

BGP: Border Gateway Protocol (BGP Router Startup)			
Internet		EventHelix.com/EventStudio 2.5	
AS 65033		21-Jan-06 07:14 (Page 1)	
BGP Router 1	BGP Router 2		

LEG: Brief

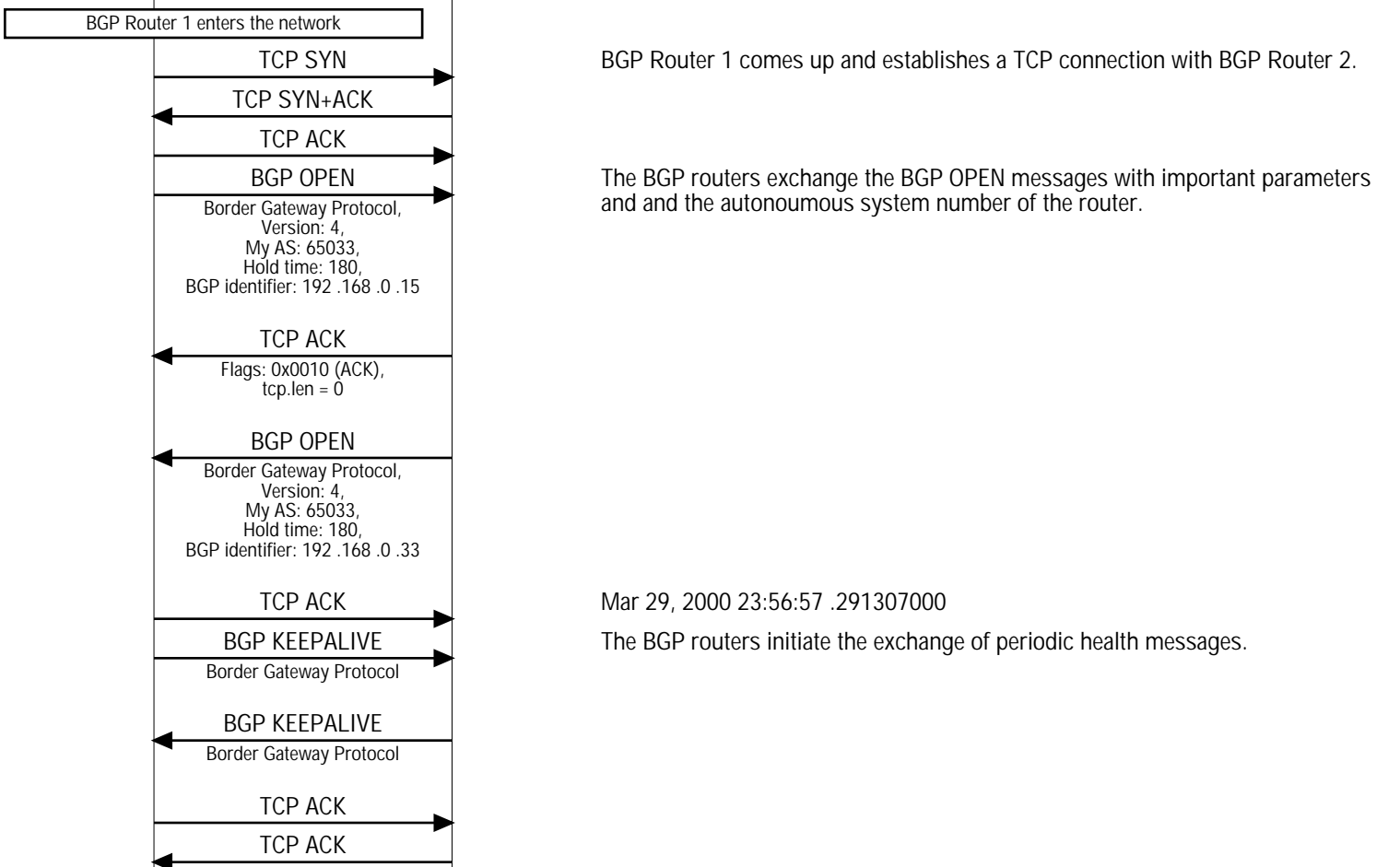
This sequence diagram was generated with EventStudio System Designer 2.5 (<http://www.EventHelix.com/EventStudio>). The diagram is based on an Ethereal capture obtained from: <http://wiki.ethereal.com/SampleCaptures>.

The Border Gateway Protocol (BGP) is an inter-autonomous system routing protocol. An autonomous system is a group of networks under common administrative control and routing policies.

This sequence diagram describes the sequence of messages exchanged when a new BGP router is made operational. The steps involved are:

1. Establish TCP connections
2. Exchange BGP Open messages.
3. Start periodic exchange of Keepalive messages.
4. Exchange routing information with the BGP Update message.

For a detailed description of BGP, refer to RFC 1771.



BGP Router 1 comes up and establishes a TCP connection with BGP Router 2.

The BGP routers exchange the BGP OPEN messages with important parameters and the autonomous system number of the router.

Mar 29, 2000 23:56:57 .291307000

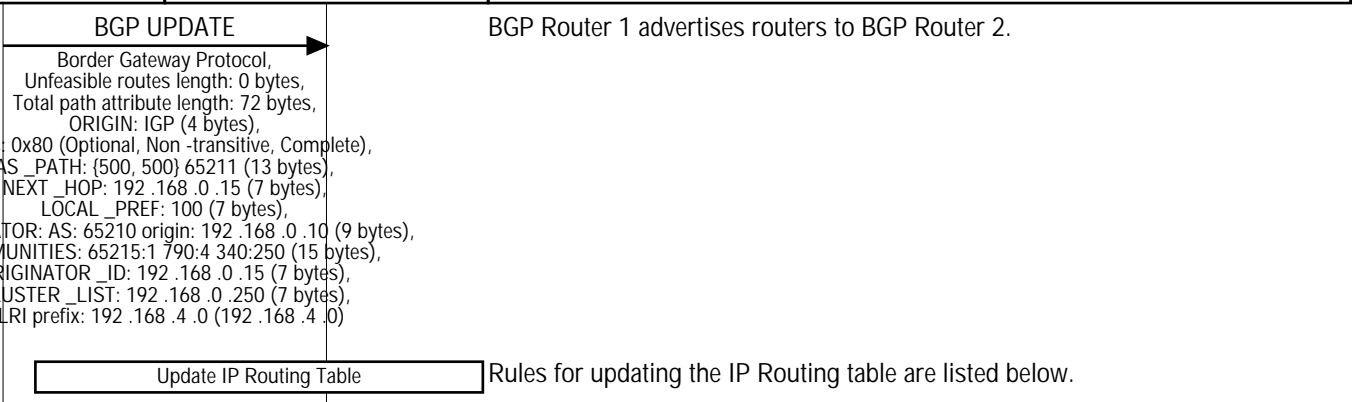
The BGP routers initiate the exchange of periodic health messages.

After the initial handshake, the routers exchange the BGP Update messages. The attributes exchanged during BGP Update coupled with router specific configuration govern the route selection. Important factors are:

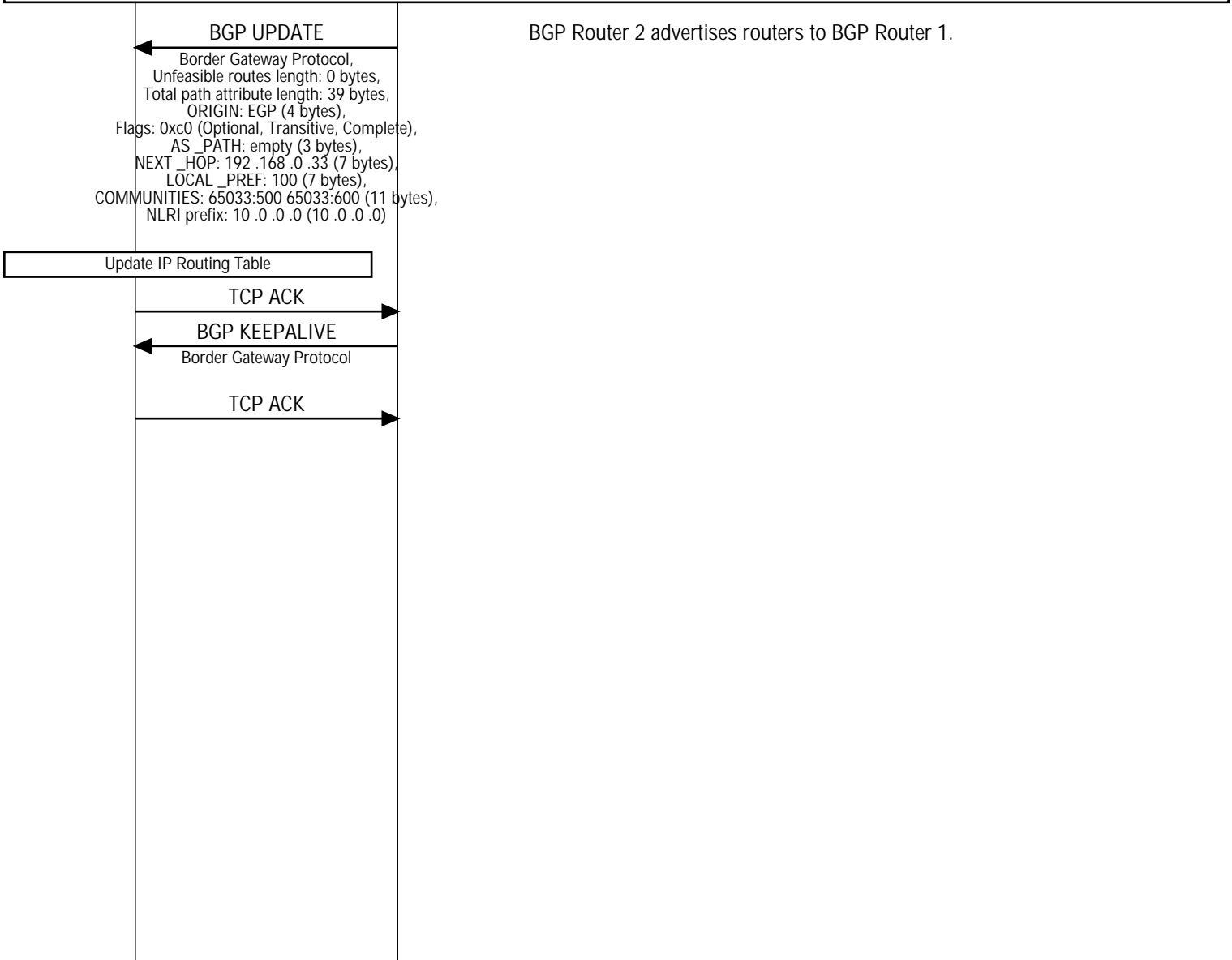
- Router level configuration of the weights.
- Local preference settings on the routers.
- Metric suggestions from the advertising router. (Multi-exist discriminator)
- Origin of the route (EGP, IGP or Unknown-Origin)
- AS_Path: Autonomous System (AS) Path of the advertised route (i.e. the list of Autonomous Systems in the route advertisement path.)
- Next Hop: IP Address used to reach the advertising EBGP router.
- Community:
 - No-Export: Routes learnt with this community setting cannot be advertised to other AS.
 - No-Advertise: Routes learnt with this attribute cannot be advertised to IGP.
 - Internet: Routes can be advertised to any BGP router in the Internet.

BGP: Border Gateway Protocol (BGP Router Startup)

Internet		EventHelix.com/EventStudio 2.5
AS 65033		
BGP Router 1	BGP Router 2	21-Jan-06 07:14 (Page 2)

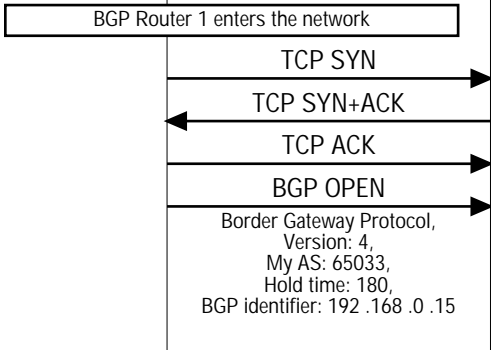


- If the path specifies a next hop that is inaccessible, drop the update.
- Prefer the path with the largest weight.
- If the weights are the same, prefer the path with the largest local preference.
- If the local preferences are the same, prefer the path that was originated by BGP running on this router.
- If no route was originated by this router, prefer the route that has the shortest AS_path.
- If all paths have the same AS_path length, prefer the path based on the origin (IGP is preferred over EGP, and EGP is preferred over Origin-Unknown).
- If the origin codes are the same, prefer the path with the lowest MED attribute (Metric suggestion from the advertising router).
- If the paths have the same MED, prefer the external path over the internal path.
- If the paths are still the same, prefer the path through the closest IGP neighbor.
- Prefer the path with the lowest IP address, as specified by the BGP router ID.



BGP: Border Gateway Protocol (BGP Router Startup (Detailed))		
Internet		EventHelix.com/EventStudio 2.5
AS 65033		
BGP Router 1	BGP Router 2	21-Jan-06 07:14 (Page 3)

LEG: Detailed

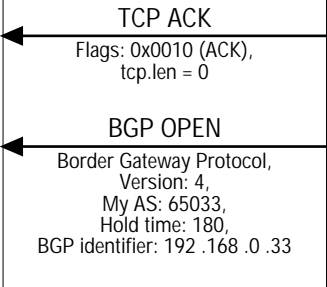


BGP Router 1 comes up and establishes a TCP connection with BGP Router 2.

The BGP routers exchange the BGP OPEN messages with important parameters and the autonomous system number of the router.

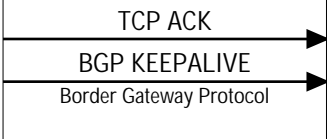
```

OPEN Message
Marker: 16 bytes
Length: 29 bytes
Type: OPEN Message (1)
Version: 4
My AS: 65033
Hold time: 180
BGP identifier: 192.168.0.15
Optional parameters length: 0 bytes
  
```



```

OPEN Message
Marker: 16 bytes
Length: 29 bytes
Type: OPEN Message (1)
Version: 4
My AS: 65033
Hold time: 180
BGP identifier: 192.168.0.33
Optional parameters length: 0 bytes
  
```



Mar 29, 2000 23:56:57 .291307000

The BGP routers initiate the exchange of periodic health messages.

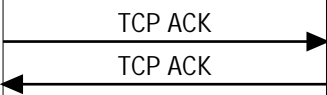
```

KEEPALIVE Message
Marker: 16 bytes
Length: 19 bytes
Type: KEEPALIVE Message (4)
  
```



```

KEEPALIVE Message
Marker: 16 bytes
Length: 19 bytes
Type: KEEPALIVE Message (4)
  
```



After the initial handshake, the routers exchange the BGP Update messages. The attributes exchanged during BGP Update coupled with router specific configuration govern the route selection. Important factors are:

- Router level configuration of the weights.
- Local preference settings on the routers.
- Metric suggestions from the advertising router. (Multi-exist discriminator)

BGP: Border Gateway Protocol (BGP Router Startup (Detailed))

Internet		EventHelix.com/EventStudio 2.5
AS 65033		
BGP Router 1	BGP Router 2	21-Jan-06 07:14 (Page 4)

- Origin of the route (EGP, IGP or Unknown-Origin)
- AS_Path: Autonomous System (AS) Path of the advertised route (i.e. the list of Autonomous Systems in the route advertisement path.)
- Next Hop: IP Address used to reach the advertising EBGp router.
- Community:
 - No-Export: Routes learnt with this community setting cannot be advertised to other AS.
 - No-Advertise: Routes learnt with this attribute cannot be advertised to IGP.
 - Internet: Routes can be advertised to any BGP router in the Internet.

BGP UPDATE BGP Router 1 advertises routers to BGP Router 2.

Border Gateway Protocol,
Unfeasible routes length: 0 bytes,
Total path attribute length: 72 bytes,
ORIGIN: IGP (4 bytes),
Flags: 0x80 (Optional, Non-transitive, Complete),
AS_PATH: {500, 500} 65211 (13 bytes),
NEXT_HOP: 192.168.0.15 (7 bytes),
LOCAL_PREF: 100 (7 bytes),
AGGREGATOR: AS: 65210 origin: 192.168.0.10 (9 bytes),
COMMUNITIES: 65215:1 790:4 340:250 (15 bytes),
ORIGINATOR_ID: 192.168.0.15 (7 bytes),
CLUSTER_LIST: 192.168.0.250 (7 bytes),
NLRI prefix: 192.168.4.0 (192.168.4.0)

```
UPDATE Message
Marker: 16 bytes
Length: 98 bytes
Type: UPDATE Message (2)
Unfeasible routes length: 0 bytes
Total path attribute length: 72 bytes
Path attributes
  ORIGIN: INCOMPLETE (4 bytes)
    Flags: 0x40 (Well-known, Transitive, Complete)
    Type code: ORIGIN (1)
    Length: 1 byte
    Origin: INCOMPLETE (2)
  AS_PATH: {500, 500} 65211 (13 bytes)
    Flags: 0x40 (Well-known, Transitive, Complete)
    Type code: AS_PATH (2)
    Length: 10 bytes
    AS path: {500, 500} 65211
      AS path segment: {500, 500}
        Path segment type: AS_SET (1)
        Path segment length: 2 ASs
        Path segment value: 500 500
      AS path segment: 65211
        Path segment type: AS_SEQUENCE (2)
        Path segment length: 1 AS
        Path segment value: 65211
  NEXT_HOP: 192.168.0.15 (7 bytes)
    Flags: 0x40 (Well-known, Transitive, Complete)
    Type code: NEXT_HOP (3)
    Length: 4 bytes
    Next hop: 192.168.0.15 (192.168.0.15)
  LOCAL_PREF: 100 (7 bytes)
    Flags: 0x40 (Well-known, Transitive, Complete)
    Type code: LOCAL_PREF (5)
    Length: 4 bytes
    Local preference: 100
  ATOMIC_AGGREGATE (3 bytes)
    Flags: 0x40 (Well-known, Transitive, Complete)
    Type code: ATOMIC_AGGREGATE (6)
    Length: 0 bytes
  AGGREGATOR: AS: 65210 origin: 192.168.0.10 (9 bytes)
    Flags: 0xc0 (Optional, Transitive, Complete)
    Type code: AGGREGATOR (7)
    Length: 6 bytes
    Aggregator AS: 65210
    Aggregator origin: 192.168.0.10 (192.168.0.10)
  COMMUNITIES: 65215:1 790:4 340:250 (15 bytes)
    Flags: 0xc0 (Optional, Transitive, Complete)
    Type code: COMMUNITIES (8)
    Length: 12 bytes
    Communities: 65215:1 790:4 340:250
      Community: 65215:1
        Community AS: 65215
        Community value: 1
      Community: 790:4
        Community AS: 790
        Community value: 4
      Community: 340:250
        Community AS: 340
        Community value: 250
```

BGP: Border Gateway Protocol (BGP Router Startup (Detailed))

Internet		EventHelix.com/EventStudio 2.5
AS 65033		
BGP Router 1	BGP Router 2	21-Jan-06 07:14 (Page 5)

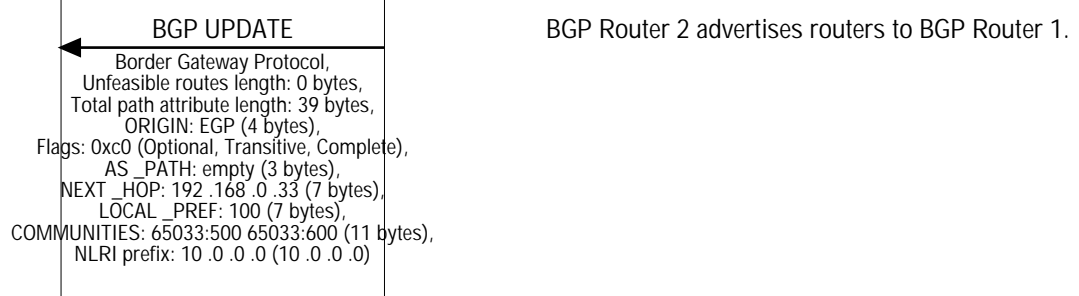
```

ORIGINATOR_ID: 192.168.0.15 (7 bytes)
  Flags: 0x80 (Optional, Non-transitive, Complete)
  Type code: ORIGINATOR_ID (9)
  Length: 4 bytes
  Originator identifier: 192.168.0.15 (192.168.0.15)
CLUSTER_LIST: 192.168.0.250 (7 bytes)
  Flags: 0x80 (Optional, Non-transitive, Complete)
  Type code: CLUSTER_LIST (10)
  Length: 4 bytes
  Cluster list: 192.168.0.250
  Cluster List: COA800FA
Network layer reachability information: 3 bytes
172.16.0.0/16
  NLRI prefix length: 16
  NLRI prefix: 172.16.0.0 (172.16.0.0)
    
```

Update IP Routing Table

 Rules for updating the IP Routing table are listed below.

- If the path specifies a next hop that is inaccessible, drop the update.
- Prefer the path with the largest weight.
- If the weights are the same, prefer the path with the largest local preference.
- If the local preferences are the same, prefer the path that was originated by BGP running on this router.
- If no route was originated by this router, prefer the route that has the shortest AS_path.
- If all paths have the same AS_path length, prefer the path based on the origin (IGP is preferred over EGP, and EGP is preferred over Origin-Unknown).
- If the origin codes are the same, prefer the path with the lowest MED attribute (Metric suggestion from the advertising router).
- If the paths have the same MED, prefer the external path over the internal path.
- If the paths are still the same, prefer the path through the closest IGP neighbor.
- Prefer the path with the lowest IP address, as specified by the BGP router ID.



```

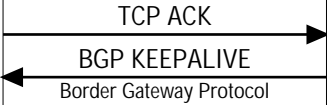
UPDATE Message
Marker: 16 bytes
Length: 64 bytes
Type: UPDATE Message (2)
Unfeasible routes length: 0 bytes
Total path attribute length: 39 bytes
Path attributes
  ORIGIN: EGP (4 bytes)
    Flags: 0x40 (Well-known, Transitive, Complete)
    Type code: ORIGIN (1)
    Length: 1 byte
    Origin: EGP (1)
  AS_PATH: empty (3 bytes)
    Flags: 0x40 (Well-known, Transitive, Complete)
    Type code: AS_PATH (2)
    Length: 0 bytes
    AS path: empty
  NEXT_HOP: 192.168.0.33 (7 bytes)
    Flags: 0x40 (Well-known, Transitive, Complete)
    Type code: NEXT_HOP (3)
    Length: 4 bytes
    Next hop: 192.168.0.33 (192.168.0.33)
  MULTI_EXIT_DISC: 0 (7 bytes)
    Flags: 0x80 (Optional, Non-transitive, Complete)
    Type code: MULTI_EXIT_DISC (4)
    Length: 4 bytes
    Multiple exit discriminator: 0
  LOCAL_PREF: 100 (7 bytes)
    Flags: 0x40 (Well-known, Transitive, Complete)
    Type code: LOCAL_PREF (5)
    Length: 4 bytes
    Local preference: 100
  COMMUNITIES: 65033:500 65033:600 (11 bytes)
    Flags: 0xc0 (Optional, Transitive, Complete)
    Type code: COMMUNITIES (8)
    Length: 8 bytes
    Communities: 65033:500 65033:600
      Community: 65033:500
      Community AS: 65033
    
```

BGP: Border Gateway Protocol (BGP Router Startup (Detailed))

Internet		EventHelix.com/EventStudio 2.5
AS 65033		
BGP Router 1	BGP Router 2	21-Jan-06 07:14 (Page 6)

Community value: 500
Community: 65033:600
Community AS: 65033
Community value: 600
Network layer reachability information: 2 bytes
10.0.0.0/8
NLRI prefix length: 8
NLRI prefix: 10.0.0.0 (10.0.0.0)

Update IP Routing Table



KEEPALIVE Message
Marker: 16 bytes
Length: 19 bytes
Type: KEEPALIVE Message (4)

