Internet Routing

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1 Administrivia

Announcements

Assignment

Read 5.1, 5.3–5.6, 5.9.

From Last Time

Introduction to routing.

Outline

1. Intra-AS routing: RIP and OSPF.

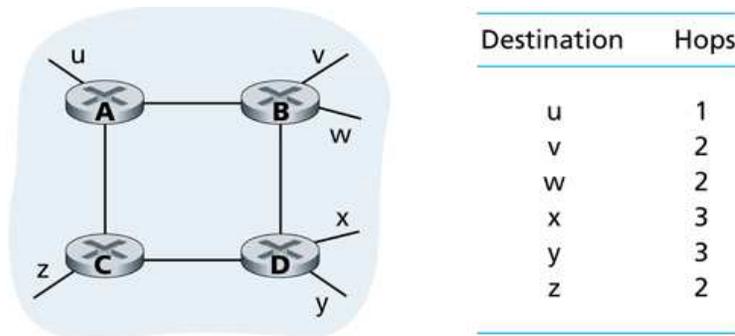2. Inter-AS routing: BGP.

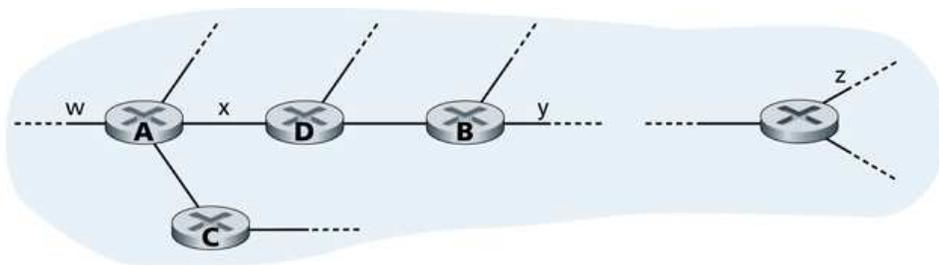**Coming Up**

Link Layer.

2 Intra-AS Routing

2.1 RIP

1. Distance vector algorithm.

2. Uses hop count as metric.

   Maximum hop count of a path is 15, limiting AS size.

   Distances from A:

Destination	Hops
u	1
v	2
w	2
x	3
y	3
z	2

3. RIP advertisements are sent to neighboring routers every 30 seconds.

4. If no advertisement received for 180 seconds, assume router/link dead.

5. Example. Consider router D in the following portion of an AS:

   Routing table in D:
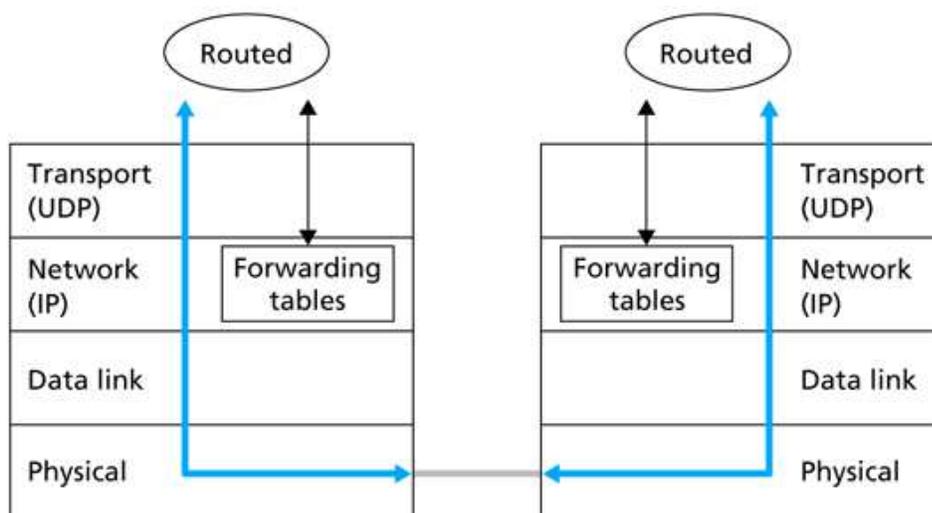
Destination Subnet	Next Router	Hop Count
w	A	2
y	B	2
z	B	7
x	–	1
. . .	. . .	. . .

Advertisement from A:

Destination Subnet	Next Router	Hop Count
z	C	4
w	–	1
x	–	1
. . .	. . .	. . .

Updated routing table in D:

Destination Subnet	Next Router	Hop Count
w	A	2
y	B	2
z	A	5
x	–	1
. . .	. . .	. . .

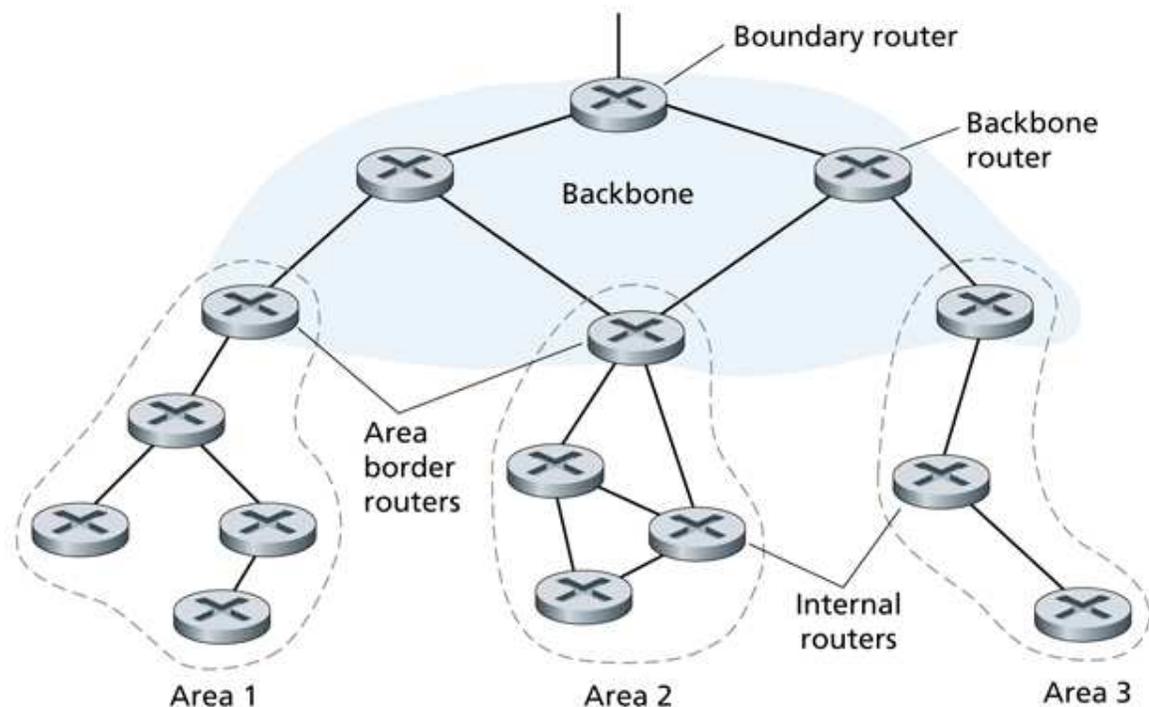6. RIP as implemented in `routed`:

2.2 OSPF

1. Link state algorithm run by each router.

   Link state info floods the network.

2. Link costs can be configured by administrator.

3. Link state updates sent each time link state changes, or every 30 minutes.

4. Envisioned as a replacement for RIP. Improvements:

   (a) Security — Authentication can be implemented.

   (b) Multiple same-cost paths.

   (c) Integrated support for unicast and multicast routing.

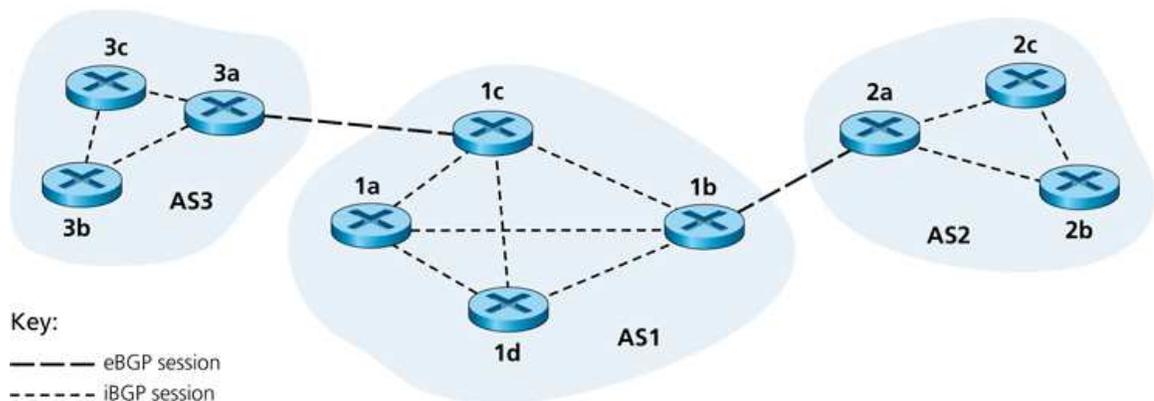   (d) Support for hierarchy within a single AS.

5. Hierarchical routing in OSPF:

(a) An AS is split into areas.

(b) Each area has one or more area border routers.

Area border routers "belong" to two areas.

(c) Link state info is broadcast only within an area.

(d) One area is designated the "backbone" and routes datagrams between areas.

3 Inter-AS Routing — BGP

1. BGP enables:

   (a) Neighboring ASs to exchange subnet reachability info.

   eBGP.

   (b) Reachability info to propagate to routers internal to an AS.

   iBGP.

   (c) Routers to determine "good" routes based on reachability info and AS policy.
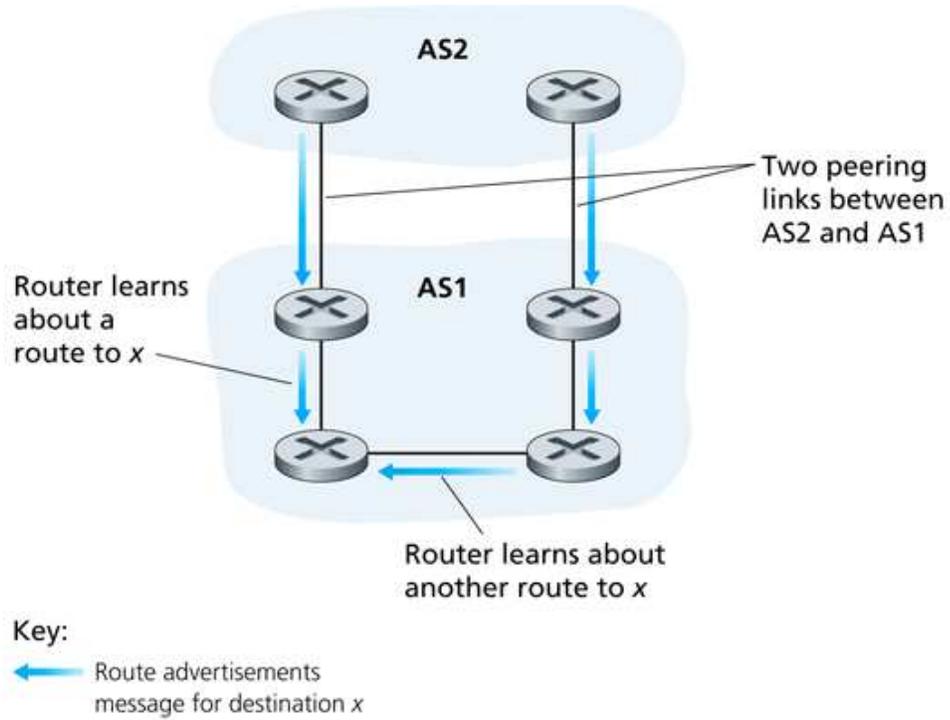

2. ASs described by ASNs.

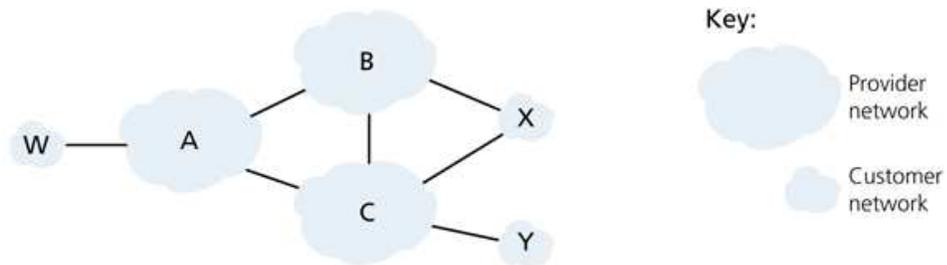3. Route described by prefix, AS-PATH, and NEXT-HOP.

   AS-PATH prevents looping and determines path "length."

   NEXT-HOP is first hop router, used to configure routing tables if route is used.

   Use NEXT-HOP and hot potato routing to determine route to subnet x:

Two peering links between AS2 and AS1

Router learns about a route to x

Router learns about another route to x

Key:
Route advertisements message for destination x

4. Import policies are used to filter routes.

Key:
Provider network
Customer network

   Policy examples:

   (a) Stub networks should only carry traffic to/from them.

(b) Multi-homed stub x should not carry traffic between B and C.

(c) B may not want to carry traffic between A and C.