



COMPUTER COMMUNICATION NETWORKS

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Inter-AS routing protocols (BGP): The Role of BGP, Advertising BGP Route Information

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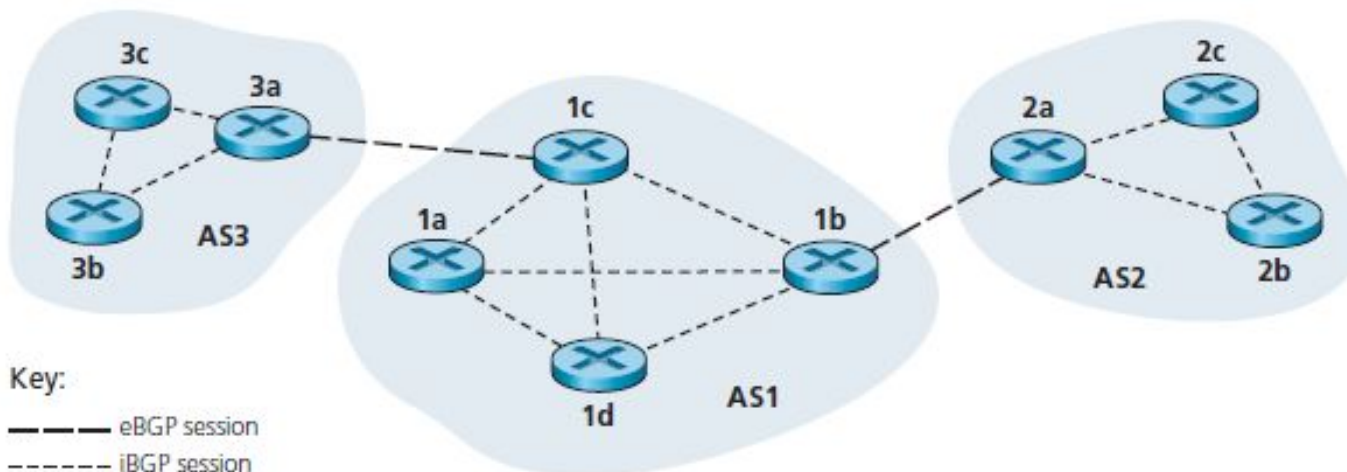
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Inter-AS routing protocols (BGP): The Role of BGP, Advertising BGP Route Information

- Routers in an AS learn about paths to networks in other ASs using policies followed by every single AS on the path

Example: AS3 can advertise its networks to AS1 based on the following:

- Amount of traffic AS3 is willing to accept (inbound)
- Amount of traffic AS1 is willing to carry (outbound)
- Amount of cost incurred by AS3



Example (contd.):

- AS1 is not obligated to advertise the networks announced by AS3
- Thus each AS controls the amount of traffic it wishes to carry
- In other words, each AS controls the routes which propagate via its network based on its policies
- Example, an AS may propagate routing updates of others but may not carry traffic originating towards the advertised networks
- The **Border Gateway Protocol (BGP)** aka **path vector protocol** includes various attributes which determine how policy decisions are implemented by different ASs.

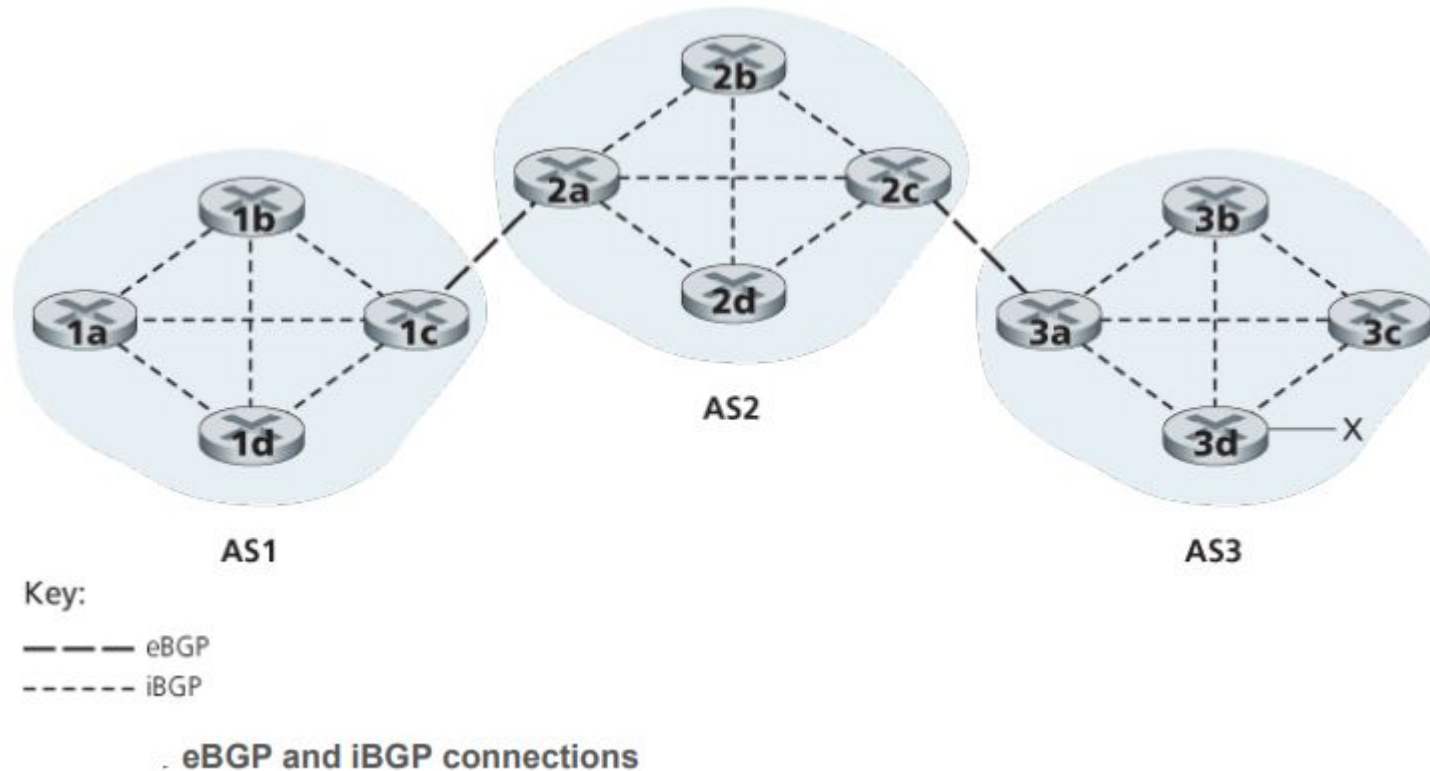
BGP (border gateway protocol):

- Current version BGP-4 is defined in RFC1771
- Used for **exchange of routing tables across Ass**
- **TCP connections** are established between routers on port **179**
- Routers exchanging BGP messages over a link are called **BGP peers** and such exchanges are called **BGP sessions**
- Sessions between gateway routers are called **eBGP sessions**
- Sessions within an AS are called **iBGP sessions**
- **Admin. distance** of **iBGP** is **200** and that of **eBGP** is **20**
- BGP sessions carry information regarding **CIDRized prefixes**

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eBGP & iBGP Connections



BGP (border gateway protocol)(Contd.):

- BGP-4 messages are given below

Open	Used to open a neighbor relationship with another router.
Update	Used to (1) transmit information about a single route and/or (2) list multiple routes to be withdrawn.
Keepalive	Used to (1) acknowledge an Open message and (2) periodically confirm the neighbor relationship.
Notification	Send when an error condition is detected.

BGP (border gateway protocol)(Contd.):

- A BGP-4 message consists of **20-byte header** (Marker, Length and Type)
- **Marker:** Reserved for authentication. (16 bytes).
 - The sender may insert a value in this field that would enable the recipient to verify the identity of the sender.
- **Length:** Length of message in bytes. (2 bytes)
- **Type:** Type of message: Open, Update, Notification, Keepalive. (1 byte)

BGP (border gateway protocol) Operation:

- Three functional procedures are involved in BGP: **Neighbor acquisition; Neighbor reachability; Network reachability**
- To perform neighbor acquisition, two routers send Open messages to each other after a TCP connection is established
- If each router accepts the request, it returns a Keepalive message in response
- After neighbor acquisition, the two routers periodically issue Keepalive messages to each other to ensure neighbor reachability
- Each router maintains a database of the networks that it can reach and the preferred route for reaching each network
- When a change is made to this database, the router broadcasts Update message to all other routers implementing BGP

BGP Open message:

- It identifies the AS to which the sender belongs and provides the IP address of the router.
- It also includes a Hold Time parameter to indicate the number of seconds that the sender proposes for the Hold Timer
- If the recipient accepts the open message, it calculates a value of Hold Timer that is the minimum of its Hold Time and the Hold Time in the Open message.

BGP Keepalive message

- It consists simply of the header.
- Each router issues these messages to each of its peers often enough to prevent the Hold Timer from expiring.

BGP Update message:

- It communicates two types of information:
 - Information about a single route through the internet which may be added to the database of any recipient router.
 - A list of routes previously advertised by this router that are being withdrawn.
- Information about a single route through the network involves three fields:
 - Network Layer Reachability Information (NLRI) field
 - Total Path Attributes Length field
 - Path Attributes field
- The NLRI field consists of a list of identifiers of networks that can be reached by this route.
 - Each network is identified by its IP address.

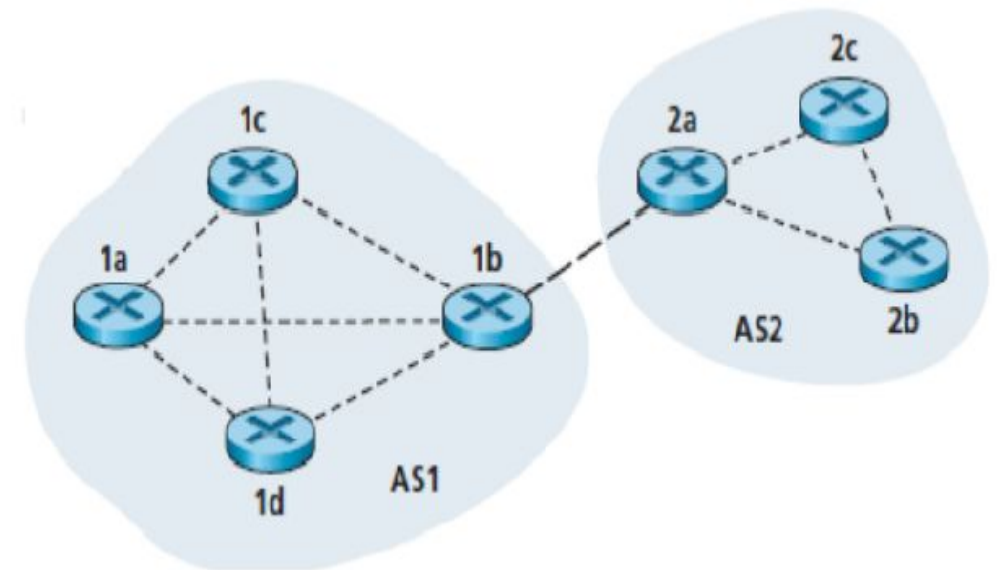
BGP Update message (Contd):

- Path attributes include the following:
- **Origin:** Indicates whether this information was generated by an inter/intra AS routing protocol.
- **AS_Path:** A list of the ASs that are traversed for this route.
- **Next_Hop:** The IP address of the border router that should be used as the next hop to the destinations listed in the NLRI field.
- **Multi_Exit_Discriminator:** Provides a preference to eBGP peers to a specific inbound router.
- **Local_Pref:** Used by a router to inform other routers within the same AS of its degree of preference for a particular route.
 - It has no significance to routers in other ASs.
- **Atomic_Aggregate, Aggregator:** These two fields implement the concept of route aggregation

Numerical 1:

Using the illustration given below, explain how the network prefixes advertised from AS1 reach router 2b and how does it update its forwarding table. Briefly state the purpose of the following BGP path attributes:

- a) Next_Hop and
- b) AS_Path.
- c) What are the likely values of Next_Hop and AS_Path router 2b will observe?

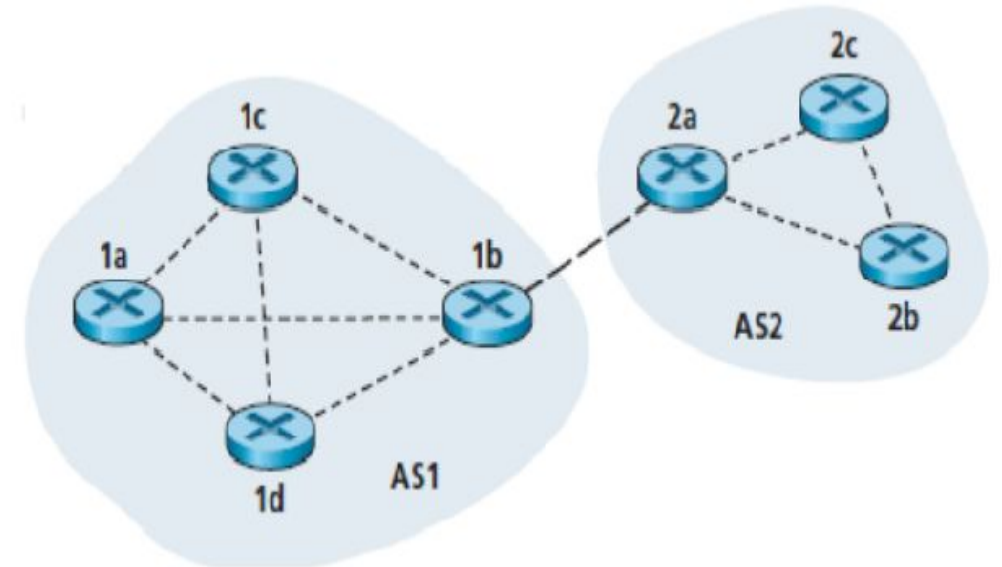


Solution

- a) Router 1b AS1 in AS1 advertises the BGP update message to 2a in AS2 over an eBGP session.
- b) Router 2b in AS2 can receive the BGP update message via 2a and 2c over iBGP sessions
- c) Router 2b uses the path attributes in the update messages received, to update its routing table with the network prefixes advertised by AS1.

Next_Hop: A recipient of the BGP update message uses the IP address provided in this attribute as the next hop to the destinations advertised. The value of Next_Hop will be the IP address of an interface in router 2a which initiated the iBGP session

AS_Path: A list of the ASs that are traversed for this route. It prevents in looping of BGP advertisements. The value of AS_Path in the question will be AS1





THANK YOU

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