1
*Mar 16 19:08:38.521:   AS 1, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Mar 16 19:08:38.869: EIGRP: Received HELLO on Serial1/1 nbr 10.1.6.2
*Mar 16 19:08:38.869:   AS 1, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Mar 16 19:08:39.081: EIGRP: Sending HELLO on FastEthernet0/0
*Mar 16 19:08:39.081:   AS 1, Fags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Mar 16 19:08:39.749: EIGRP: Received HELLO on Serial1/2 nbr 10.1.7.2
*Mar 16 19:08:39.749:   AS 1, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Mar 16 19:08:40.973: EIGRP: Sending HELLO on FastEthernet0/1
*Mar 16 19:08:40.973:   AS 1, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Mar 16 19:08:43.409: EIGRP: Sending HELLO on Serial1/1
*Mar 16 19:08:43.409:   AS 1, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
```


Unusual Neighbor Problems

- Unidirectional links
- Mismatched masks
- Mismatch of primary/secondary addresses

Unidirectional Links



RtrA#show ip eigrp neighbors
IP-EIGRP neighbors for process 1
rtrA#

PVC
Hello
Update

RtrB#show ip eigrp neighbors
IP-EIGRP neighbors for process 1

H	Address	Interface	Hold (sec)	Uptime	SRTT (ms)	RTO	Q Cnt	Seq Num
1	10.1.102.2	Et0	14	00:00:15	0	5000	4	0

Mismatched Masks

Hello
Update
Ack

interface serial 0
ip address 10.1.1.2 255.255.255.128
interface serial 1
ip address 10.1.3.1 255.255.255.0

Router A

interface serial 0
ip address 10.1.1.1 255.255.255.0
interface ethernet 0
ip address 10.1.2.1 255.255.255.0

Interface ethernet 0
ip address 10.1.2.2 255.255.255.0
interface serial 0
ip address 10.1.3.2 255.255.255.0

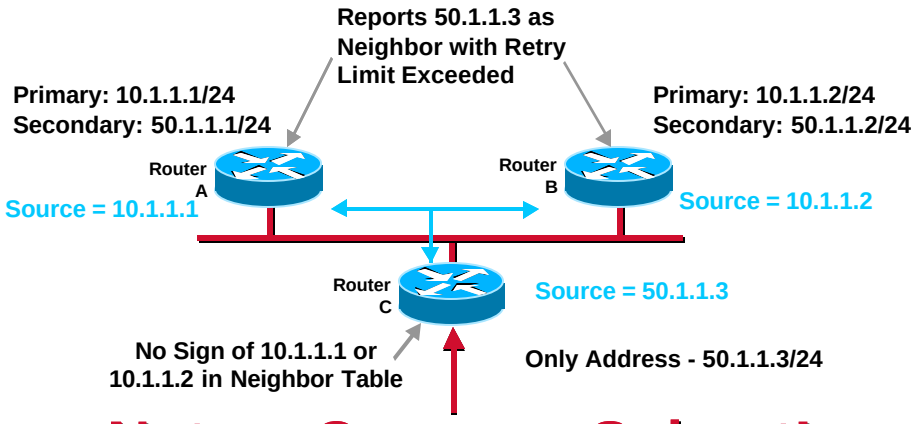
Router B

Router C

Routing Table:
C 10.1.1.0/24 Serial 0
D 10.1.1.0/25 10.1.2.2

Routing Table:
D 10.1.1.0/24 10.1.2.1
D 10.1.1.0/25 10.1.3.1

Primary/Secondary Mismatch



Not on Common Subnet!

Troubleshooting

- Neighbor relationship
- Stuck-in-active routes
- High CPU
- Troubleshooting tools

Stuck-In-Active Routes (SIA)

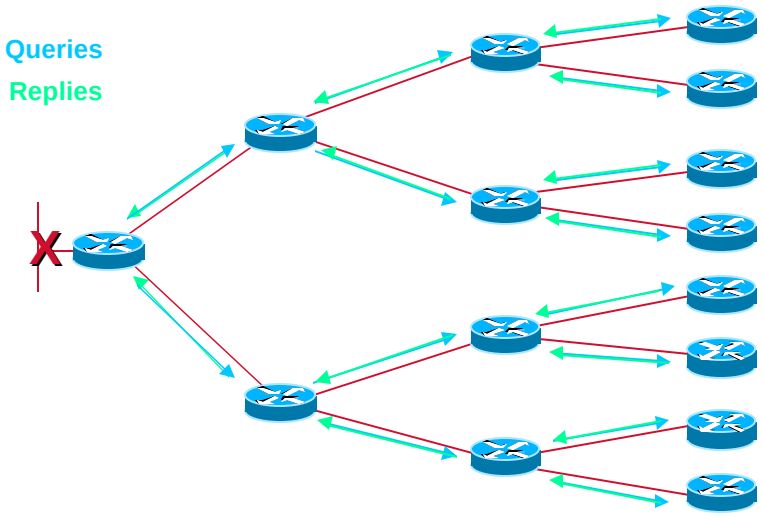
%DUAL-3-SIA: Route 10.64.5.0 255.255.255.192 stuck-in-active state in IP-EIGRP 100. Cleaning up

- **Always indicates at least two problems**
- **Two parts—Stuck and Active**

Active Process

- **Normal process for resolving network changes**
- **Normal (up) state is passive**
- **Route "active" if lost and no other successor or feasible successor**

Active Process (Cont.)



Active Process (Cont.)

- **Query process stops when:**
  - **All queries are answered**
  - **End of network reached**
  - **End of the autonomous system reached (sort of)**
  - **The lost component is unknown**

Stuck-In-Active

- When a route goes active, timer started
  - Approximately 3 to 3-1/2 minutes
- If timer expires without all queries being answered,“stuck” in the active process

Stuck-In-Active (Cont.)

- On the router where timer expires:
  - Reinitializes neighbor(s) who didn’t answer
  - Goes active on all routes known through bounced neighbor(s)
  - Re-advertises to bounced neighbor all routes that we were advertising

Likely Causes for Stuck-In-Active

- Bad or congested links
- Query range is too long
- Excessive redundancy
- Router memory shortage
- Software defects (very seldom)

Troubleshooting SIAs

- Two parts—stuck and active
- Need to troubleshoot both parts
  - Cause of active often easier to find
  - Cause of stuck more important to find

Troubleshooting the Active Part of SIAs

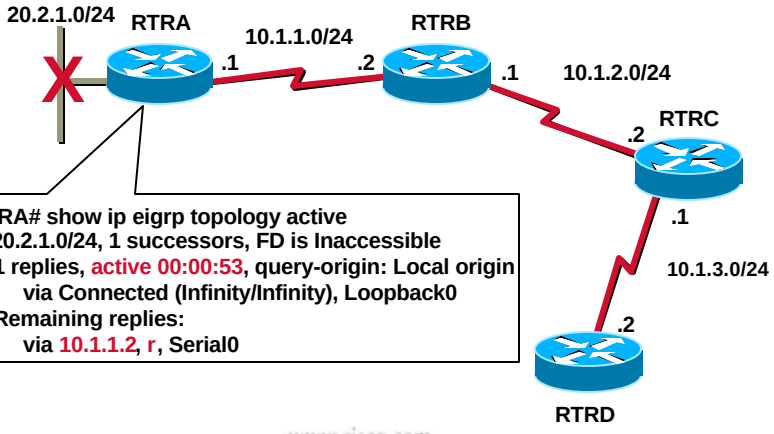
- Determine what is common to routes going active
  - /32s from dial-in PPP?
  - Flapping link(s)?
  - From the same region of the network?

Troubleshooting the Stuck Part of SIAs

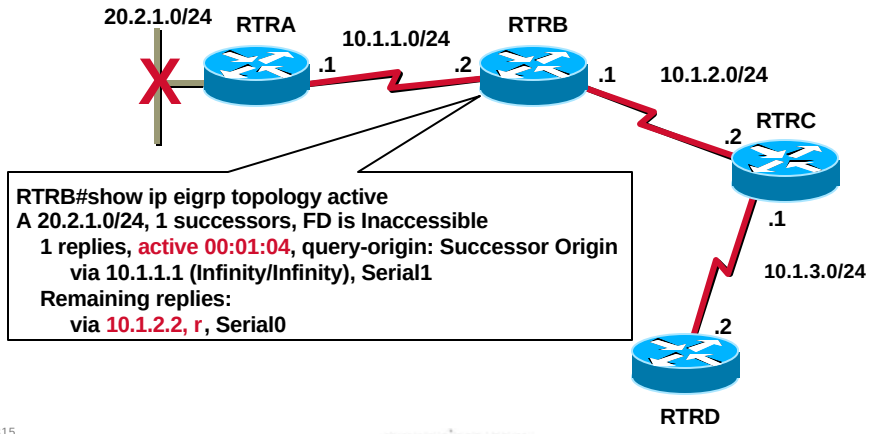
- *Show ip eigrp topology active*
  - Useful only while the problem is occurring
  - If problem isn't occurring at the time, it is difficult to find the source of route getting stuck

Chasing Active Routes—Example

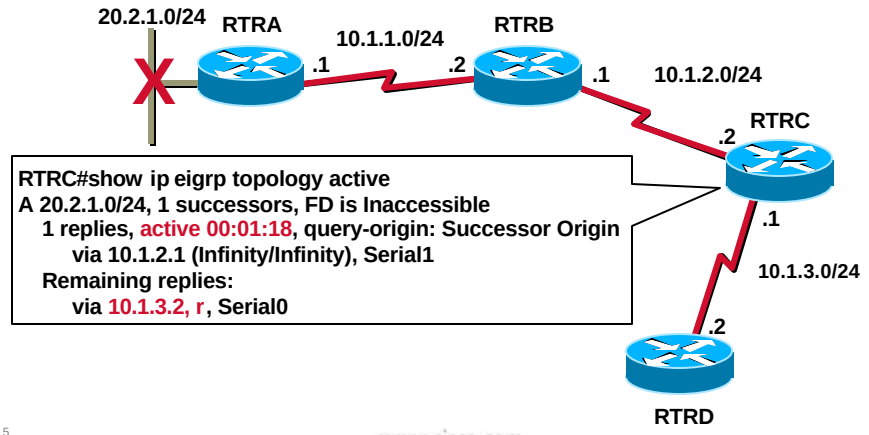
Why Is RTRA Reporting SIA Routes? Let's Look at a Problem in Progress…



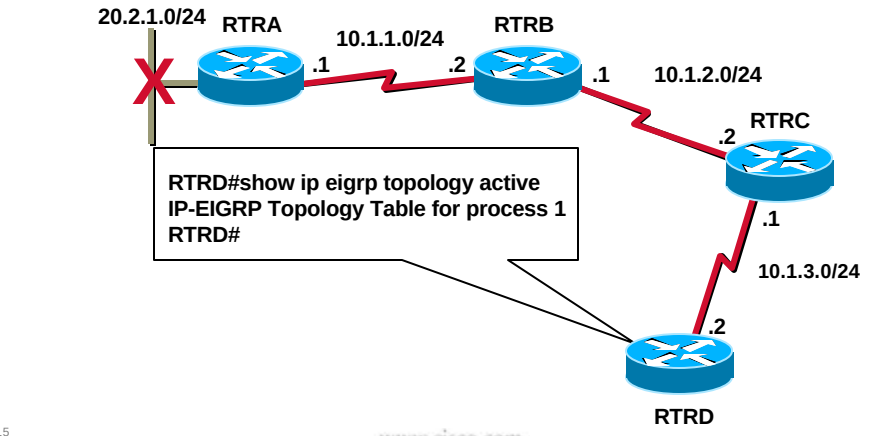
Chasing Active Routes (Cont.)



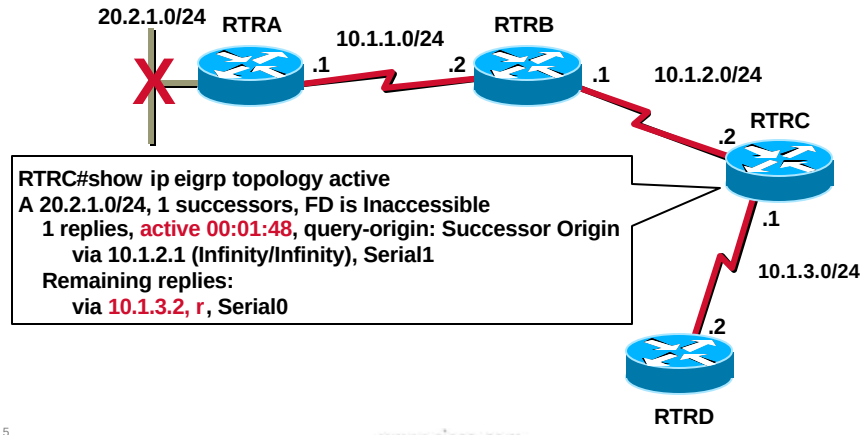
Chasing Active Routes (Cont.)



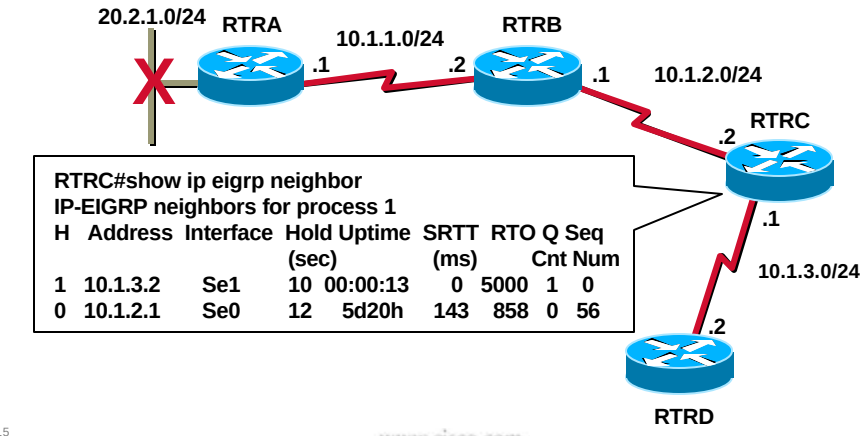
Chasing Active Routes (Cont.)



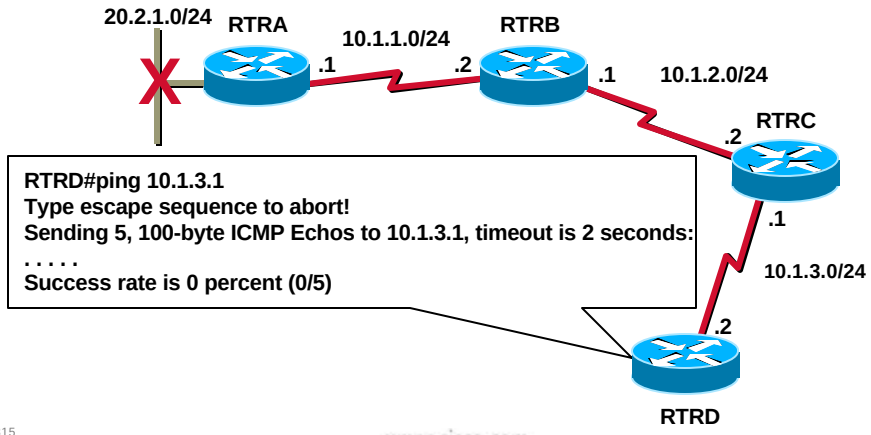
Chasing Active Routes (Cont.)



Chasing Active Routes (Cont.)



Chasing Active Routes (Cont.)



Troubleshooting the Stuck Part of SIAs (Cont.)

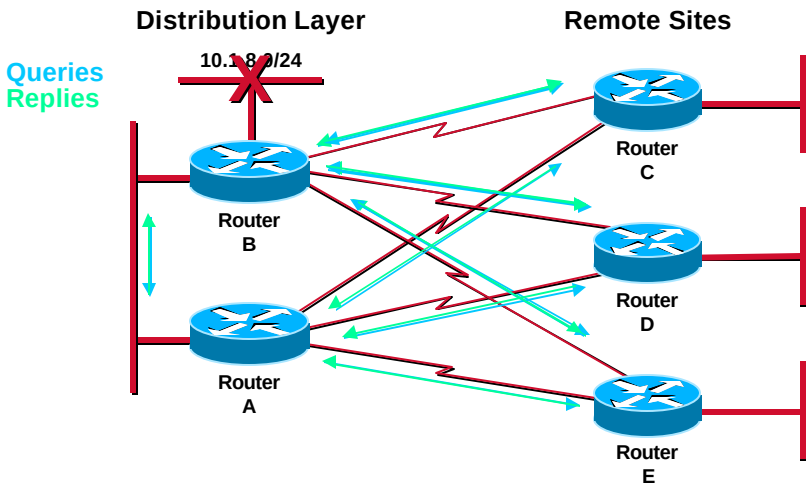
- It's not always this easy to find the cause
- Sometimes you chase the waiting neighbors in a circle

  If so, summarize and simplify!

Minimizing SIA Routes

- **Decrease query scope**
  - **Summarization (manual or auto)**
  - **Distribute-lists**
    - **Particularly on dual-homed remotes**
  - **Stub routers (future)**

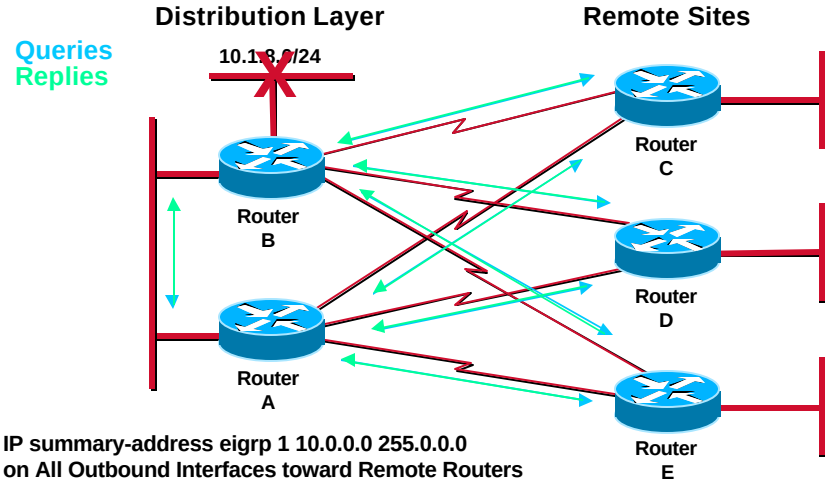
Decreasing Query Scope—Example



Decreasing Query Scope—Summary

- **Remote routers are fully involved in convergence**
  - **Usually remote routers are not intended to be transit paths**
  - **Convergence is complicated through lack of information hiding**

Decreasing Query Scope—A Little Better

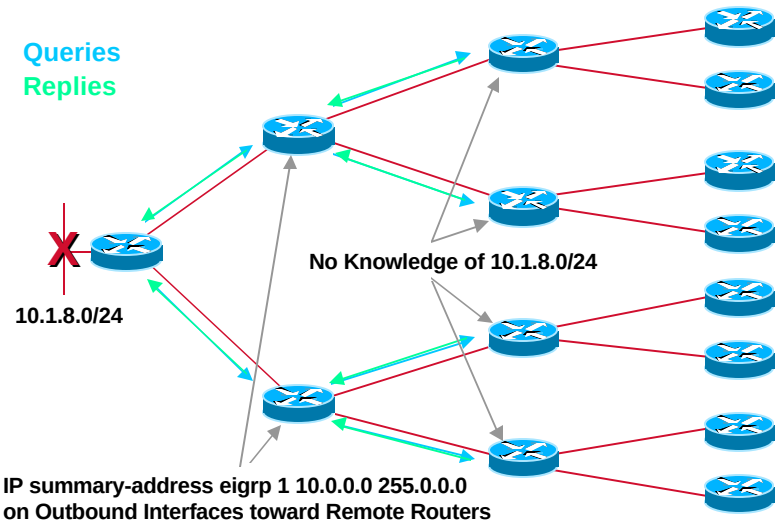


IP summary-address eigrp 1 10.0.0.0 255.0.0.0 on All Outbound Interfaces toward Remote Routers

Decreasing Query Scope—Summary

- **Convergence simplified**
  - **Remotes immediately reply**
  - **Compound by number of remotes!**
- **Even simpler with new stub feature**

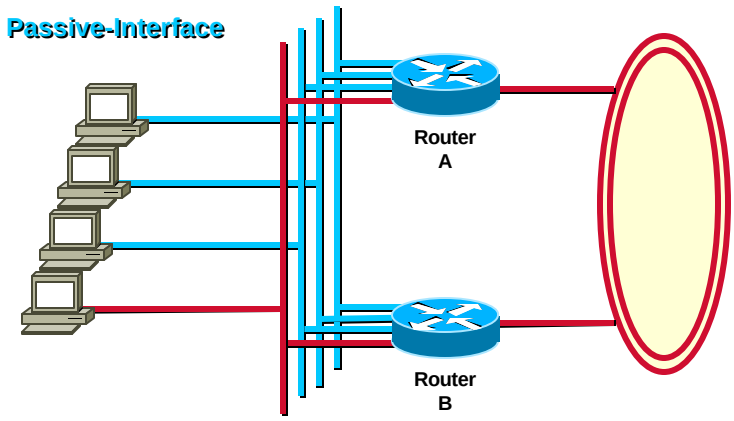
Decreasing Query Scope—Another Example



Minimizing SIA routes (Cont.)

- **Maintain reasonable redundancy**
  - **Don’t make EIGRP’s job too difficult**
  - **Use passive-interface**
  - **Use hierarchy**

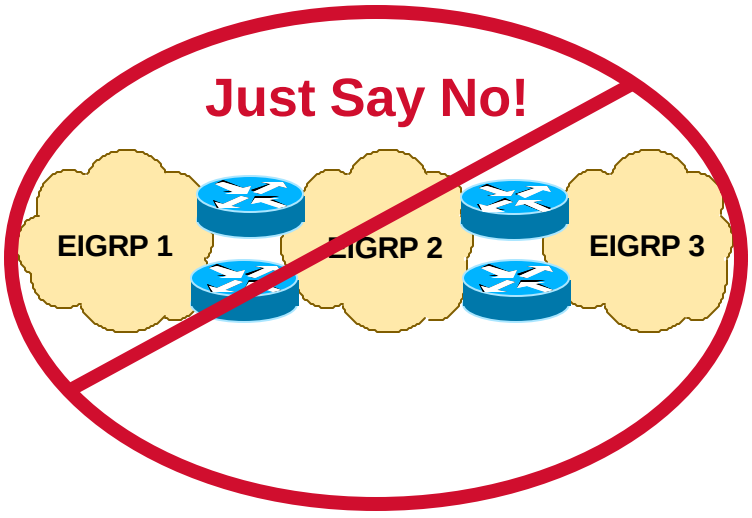
Removing Excessive Redundancy



Minimizing SIA Routes (Cont.)

- **Multiple EIGRP AS' are NOT the answer**
  - **Terminates original query, but new one starts**
  - **Adds redistribution complexity**
  - **Requires distribute-lists to stop routing loops**

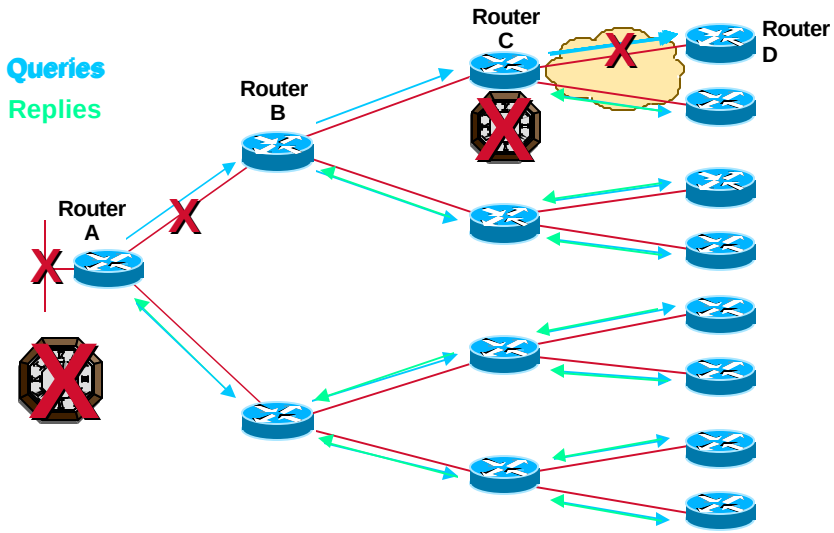
Multiple EIGRP AS'



Impact of Low-Speed NBMA Links

- Retry limit = hold time
- Hold time = 180 seconds
- Active timer = 180 seconds
- One broken link can cause SIAs!

Low-Speed NBMA (Cont.)



Workarounds for Low-Speed NBMA

- Use point-to-point subinterfaces instead
- Change the Active timer to 4-5 minutes (NOT recommended)
- Change the hello/hold timers to 30/90

Troubleshooting

- Neighbor relationship
- Stuck-in-active routes
- High CPU
- Troubleshooting tools

High CPU

Busy, Busy!

Here's a Big Chunk of It!

```
RTRA#show process cpu
CPU utilization for five seconds: 96%/35%; one minute: 91%; five minutes: 89%
 PID  Runtime(ms)  Invoked  uSecs    5Sec    1Min    5Min TTY Process
   1       60000  2484685     24   0.00%  0.00%  0.00%   0 Load Meter
   2    21595164 66420469    325  25.96%  9.23%  8.17%   0 IP-EIGRP Router
   3    30432980   414274  73461   0.00%  0.37%  0.29%   0 Check heaps
   4        1356     3043    445   0.00%  0.00%  0.00%   0 Pool Manager
   5           0        2      0   0.00%  0.00%  0.00%   0 Timers
   6           0        1      0   0.00%  0.00%  0.00%   0 OIR Handler
   7           0        1      0   0.00%  0.00%  0.00%   0 IPC Zone Manager
   8           0        1      0   0.00%  0.00%  0.00%   0 IPC Realm Manager
   9        2856   621291      4   0.00%  0.00%  0.00%   0 IPC Seat Manager
  10     2582920  6744442    382   0.16%  0.01%  0.00%   0 ARP Input
  11           0        1      0   0.00%  0.00%  0.00%   0 SERIAL A'detect
```


High CPU (Cont.)

Unstable Neighbors!

```
RTRA#sh ip eigrp neighbor
IP-EIGRP neighbors for process 1
H   Address      Interface  Hold Uptime  SRTT  RTO  Q  Seq
                            (sec)        (ms)      Cnt Num
11  10.1.15.181    Fd5/0     14 00:00:03  414  2484 35  309
26  10.1.15.145    Fd5/0     14 00:01:10  102   612  1  495
17  10.1.15.130    Fd5/0     14 00:01:13  220  1320  2  241
. . . More unstable neighbors
RTRA#

Neighbor 10.1.1.1 (Ethernet0) is down: holding time expired
```

High CPU (Cont.)

```
RTRA#show interface fddi 5/0
Fddi5/0 is up, line protocol is up
  Hardware is cxBus FDDI, address is aa00.0400.e9ab (bia 0060.2faa.0da0)
  Description: Core FDDI Ring
  Internet address is 10.1.15.1/24
  MTU 4470 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 23/255
  Encapsulation SNAP, loopback not set, keepalive not set
  ARP type: SNAP, ARP Timeout 04:00:00
  Phy-A state is  active, neighbor is   M, cmt signal bits 008/00E, status ILS
  Phy-B state is connect, neighbor is unk, cmt signal bits 20C/000, status QLS
  ECM is in, CFM is c_wrap_a, RMT is ring_op
  Requested token rotation 5000 usec, negotiated 5000 usec
  Configured tvx is 2500 usec ring operational 00:05:57
  Upstream neighbor aa00.0400.eeab, downstream neighbor 0060.5c5e.bc08
  Last input 00:00:00, output 00:00:00, output hang never
  Last clearing of "show interface" counters 5w0d
  Queueing strategy: fifo
  Output queue 0/40, 168 drops; input queue 1/500, 102863 drops
```

High CPU (Cont.)

- ***Show ip eigrp events***
  - **Route(s) flapping?**
  - **Routing loop?**
  - **Find what activity is taking CPU and resolve it!**

Troubleshooting

- Neighbor relationship
- Stuck-in-active routes
- High CPU
- Troubleshooting tools

EIGRP Troubleshooting Tools

- Debugs and the EIGRP event log
  - On a busy, unstable network debugs can be hazardous to your health!
  - Event log is non-disruptive—already running!
  - Not for mere mortals to interpret!

Event Log

- Always running (unless manually disabled)
- Default 500 lines (configurable)
- Most recent events at top of log

Event Log (Cont.)

- Three different event types can be logged
  - *EIGRP log-event-type [dual][xmit][transport]*
  - Default is dual—most useful
  - Any combination of the three can be on at the same time

Event Log (Cont.)

```
RTRA#show ip eigrp events
Event information for AS 1:
1   12:49:43.605 Poison squashed: 10.1.2.0/24 reverse
2   12:49:43.553 Change queue emptied, entries: 1
3   12:49:43.553 Metric set: 10.1.2.0/24 21536000
4   12:49:43.553 Update reason, delay: new if 4294967295
5   12:49:43.553 Update sent, RD: 10.1.2.0/24 4294967295
6   12:49:43.553 Update reason, delay: metric chg 4294967295
7   12:49:43.553 Update sent, RD: 10.1.2.0/24 4294967295
8   12:49:43.553 Route install: 10.1.2.0/24 10.1.6.2
9   12:49:43.553 Find FS: 10.1.2.0/24 4294967295
10  12:49:43.553 Rcv update met/succmet: 21536000 21024000
11  12:49:43.553 Rcv update dest/nh: 10.1.2.0/24 10.1.6.2
12  12:49:43.553 Metric set: 10.1.2.0/24 4294967295
```


SIA Event Log

- ***Show ip eigrp sia***
  - **Snapshot of event log when SIA occurs**
  - **Typically lets you know results of SIA, not the cause**
  - **Seldom useful**

Debugs

- **Remember—can be dangerous!**
  - **Use only in the lab or**
  - **If advised by the TAC**
- **To make a little safer:**
  - ***logging buffered <size>***
  - ***no logging console***

Debugs (Cont.)

- **Use modifiers to limit scope of route events or packet debugs**
  - ***debug ip eigrp*** *AS network mask*
  - ***debug ip eigrp neighbor*** *AS address*

Debug IP Eigrp (Route Events)

```
RTRA#debug ip eigrp
IP-EIGRP Route Events debugging is on
RTRA#debug ip eigrp neighbor 1 10.1.6.2
IP Neighbor target enabled on AS 1 for 10.1.6.2
IP-EIGRP Neighbor Target Events debugging is on
RTRA#clear ip eigrp neighbor
RTRA#
*Mar 17 15:50:53.244: IP-EIGRP: 10.1.6.0/24 - do advertise out Serial1/2
*Mar 17 15:50:53.244: IP-EIGRP: Int 10.1.6.0/24 metric 20512000 -20000000 512000
*Mar 17 15:50:53.244: IP-EIGRP: 10.1.8.0/24 - do advertise out Serial1/2
*Mar 17 15:50:53.244: IP-EIGRP: Int 10.1.8.0/24 metric 28160 - 256002560
*Mar 17 15:50:53.244: IP-EIGRP: 10.1.7.0/24 - do advertise out Serial1/2
*Mar 17 15:50:53.244: IP-EIGRP: 10.1.1.0/24 - do advertise out Serial1/2
*Mar 17 15:50:53.244: IP-EIGRP: Int 10.1.1.0/24 metric 28160 - 25600256
*Mar 17 15:50:53.668: IP-EIGRP: Processing incoming UPDATE packet
*Mar 17 15:50:54.544: IP-EIGRP: 10.1.6.0/24 - do advertise out Serial1/1
```


Debug IP Eigrp (Cont.)

```
RTRA#debug ip eigrp
IP-EIGRP Route Events debugging is on
RTRA#debug ip eigrp 1 10.1.7.0 255.255.255.0
IP Target enabled on AS 1 for 10.1.7.0/24
IP-EIGRP AS Target Events debugging is on
RTRA#clear ip eigrp neighbor
*Mar 17 15:52:20.940: IP-EIGRP: 10.1.7.0/24 - do advertise out Serial1/2
*Mar 17 15:52:22.684: IP-EIGRP: 10.1.7.0/24 - do advertise out Serial1/1
*Mar 17 15:52:22.684: IP-EIGRP: Int 10.1.7.0/24 metric 20512000 20000000 512000
*Mar 17 15:52:22.940: IP-EIGRP: 10.1.7.0/24 - do advertise out Serial1/2
*Mar 17 15:52:22.968: IP-EIGRP: Processing incoming UPDATE packet
*Mar 17 15:52:24.684: IP-EIGRP: 10.1.7.0/24 - do advertise out Serial1/1
*Mar 17 15:52:24.684: IP-EIGRP: Int 10.1.7.0/24 metric 20512000 - 20000000 512000
*Mar 17 15:52:25.940: IP-EIGRP: 10.1.7.0/24 - do advertise out Serial1/2
```

Debug eigrp packet <type>

```
RTRA#debug eigrp packet ?
  ack        EIGRP ack packets
  hello      EIGRP hello packets
  ipxsap     EIGRP ipxsap packets
  probe      EIGRP probe packets
  query      EIGRP query packets
  reply      EIGRP reply packets
  request    EIGRP request packets
  retry      EIGRP retransmissions
  terse      Display all EIGRP packets except Hellos
  update     EIGRP update packets
  verbose    Display all EIGRP packet
```


Debug IP Eigrp Packet Terse

```
RTRA#debug eigrp packet terse
EIGRP Packets debugging is on
    (UPDATE, REQUEST, QUERY, REPLY, IPXSAP, PROBE, ACK)
RTRA#
*Mar 17 15:54:39.768: EIGRP: Enqueueing UPDATE on Serial1/2 nbr 10.1.7.2 iidbQ un/rely
    0/1 peerQ un/rely 0/0 serno 25-105
*Mar 17 15:54:39.772: EIGRP:  Requeued unicast on Serial1/2
*Mar 17 15:54:39.772: EIGRP: Forcing multicast xmit on Serial1/2
*Mar 17 15:54:39.772: EIGRP: Sending UPDATE on Serial1/2 nbr 10.1.7.2
*Mar 17 15:54:39.772:   AS 1, Flags 0x1, Seq 305/0 idbQ 0/0 iidbQ un/rely 0/0 peerQ un/rely
```

Debug IP EIGRP Notifications


```
rp-esc-2621b#debug ip eigrp notifications
IP-EIGRP Event notification debugging is on
rp-esc-2621b#clear ip route *
rp-esc-2621b#
*Mar 17 15:58:07.144: IP-EIGRP: Callback: reload_iptable
*Mar 17 15:58:08.148: IP-EIGRP: iptable_redistribute into eigrp AS 1
*Mar 17 15:58:12.144: IP-EIGRP: Callback: redist frm static AS 0 100.100.100.0/24
*Mar 17 15:58:12.144:          into: eigrp AS 1  event: 1
*Mar 17 15:58:12.144: IP-EIGRP: Callback: redist frm static AS 0 200.200.200.0/24
*Mar 17 15:58:12.144:          into: eigrp AS 1  event: 1
```


Debug Eigrp FSM

```
RTRA#debug eigrp fsm
EIGRP FSM Events/Actions debugging is on
RTRA#clear ip route *
RTRA#
*Mar 17 15:59:04.972: DUAL: Find FS for dest 10.1.8.0/24. FD is 28160, RD is 28160
*Mar 17 15:59:04.972: DUAL:     0.0.0.0 metric 28160/0 found Dmin is 28160
*Mar 17 15:59:04.976: DUAL: Find FS for dest 10.1.3.0/24. FD is 21024000, RD is 21024000
*Mar 17 15:59:04.976: DUAL:     10.1.6.2 metric 21024000/2169856 found Dmin is 21024000
*Mar 17 15:59:04.976: DUAL: RT installed 10.1.3.0/24 via 10.1.6.2
*Mar 17 15:59:04.976: DUAL: Find FS for dest 10.1.2.0/24. FD is 21536000, RD is 21536000
```

Debug IP Eigrp Summary

Summary Changed

```
RTRA#debug ip eigrp summary
IP-EIGRP Summary route processing debugging is on
RTRA#
*Mar 17 16:01:06.164: IP-EIGRP: conn_summary_depend: Loopback0 20.20.20.0/24 0
*Mar 17 16:01:06.164: IP-EIGRP: summary_depend: 20.20.20.0/24 0 128256
*Mar 17 16:01:06.168: IP-EIGRP: summary_revise: 20.0.0.0/8 0 128256
*Mar 17 16:01:06.168: IP-EIGRP: summary_revise: Metric now 128256, result 2
*Mar 17 16:01:06.168: IP-EIGRP: process_summary: 20.0.0.0/8 1
*Mar 17 16:01:07.460: %SYS-5-CONFIG_I: Configured from console by console
*Mar 17 16:01:08.164: %LINK-5-CHANGED: Interface Loopback0, changed state to
administratively down
```

This Is Why!

Agenda

- Troubleshooting
- New features

New Features

- Classless network statements
- Neighbor control
- Stub routers

Classless Network Statements

```
router eigrp 1
 network 10.1.0.0 0.0.255.255
 network 192.31.0.0 0.0.255.255
```

- Allows supernetted interfaces
- Granular control of interfaces included in EIGRP

Neighbor Control

```
router eigrp 1
[no] eigrp neighbor auto-discovery [interface]
[no] neighbor A.B.C.D
```

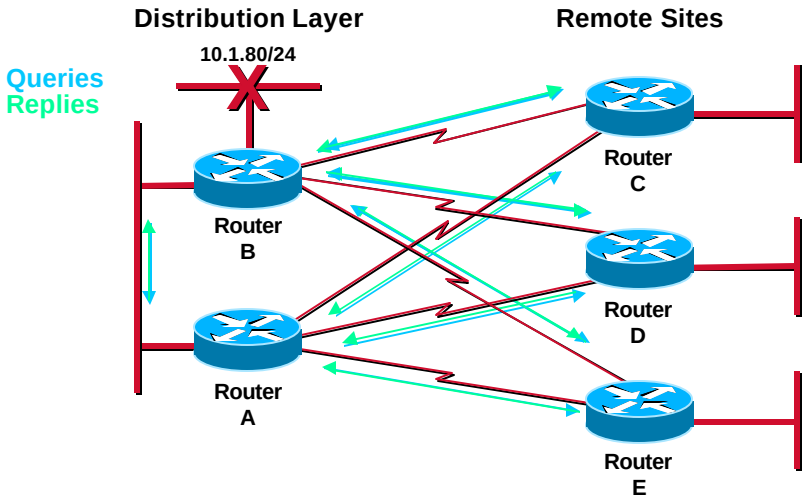
- Supports non-broadcast media (Classical IP on ATM)
- Permits explicit definition of neighbors

Stub Routers

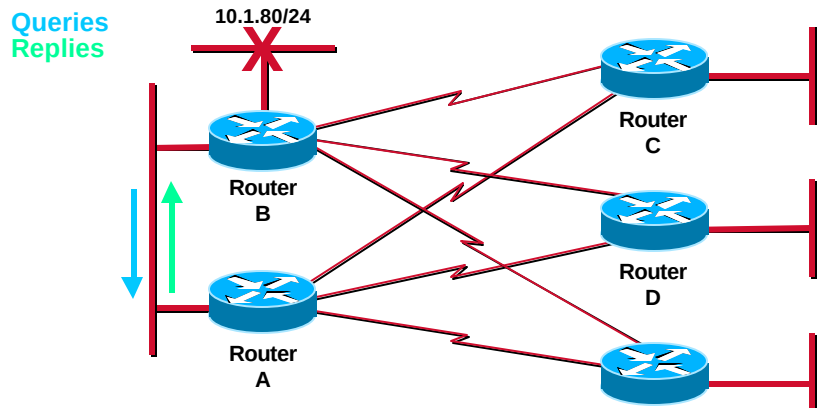
```
Router eigrp 1
  stub [connected][static][summary][receive-only]
```

- Defined on remote routers
- Restricts route advertisement to connected, static, summary, or none
- Queries are not propagated to stub routers

Decreasing Query Scope—Example



Decreasing Query Scope—Stub Remotes



Remote Routers (Router C, Router D, and Router E) Are All Defined as Stub Routers

Advanced EIGRP Summary

- There are many tools in EIGRP for troubleshooting network problems
- New features will further improve EIGRP scalability and flexibility

Questions?