# BGP (Border Gateway Routing Protocol)

Autonomous Systems

- Network under one administrative control
- AS number is unique for every organization assigned by IANA http://www.iana.org/assignments/as-numbers/as-numbers.xhtml
- BGP as the only routing protocol for the Internet (between Autonomous Systems)
- Range of AS 0 – 65535 and 0 – 4.294.967.295
- For private usage 64512 - 65534 and 4200000000 - 4294967294

Autonomous Systems
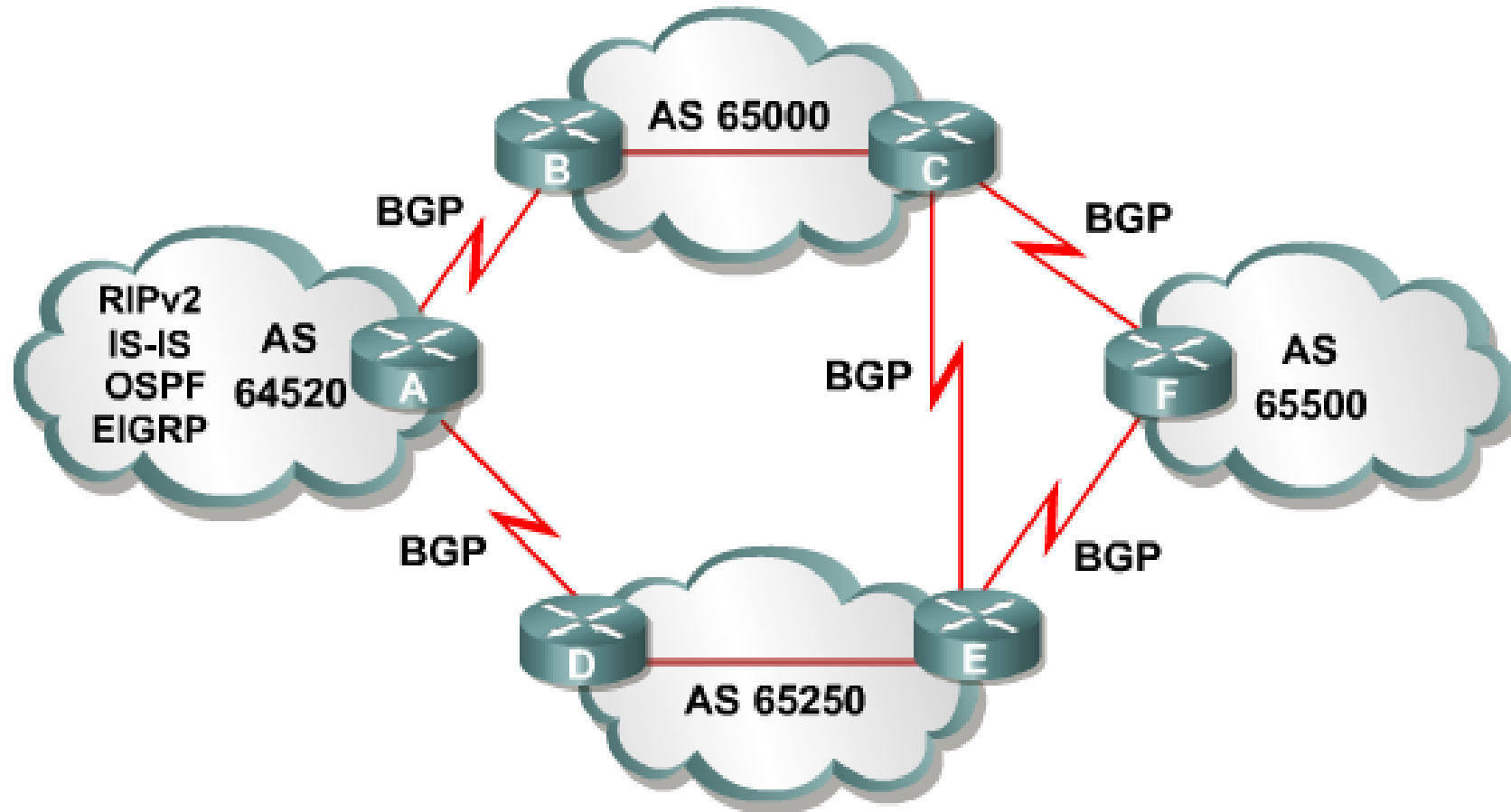
Autonomous Systems

Depending on the type of the company AS can be divided:
- Stub AS/Single-homed AS (small-medium companies that requires their own address space-loadbalancing, visibility, avoiding NAT…)
- Multi-homed AS non transit (big companies with redundancy requirements but not willing to route Internet traffic through their own network)
- Multi-homed AS transit (ISP)

Stub

Non transit

Transit
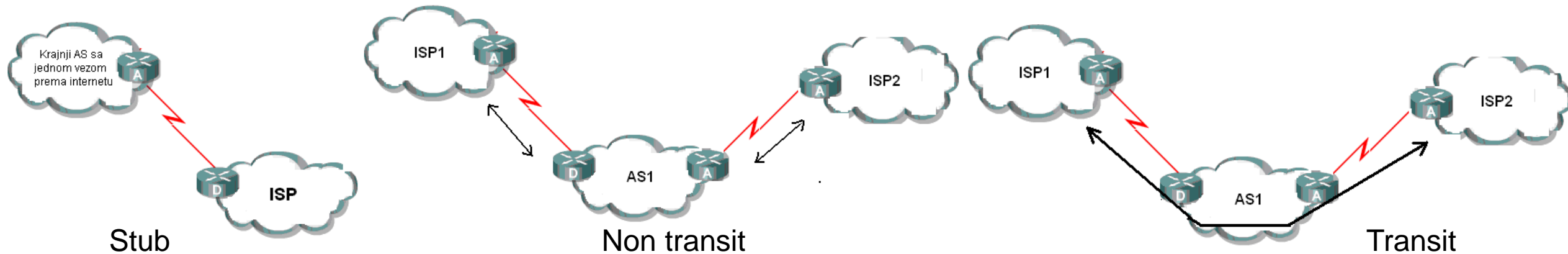
BGP (Border Gateway Protocol)

- **iBGP** – internal BGP
  Inside ones Autonomous System (one company)

- **eBGP** – external BGP
  For connecting with Internet/other AS
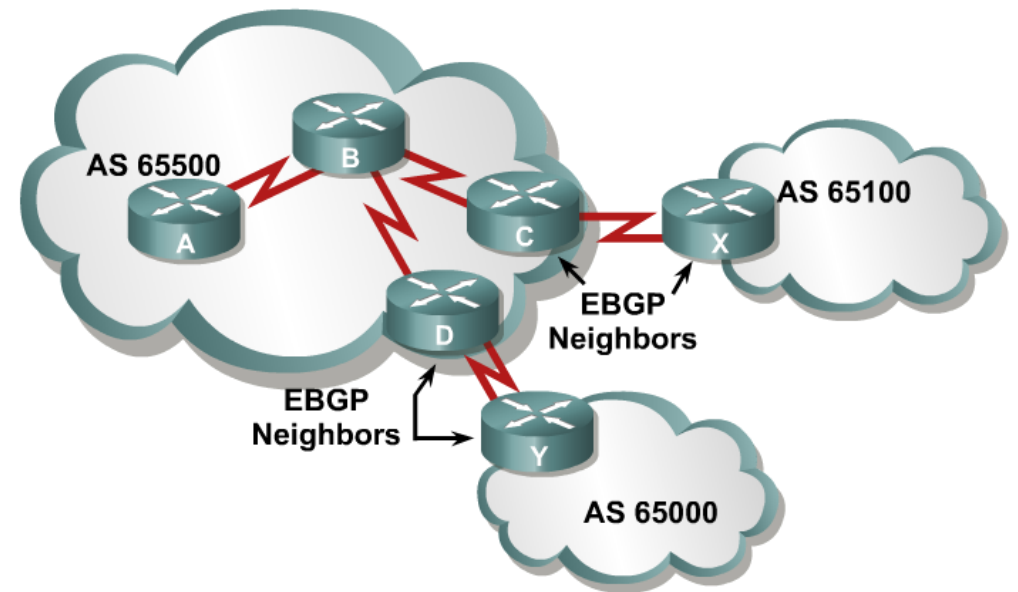
BGP (Border Gateway Protocol)

- For BGP to work we must ensure L3 connectivity between neighbours (neighbours must be able to reach eachother)
- BGP neighbours establish TCP connection over port 179
- Normally neighbours are directly connected but they can be connected over multiple routers
- Some underlying routing protocol must be functional to enable connectivity between remote neighbours
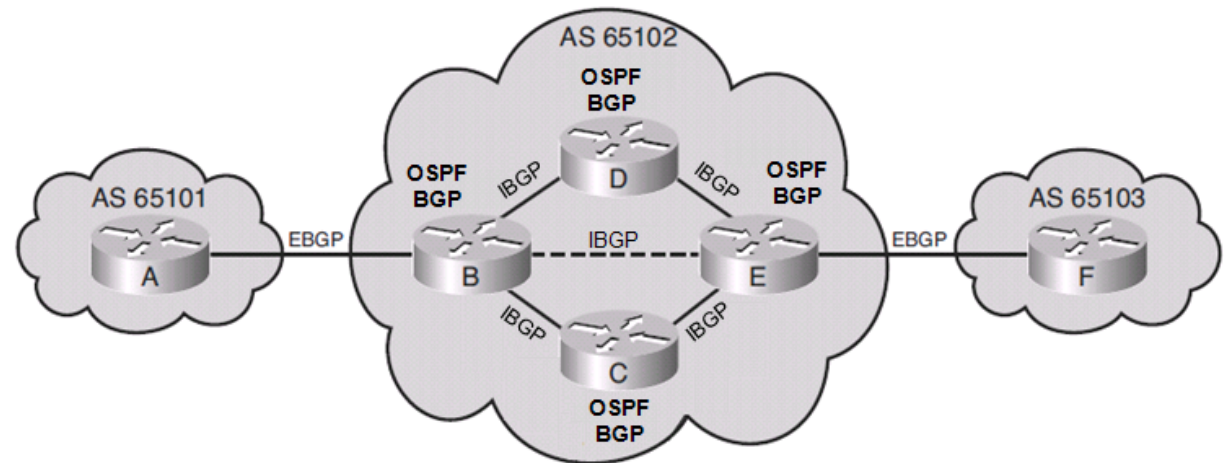
BGP (Border Gateway Protocol)

- eBGP Loop prevention is based on AS-PATH atribute-no route will be accepted if the BGP router sees his own AS number in the AS-PATH attribute
- iBGP- Split horizon rule says that routes learned from one iBGP neighbour will NOT be propagated to another iBGP neighbour (peer)-iBGP requires full-mesh topology

BGP (Border Gateway Protocol)

BGP maintains three tables
- Neighbour table
- BGP table
- IP routing table

BGP (Border Gateway Protocol)

```
R1#show ip bgp summary
BGP router identifier 99.1.14.1, local AS number 1111
BGP table version is 12, main routing table version 12
11 network entries using 1287 bytes of memory
18 path entries using 936 bytes of memory
11/7 BGP path/bestpath attribute entries using 1364 bytes of memory
5 BGP AS-PATH entries using 120 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 3707 total bytes of memory
BGP activity 11/0 prefixes, 18/0 paths, scan interval 60 secs


Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
99.1.22.22      4  1111       9       8       12    0    0 00:01:03           8
99.1.33.33      4  1111       6       8       12    0    0 00:01:01           2
99.2.11.11      4  2222      11       8       12    0    0 00:01:34           7
R1#
```

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BGP (Border Gateway Protocol)


```
R1#show ip bgp
BGP table version is 12, local router ID is 99.1.14.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*>i99.1.1.0/24      99.1.200.2               0    100      0 64512 i
*>i99.1.13.0/24     99.1.33.33               0    100      0 i
*> 99.1.14.0/24     0.0.0.0                  0         32768 i
*>i99.1.15.0/24     99.1.22.22               0    100      0 i
*  i99.2.1.0/24     99.1.22.22               0    100      0 2222 i
*>                  99.2.11.11               0             0 2222 i
*  i99.2.2.0/24     99.1.22.22               0    100      0 2222 i
*>                  99.2.11.11                             0 2222 i
*>i99.3.1.0/24      99.1.22.22               0    100      0 3333 i
*                   99.2.11.11                             0 2222 4444 3333 i
*  i99.4.0.0/24     99.1.22.22               0    100      0 2222 4444 i
*>                  99.2.11.11                             0 2222 4444 i
*  i99.4.1.0/24     99.1.22.22               0    100      0 2222 4444 i
*>                  99.2.11.11                             0 2222 4444 i
*  i99.4.2.0/24     99.1.22.22               0    100      0 2222 4444 i
*>                  99.2.11.11                             0 2222 4444 i
*  i99.4.3.0/24     99.1.22.22               0    100      0 2222 4444 i
```

BGP (Border Gateway Protocol)

```
      99.0.0.0/8 is variably subnetted, 16 subnets, 3 masks
B        99.2.1.0/24 [20/0] via 99.2.11.11, 00:06:01
B        99.3.1.0/24 [200/0] via 99.1.22.22, 00:06:01
S        99.2.11.11/32 [1/0] via 93.200.201.1
O        99.1.33.33/32 [110/11] via 10.1.1.6, 00:06:37, FastEthernet0/1
O        99.1.22.22/32 [110/11] via 10.1.1.2, 00:06:37, FastEthernet0/0
B        99.2.2.0/24 [20/0] via 99.2.11.11, 00:06:01
B        99.1.1.0/24 [200/0] via 99.1.200.2, 00:06:00
B        99.4.3.0/24 [20/0] via 99.2.11.11, 00:06:02
B        99.4.2.0/24 [20/0] via 99.2.11.11, 00:06:02
B        99.4.1.0/24 [20/0] via 99.2.11.11, 00:06:02
B        99.4.0.0/24 [20/0] via 99.2.11.11, 00:06:02
C        99.1.11.0/24 is directly connected, Loopback1
C        99.1.14.0/24 is directly connected, Loopback2
B        99.1.15.0/24 [200/0] via 99.1.22.22, 00:06:02
B        99.1.13.0/24 [200/0] via 99.1.33.33, 00:06:02
O        99.1.200.0/30 [110/74] via 10.1.1.6, 00:06:39, FastEthernet0/1
      93.0.0.0/30 is subnetted, 1 subnets
C        93.200.201.0 is directly connected, Serial0/0
      10.0.0.0/30 is subnetted, 3 subnets
O        10.1.1.8 [110/20] via 10.1.1.6, 00:06:39, FastEthernet0/1
                  [110/20] via 10.1.1.2, 00:06:39, FastEthernet0/0
C        10.1.1.0 is directly connected, FastEthernet0/0
C        10.1.1.4 is directly connected, FastEthernet0/1
R1#
```

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BGP RIB (Routing Information Failure)

```
r  99.4.11.11/32      99.1.22.22                      0 1111 1111 1111 1111 2222 ?
r>                    99.4.11.11                      0 4444 2222 ?
```

```
R5# show ip bgp 99.4.11.11 255.255.255.255
BGP routing table entry for 99.4.11.11/32, version 19
Paths: (2 available, best #2, table Default-IP-Routing-Table, RIB-failure(17))
Flag: 0x820
  Advertised to update-groups:
     2
  1111 1111 1111 1111 2222
    99.1.22.22 from 99.1.22.22 (99.1.22.22)
      Origin incomplete, localpref 100, valid, external
      Community: 3333:100
  4444 2222
    99.4.11.11 from 99.4.11.11 (99.4.11.11)
      Origin incomplete, localpref 100, valid, external, best
R5#sh ip route 99.4.11.11
Routing entry for 99.4.11.11/32
  Known via "static", distance 1, metric 0
  Routing Descriptor Blocks:
  * 95.200.202.1
      Route metric is 0, traffic share count is 1
```

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BGP Administrative Distance

Routing Protocol	Administrative distance
Directly connected interface	0
Static route out an interface	1
Static route to next-hop address	1
EIGRP summary route	5
External BGP	20
Internal EIGRP	90
IGRP	100
OSPF	110
IS-IS	115
Routing Information Protocol (RIP)	120
Exterior Gateway Protocol (EGP)	140
On Demand Routing (ODR)	160
External EIGRP	170
Internal BGP	200
DHCP-learned	254
Unknown	255

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BGP Important

- BGP holds all of the learned routes in a separate table and only the BEST routes ar transferred to the routing table of the router
- BGP table holds all of the routes that router learned from his neighbors
- Every route is described with BGP attributes
- The router will forward only the best routes

BGP attributes

1. **Well-Known** Mandatory
2. **Well-Known** Discretionary
3. Optional Transitive
4. Optional Non-Transitive

BGP attributes (not all of them)

ORIGIN	**Well-Known Mandatory**
AS_PATH	**Well-Known Mandatory**
NEXT_HOP	**Well-Known Mandatory**
LOCAL_PREF	**Well-Known Discretionary**
ATOMIC_AGGREGATE	**Well-Known Discretionary**
AGGREGATOR	**Optional Transitive**
COMMUNITY	**Optional Transitive**
MULTI_EXIT_DISC (MED)	**Optional Non-Transitive**
ORIGINATOR_ID	**Optional Non-Transitive**
CLUSTER LIST	**Optional Non-Transitive**
MULTIPROTOCOL Reachable NLRI	**Optional Non-Transitive**
MULTIPROTOCOL Unreachable NLRI	**Optional Non-Transitive**

BGP best path selection

https://www.cisco.com/c/en/us/support/docs/ip/border-gateway-protocol-bgp/13753-25.html
https://www.juniper.net/documentation/en_US/junos/topics/reference/general/routing-protocols-address-representation.html
http://support.huawei.com/enterprise/en/doc/EDOC1000079847
http://h22208.www2.hpe.com/eginfolib/networking/docs/switches/K-KA-KB/15-18/5998-8164_mrg/content/ch15s08.html

BGP best path selection in short-Cisco

1. Highest Weight (By default it is not used-higher is better)
2. Local Preference attribute (higher is better)
3. Prefer the path that was locally originated via a **network** or **aggregate** BGP subcommand or through redistribution from an IGP.
4. Shortest AS Path attribute value
5. Origin code (**i** better than **e** better than **?**)
6. Lowest MED (Multi-exit discriminator) attribute value
7. eBGP is preffered over iBGP routes

- All of the attributes can be configured independently of each other

BGP attributes

Weight

- Only locally for the router
- For choosing the exit interface (uplink)
- Higher is better
- Non transitive
- Values 0 to 65535 (local routes 32768 all other 0)
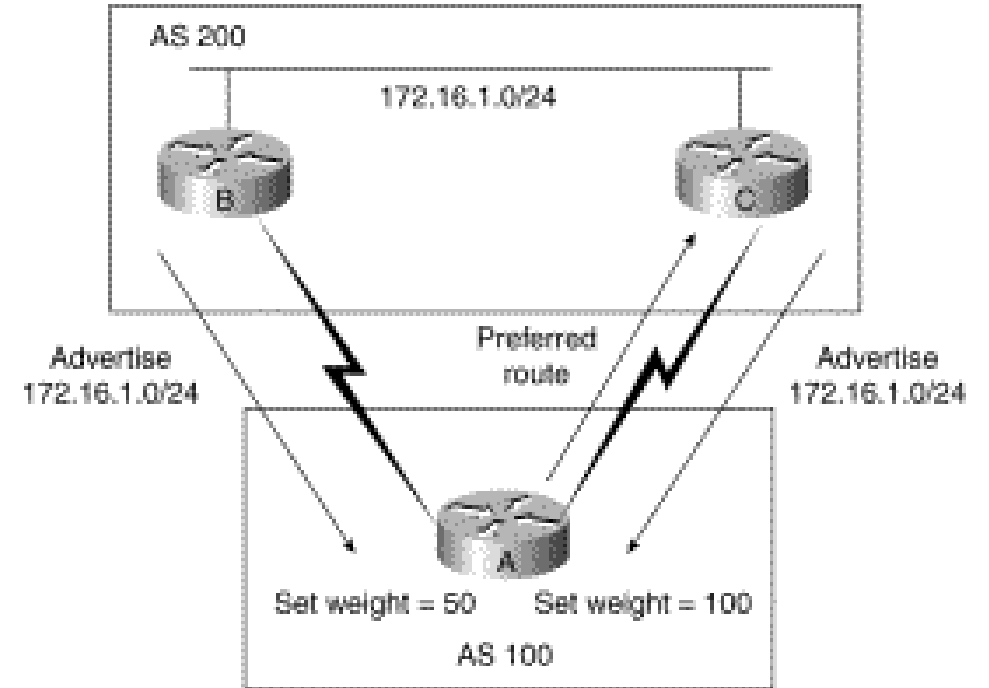
BGP attributes

Local Preference

- Configured on the router (ASBR)
- For choosing the exit path form the local AS
- Higher is better
- Well-Known Discretionary
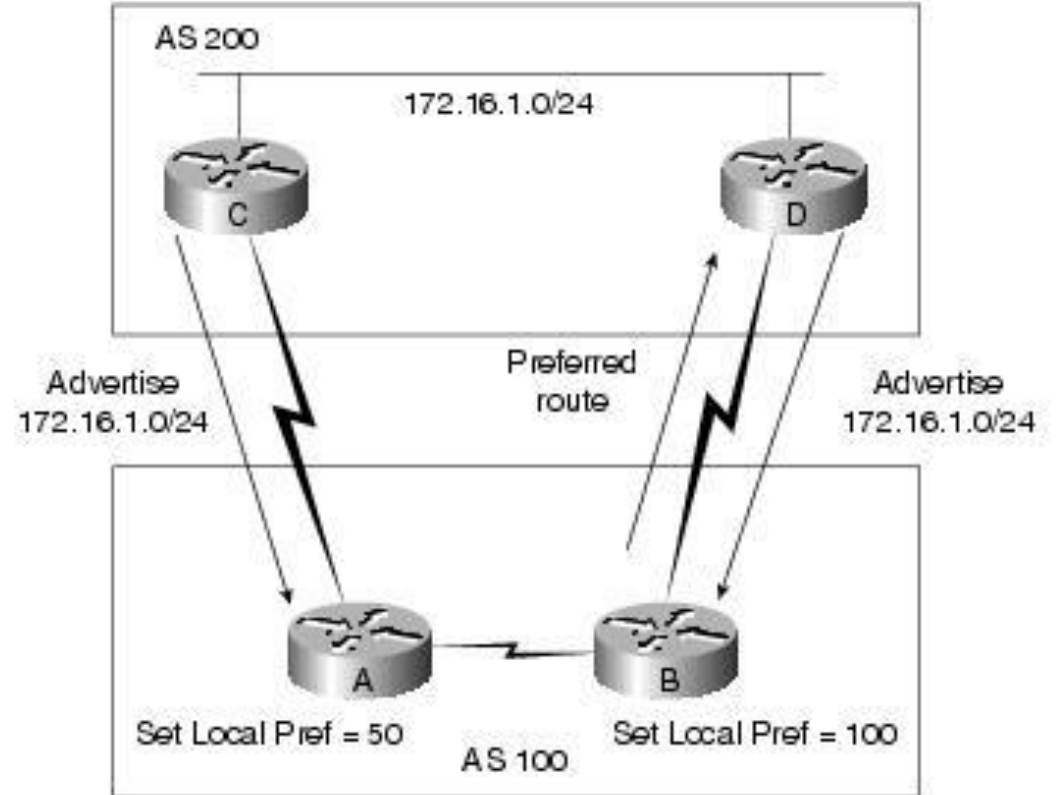
BGP attributes

AS Path

- List of all of the AS on the path to the destination network
- Loop prevention mechanism
- Shorter is better (similar to Hop-count)
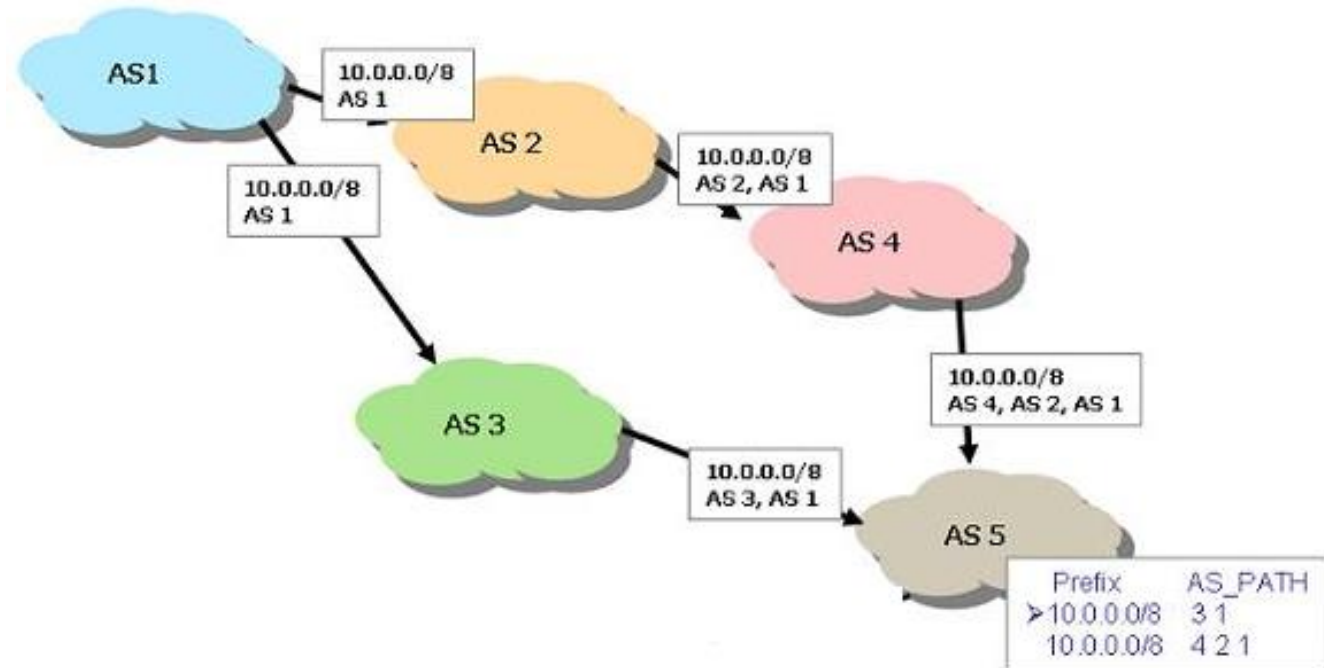
BGP attributes

Origin code

- Defines origin of the information
- IGP (i) network was advertised using network command in BGP process on some router
- EGP (e) is not used
- Redistributed network (?) –static, some other routing protocol

Static route for 77.77.77.0/24

AS300

AS400

Lo1: 88.88.88.0/24

R1

eBGP

R2

R1(config-router)#network **88.88.88.0** mask **255.255.255.0**
R1(config-router)#redistribute static

Origin code za 88.88.88.0/24 je «**i**»

Origin code za 77.77.77.0/24 je «**?**»
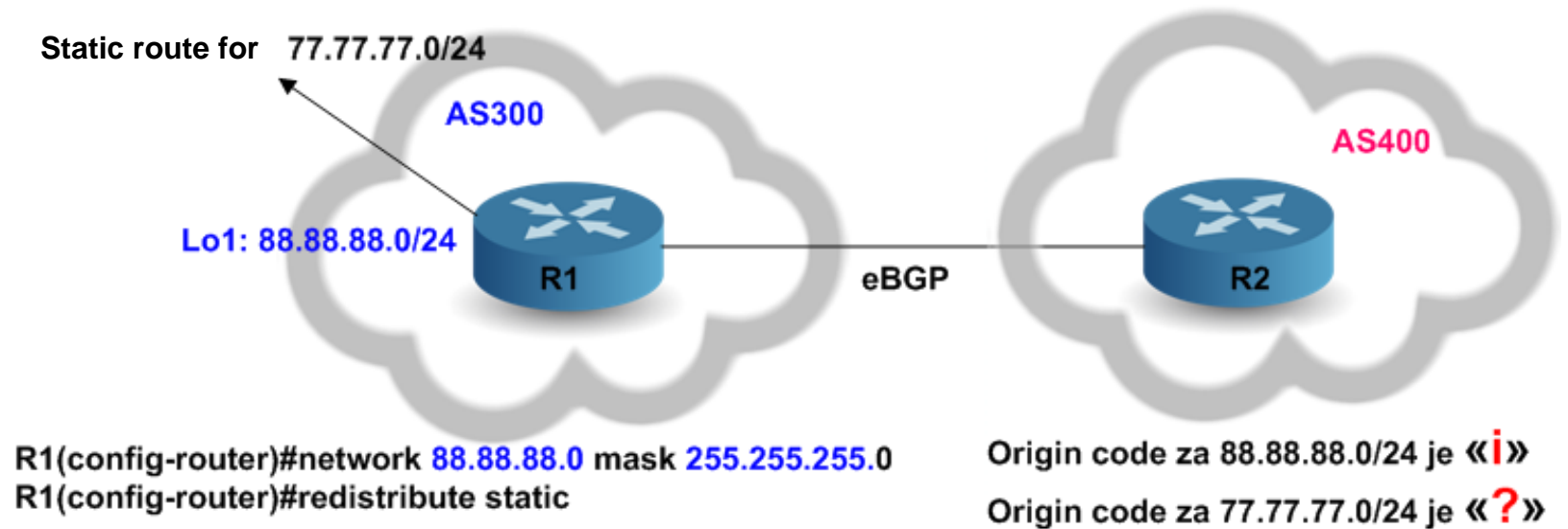
BGP attributes

MED (Multi-exit discriminator)

- It is exchanged between Autonomous systems
- For influencing return traffic
- Optional Non transitive
- Lower is better

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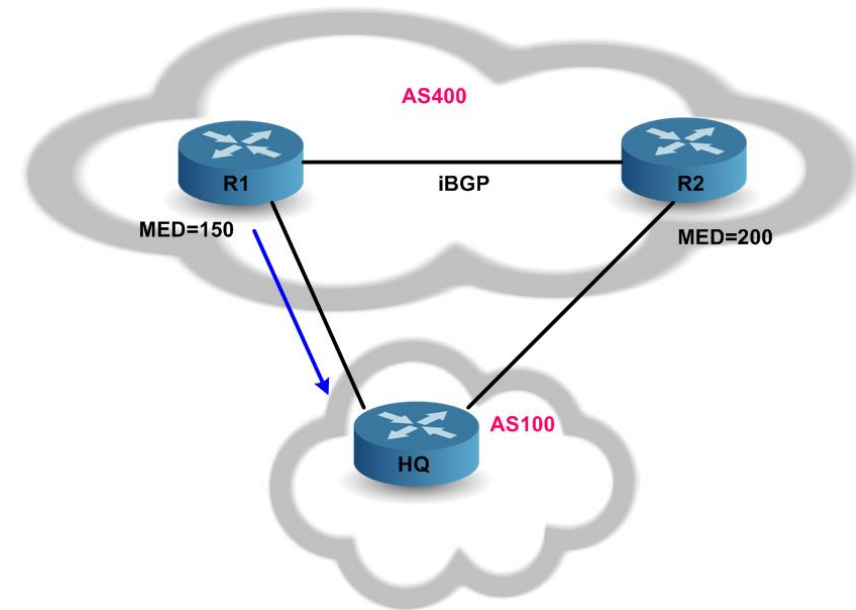
BGP influencing route exchange

1. **Distribute-list filtering**

2. **Route-map filtering**

3. **Prefix-list**

4. **Community-list**

5. **Regular expression filtering**

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BGP communities

- 32 bit number in format 16bit:16bit (eg. AS:X)
- Optional Transitive Atribut
  1. Method of „tagging" routes
  2. Used inside one AS or between AS
  3. Normally used in agreement with ISP or other AS for configuring ISP network from customer side (in limited/allowed/agreed scope)

```
R6#sh ip bgp
BGP table version is 15, local router ID is 99.2.11.11
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop         Metric LocPrf Weight Path
*>i99.1.1.0/24      99.2.22.22            0    500      0 1111 i
*                   99.1.11.11                200      0 1111 i
*>i99.1.13.0/24     99.2.22.22            0    500      0 1111 i
*                   99.1.11.11                200      0 1111 i
*>i99.1.14.0/24     99.2.22.22            0    500      0 1111 i
*                   99.1.11.11            0    200      0 1111 i
*   99.1.15.0/24    99.1.11.11                200      0 1111 i
*>i                 99.2.22.22            0    500      0 1111 i
*> 99.2.1.0/24      0.0.0.0              0          32768 i
*>i99.2.2.0/24      99.2.22.22            0    100      0 i
*> 99.3.1.0/24      99.4.11.11                         0 4444 3333 i
*> 99.4.0.0/24      99.4.11.11            0             0 4444 i
*> 99.4.1.0/24      99.4.11.11            0             0 4444 i
*> 99.4.2.0/24      99.4.11.11            0             0 4444 i
*> 99.4.3.0/24      99.4.11.11            0             0 4444 i
```

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BGP communities

USER SIDE:

R1(config)#ip bgp-community new-format

R1(config-router)#neighbor 99.2.11.11 send-community

R1(config)#access-list 50 permit 99.1.0.0 0.0.255.255

R1(config)#route-map LP200 permit 10

R1(config-route-map)#match ip address 50

R1(config-route-map)# set community 222:200

R1(config-router)# neighbor 99.2.11.11 route-map LP200 out

ISP SIDE:

R1_ISP(config)#ip bgp-community new-format

R1_ISP (config-router)#neighbor 99.1.11.11 send-community

R1_ISP (config)# ip community-list 1 permit 222:200

R1_ISP (config)#route-map LP200 permit 10

R1_ISP (config-route-map)#match community 1

R1_ISP (config-route-map)# set local-preference 200

R1_ISP (config-router)# neighbor 99.1.11.11 route-map LP200 in

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Regular expression-route filtering

- A regular expression is a search pattern
- Used for matching/finding specific strings (sequence of characters)-pattern
- Specifically in a context-using meta characters (in BGP route filtering)

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Regular expression-route filtering

Expression	Meaning
.*	Anything (wildcard)
^$	Locally originated routes
^100_	Learned from AS 100
_100$	Originated in AS 100
_100_	Any instance of AS 100
^[0-9]+$	Directly connected ASes

Symbol	Meaning
^	Start of string
$	End of string
[]	Range of characters
-	Used to specify range (i.e. [0-9])
( )	Logical grouping
.	Any single character
*	Zero or more instances
+	One or more instance
?	Zero or one instance
_	SPACE
\	mijenja značenje

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Regular expressions example-Start topology
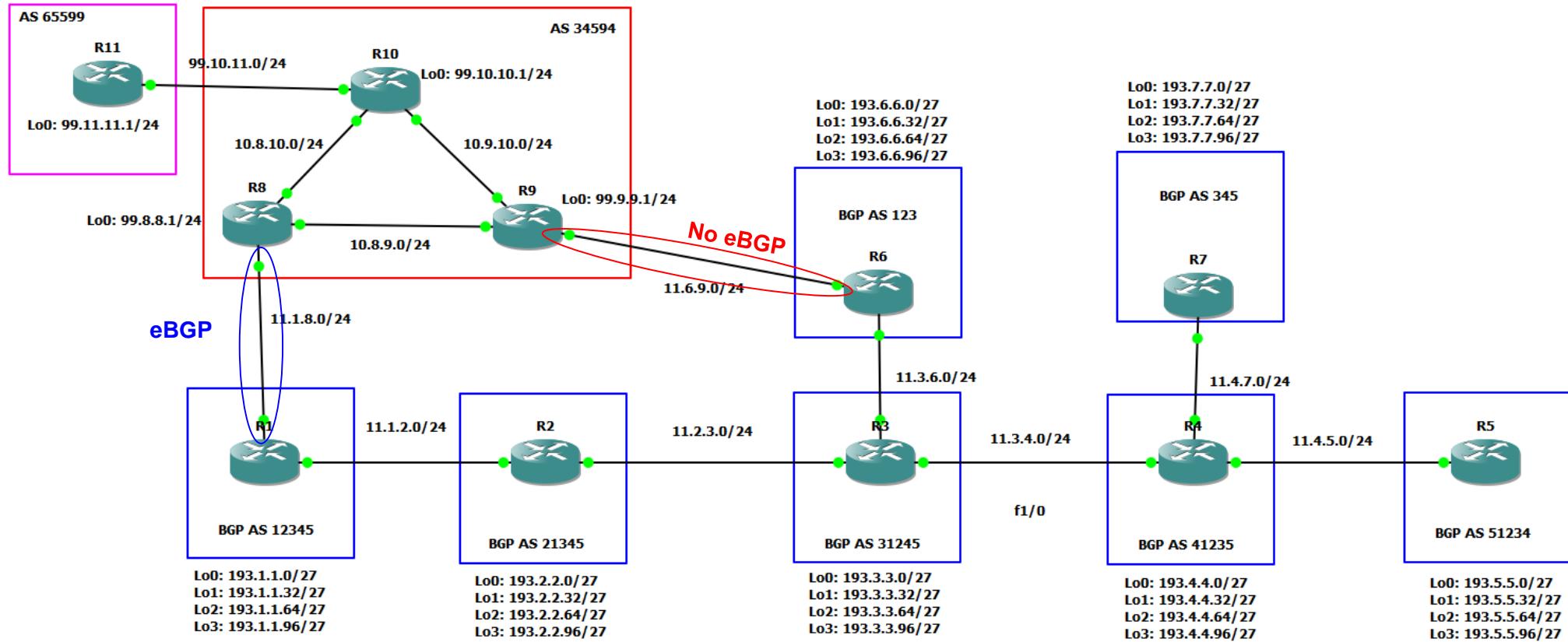
For check

R8#show ip bgp regexp ^[0-3]+$ -in the red write your filter to see the results

R8# show ip as-path-access-list

R8#show ip bgp

R8#clear ip bgp 11.1.8.1

Regular expressions example

```
R8#sh ip bgp
BGP table version is 1, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*  99.8.8.0/24      0.0.0.0                  0         32768 i
*  193.1.1.0/27     193.1.1.1                0             0 12345 i
*  193.1.1.32/27    193.1.1.1                0             0 12345 i
*  193.1.1.64/27    193.1.1.1                0             0 12345 i
*  193.1.1.96/27    193.1.1.1                0             0 12345 i
*  193.2.2.0/27     193.1.1.1                              0 12345 21345 i
*  193.2.2.32/27    193.1.1.1                              0 12345 21345 i
*  193.2.2.64/27    193.1.1.1                              0 12345 21345 i
*  193.2.2.96/27    193.1.1.1                              0 12345 21345 i
*  193.3.3.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 i
*  193.3.3.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*  193.3.3.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*  193.3.3.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*  193.4.4.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*  193.4.4.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*  193.4.4.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*  193.4.4.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*  193.5.5.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*  193.5.5.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*  193.5.5.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*  193.5.5.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*  193.7.7.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*  193.7.7.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*  193.7.7.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*  193.7.7.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
```

Regular expressions example

```
R8#conf t
R8(config)#ip as-path access-list ?
  <1-500>  AS path access list number

R8(config)#ip as-path access-list 1 ?
  deny    Specify packets to reject
  permit  Specify packets to forward

R8(config)#ip as-path access-list 1 deny ?
  LINE  A regular-expression to match BGP AS paths. Use "ctrl-v ?" to enter "?"
```

R8(config)#ip as-path access-list 1 deny 34   -It will deny all with number 34 in the AS path
R8(config)#ip as-path access-list 1 permit .*   -Permit all
```
R8(config)#route-map REGEX permit 10
R8(config-route-map)#match as-path ?
  <1-500>  AS path access-list
  <cr>

R8(config-route-map)#match as-path 1
R8(config-route-map)#exi
R8(config)#router bgp 34594
R8(config-router)#neig 193.1.1.1 route-map REGEX in
R8(config-router)#end
```
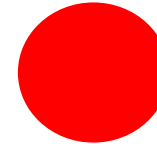
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Regular expressions example

```
R8#sh ip bgp
BGP table version is 134, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0                  0          32768 i
*> 193.1.1.0/27     193.1.1.1                0              0 12345 i
*> 193.1.1.32/27    193.1.1.1                0              0 12345 i
*> 193.1.1.64/27    193.1.1.1                0              0 12345 i
*> 193.1.1.96/27    193.1.1.1                0              0 12345 i
*> 193.2.2.0/27     193.1.1.1                               0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                               0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                               0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                               0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                               0 12345 21345 31245 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                               0 12345 21345 31245 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                               0 12345 21345 31245 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                               0 12345 21345 31245 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                               0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                               0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                               0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                               0 12345 21345 31245 31245 31245 41235 i
*> 193.5.5.0/27     193.1.1.1                               0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27    193.1.1.1                               0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27    193.1.1.1                               0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27    193.1.1.1                               0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27     193.1.1.1                               0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                               0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                               0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                               0 12345 21345 31245 31245 31245 123 i
*> 193.7.7.0/27     193.1.1.1                               0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.32/27    193.1.1.1                               0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.64/27    193.1.1.1                               0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.96/27    193.1.1.1                               0 12345 21345 31245 31245 31245 41235 345 i
R8#
```
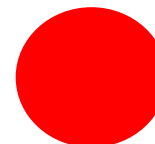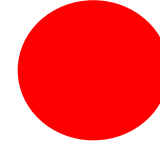
ALGEBRA

Regular expressions example

R8#sh ip bgp
BGP table version is 2, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
            r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 99.8.8.0/24	0.0.0.0	0		32768	i

Regular expressions example

-It will deny all with number 31245 in AS path
-Permit all

R8(config)#no ip as-path access-list 1 deny 34
R8(config)#no ip as-path access-list 1 permit .*
R8(config)#ip as-path access-list 1 deny 31245
R8(config)#ip as-path access-list 1 permit .*

ALGEBRA

Regular expressions example

```
R8#sh ip bgp
BGP table version is 134, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0                0        32768 i
*> 193.1.1.0/27     193.1.1.1              0            0 12345 i
*> 193.1.1.32/27    193.1.1.1              0            0 12345 i
*> 193.1.1.64/27    193.1.1.1              0            0 12345 i
*> 193.1.1.96/27    193.1.1.1              0            0 12345 i
*> 193.2.2.0/27     193.1.1.1                           0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                           0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                           0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                           0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                           0 12345 21345 31245 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                           0 12345 21345 31245 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                           0 12345 21345 31245 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                           0 12345 21345 31245 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                           0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                           0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                           0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                           0 12345 21345 31245 31245 31245 41235 i
*> 193.5.5.0/27     193.1.1.1                           0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27    193.1.1.1                           0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27    193.1.1.1                           0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27    193.1.1.1                           0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27     193.1.1.1                           0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                           0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                           0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                           0 12345 21345 31245 31245 31245 123 i
*> 193.7.7.0/27     193.1.1.1                           0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.32/27    193.1.1.1                           0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.64/27    193.1.1.1                           0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.96/27    193.1.1.1                           0 12345 21345 31245 31245 31245 41235 345 i
R8#
```

Regular expressions example

```
R8#sh ip bgp
BGP table version is 10, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network           Next Hop            Metric LocPrf Weight Path
*> 99.8.8.0/24       0.0.0.0                  0          32768 i
*> 193.1.1.0/27      193.1.1.1                0              0 12345 i
*> 193.1.1.32/27     193.1.1.1                0              0 12345 i
*> 193.1.1.64/27     193.1.1.1                0              0 12345 i
*> 193.1.1.96/27     193.1.1.1                0              0 12345 i
*> 193.2.2.0/27      193.1.1.1                               0 12345 21345 i
*> 193.2.2.32/27     193.1.1.1                               0 12345 21345 i
*> 193.2.2.64/27     193.1.1.1                               0 12345 21345 i
*> 193.2.2.96/27     193.1.1.1                               0 12345 21345 i
R8#
```
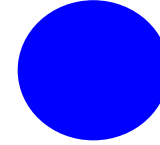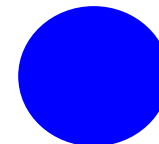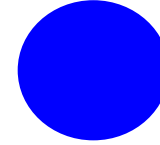
Regular expressions example

-It will deny all with AS 31245 and AS 41235 sequentially
-permit all

R8(config)#no ip as-path access-list 1 deny 31245
R8(config)#no ip as-path access-list 1 permit .*
R8(config)#ip as-path access-list 1 deny 31245_41235
R8(config)#ip as-path access-list 1 permit .*

```
R8#sh ip bgp
BGP table version is 34, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop         Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0               0         32768 i
*> 193.1.1.0/27     193.1.1.1             0             0 12345 i
*> 193.1.1.32/27    193.1.1.1             0             0 12345 i
*> 193.1.1.64/27    193.1.1.1             0             0 12345 i
*> 193.1.1.96/27    193.1.1.1             0             0 12345 i
*> 193.2.2.0/27     193.1.1.1                           0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                           0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                           0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                           0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                           0 12345 21345 31245 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                           0 12345 21345 31245 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                           0 12345 21345 31245 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                           0 12345 21345 31245 31245 31245 i
*> 193.6.6.0/27     193.1.1.1                           0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                           0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                           0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                           0 12345 21345 31245 31245 31245 123 i
R8#
```

Regular expressions example

```
R8#sh ip bgp
BGP table version is 134, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop           Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0                 0        32768 i
*> 193.1.1.0/27     193.1.1.1               0            0 12345 i
*> 193.1.1.32/27    193.1.1.1               0            0 12345 i
*> 193.1.1.64/27    193.1.1.1               0            0 12345 i
*> 193.1.1.96/27    193.1.1.1               0            0 12345 i
*> 193.2.2.0/27     193.1.1.1                            0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                            0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                            0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                            0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.5.5.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.7.7.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 345 i
R8#
```
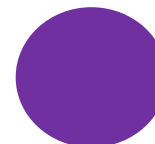
Regular expressions example

-It will deny all originating in AS 345

-Permit all

R8(config)#no ip as-path access-list 1 deny 31245_41235
R8(config)#no ip as-path access-list 1 permit .*
R8(config)#ip as-path access-list 1 deny _345$
R8(config)#ip as-path access-list 1 permit .*

```
R8#sh ip bgp
BGP table version is 26, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0                0         32768 i
*> 193.1.1.0/27     193.1.1.1              0             0 12345 i
*> 193.1.1.32/27    193.1.1.1              0             0 12345 i
*> 193.1.1.64/27    193.1.1.1              0             0 12345 i
*> 193.1.1.96/27    193.1.1.1              0             0 12345 i
*> 193.2.2.0/27     193.1.1.1                            0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                            0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                            0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                            0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.5.5.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
R8#
```

Regular expressions example

```
R8#sh ip bgp
BGP table version is 134, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0                  0         32768 i
*> 193.1.1.0/27     193.1.1.1                0             0 12345 i
*> 193.1.1.32/27    193.1.1.1                0             0 12345 i
*> 193.1.1.64/27    193.1.1.1                0             0 12345 i
*> 193.1.1.96/27    193.1.1.1                0             0 12345 i
*> 193.2.2.0/27     193.1.1.1                              0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                              0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                              0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                              0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.5.5.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.7.7.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
R8#
```

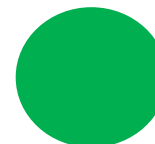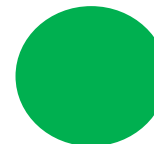# Regular expressions example

-It will deny all with AS 41235 in AS path

-Permit all

R8(config)#no ip as-path access-list 1 deny _345$

R8(config)#no ip as-path access-list 1 permit .*

R8(config)#ip as-path access-list 1 permit _41235$

R8(config)#ip as-path access-list 1 deny _41235_

R8(config)#ip as-path access-list 1 permit .*

```
R8#sh ip bgp
BGP table version is 18, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0                  0         32768 i
*> 193.1.1.0/27     193.1.1.1                0             0 12345 i
*> 193.1.1.32/27    193.1.1.1                0             0 12345 i
*> 193.1.1.64/27    193.1.1.1                0             0 12345 i
*> 193.1.1.96/27    193.1.1.1                0             0 12345 i
*> 193.2.2.0/27     193.1.1.1                              0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                              0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                              0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                              0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.6.6.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
R8#
```

Regular expressions example

```
R8#sh ip bgp
BGP table version is 134, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop         Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0                0         32768 i
*> 193.1.1.0/27     193.1.1.1              0             0 12345 i
*> 193.1.1.32/27    193.1.1.1              0             0 12345 i
*> 193.1.1.64/27    193.1.1.1              0             0 12345 i
*> 193.1.1.96/27    193.1.1.1              0             0 12345 i
*> 193.2.2.0/27     193.1.1.1                            0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                            0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                            0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                            0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.5.5.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.7.7.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 345 i
R8#
```

ALGEBRA

Regular expressions example

-It will deny all originating from any directly connected AS

-Permit all

R8(config)#no ip as-path access-list 1 permit _41235$

R8(config)#no ip as-path access-list 1 deny _41235_

R8(config)#no ip as-path access-list 1 permit .*

R8(config)#ip as-path access-list 1 deny ^[0-9]+$

R8(config)#ip as-path access-list 1 permit .*

```
R8#sh ip bgp
BGP table version is 26, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0                  0         32768 i
*> 193.2.2.0/27     193.1.1.1                              0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                              0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                              0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                              0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.5.5.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.7.7.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
R8#
```
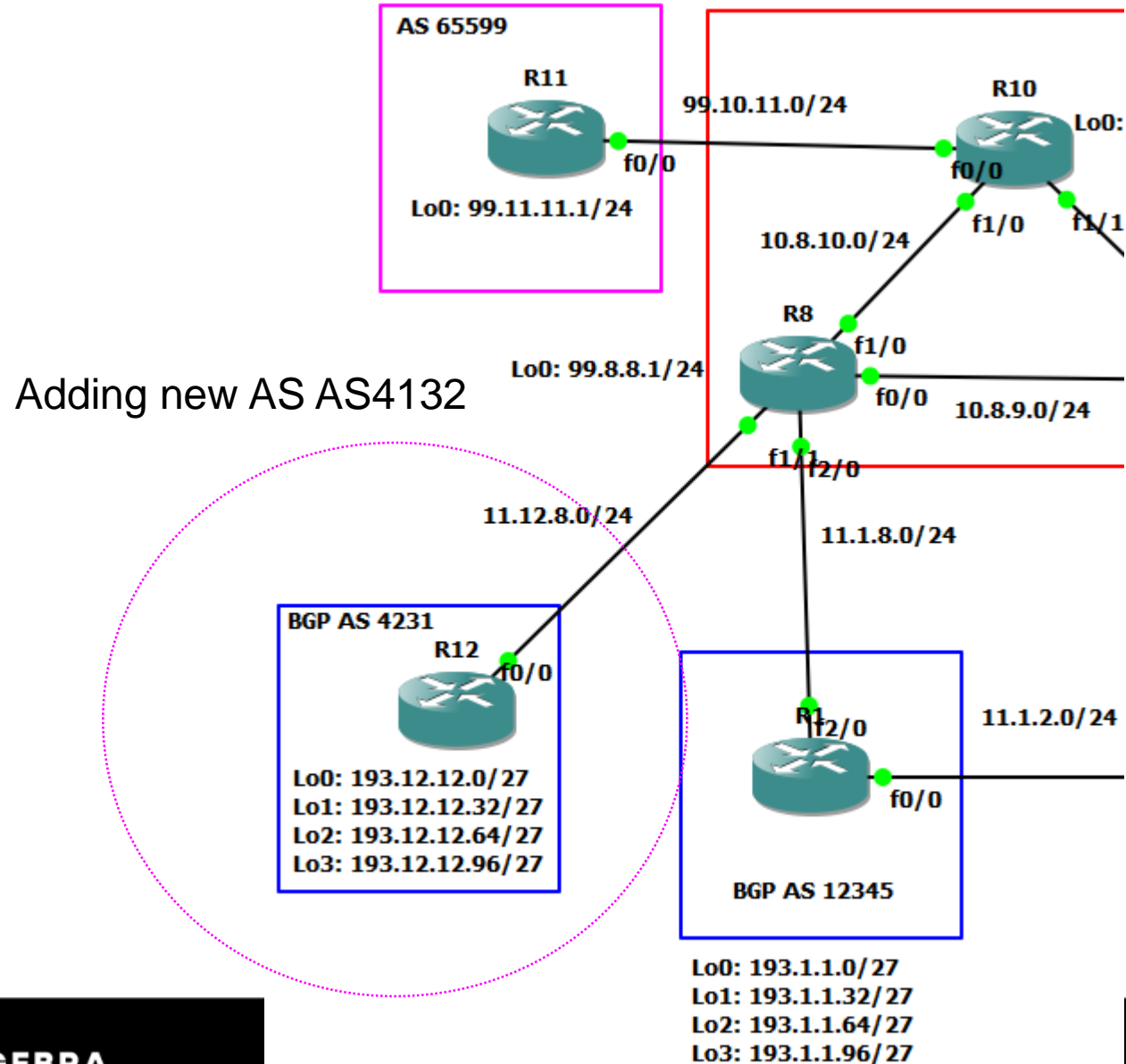
Regular expressions example

```
R8#sh ip bgp
BGP table version is 134, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0                  0         32768 i
*> 193.1.1.0/27     193.1.1.1                0             0 12345 i
*> 193.1.1.32/27    193.1.1.1                0             0 12345 i
*> 193.1.1.64/27    193.1.1.1                0             0 12345 i
*> 193.1.1.96/27    193.1.1.1                0             0 12345 i
*> 193.2.2.0/27     193.1.1.1                              0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                              0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                              0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                              0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.5.5.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.7.7.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
R8#
```

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Regular expressions example

Regular expressions example

```
R8#sh ip bgp
*Nov 18 10:16:35.151: %SYS-5-CONFIG_I: Configured from console by console
R8#sh ip bgp
BGP table version is 34, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

     Network          Next Hop          Metric LocPrf Weight Path
*> 99.8.8.0/24       0.0.0.0                0        32768 i
*> 193.1.1.0/27      193.1.1.1              0            0 12345 i
*> 193.1.1.32/27     193.1.1.1              0            0 12345 i
*> 193.1.1.64/27     193.1.1.1              0            0 12345 i
*> 193.1.1.96/27     193.1.1.1              0            0 12345 i
*> 193.2.2.0/27      193.1.1.1                           0 12345 21345 i
*> 193.2.2.32/27     193.1.1.1                           0 12345 21345 i
*> 193.2.2.64/27     193.1.1.1                           0 12345 21345 i
*> 193.2.2.96/27     193.1.1.1                           0 12345 21345 i
*> 193.3.3.0/27      193.1.1.1                           0 12345 21345 31245 31245 31245 i
*> 193.3.3.32/27     193.1.1.1                           0 12345 21345 31245 31245 31245 i
*> 193.3.3.64/27     193.1.1.1                           0 12345 21345 31245 31245 31245 i
*> 193.3.3.96/27     193.1.1.1                           0 12345 21345 31245 31245 31245 i
*> 193.4.4.0/27      193.1.1.1                           0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.32/27     193.1.1.1                           0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.64/27     193.1.1.1                           0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.96/27     193.1.1.1                           0 12345 21345 31245 31245 31245 41235 i
*> 193.5.5.0/27      193.1.1.1                           0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27     193.1.1.1                           0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27     193.1.1.1                           0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27     193.1.1.1                           0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27      193.1.1.1                           0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.32/27     193.1.1.1                           0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.64/27     193.1.1.1                           0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.96/27     193.1.1.1                           0 12345 21345 31245 31245 31245 123 i
*> 193.7.7.0/27      193.1.1.1                           0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.32/27     193.1.1.1                           0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.64/27     193.1.1.1                           0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.96/27     193.1.1.1                           0 12345 21345 31245 31245 31245 41235 345 i
*> 193.12.12.0/27    11.12.8.12             0            0 4231 i
*> 193.12.12.32/27   11.12.8.12             0            0 4231 i
*> 193.12.12.64/27   11.12.8.12             0            0 4231 i
*> 193.12.12.96/27   11.12.8.12             0            0 4231 i
R8#
```

Without filtering

ALGEB

Regular expressions example

-It will deny all from directly connected AS if AS has numbers from 0 to 3 in itself
-Permit all

R8(config)#ip as-path access-list 1 deny ^[0-3]+$
R8(config)#ip as-path access-list 1 permit .*

Is the same as with filter

```
R8#sh ip bgp
*Nov 18 10:16:35.151: %SYS-5-CONFIG_I: Configured from console by console
R8#sh ip bgp
BGP table version is 34, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0                  0         32768 i
*> 193.1.1.0/27     193.1.1.1                0             0 12345 i
*> 193.1.1.32/27    193.1.1.1                0             0 12345 i
*> 193.1.1.64/27    193.1.1.1                0             0 12345 i
*> 193.1.1.96/27    193.1.1.1                0             0 12345 i
*> 193.2.2.0/27     193.1.1.1                              0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                              0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                              0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                              0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.5.5.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.7.7.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.12.12.0/27   11.12.8.12               0             0 4231 i
*> 193.12.12.32/27  11.12.8.12               0             0 4231 i
*> 193.12.12.64/27  11.12.8.12               0             0 4231 i
*> 193.12.12.96/27  11.12.8.12               0             0 4231 i
R8#
```

Regular expressions example

-It will deny all from any directly connected AS if AS has numbers from 0 to 5 in itself
-Permit all

R8(config)#no ip as-path access-list 1 deny ^[0-3]+$
R8(config)#no ip as-path access-list 1 permit .*
R8(config)#ip as-path access-list 1 deny ^[0-5]+$
R8(config)#ip as-path access-list 1 permit .*

```
R8#sh ip bgp
BGP table version is 26, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0                  0         32768 i
*> 193.2.2.0/27     193.1.1.1                              0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                              0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                              0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                              0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 i
*> 193.5.5.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 123 i
*> 193.7.7.0/27     193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.32/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.64/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.96/27    193.1.1.1                              0 12345 21345 31245 31245 31245 41235 345 i
R8#
```

Regular expressions example

```
R8#sh ip bgp
*Nov 18 10:16:35.151: %SYS-5-CONFIG_I: Configured from console by console
R8#sh ip bgp
BGP table version is 34, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0                0         32768 i
*> 193.1.1.0/27     193.1.1.1              0             0 12345 i
*> 193.1.1.32/27    193.1.1.1              0             0 12345 i
*> 193.1.1.64/27    193.1.1.1              0             0 12345 i
*> 193.1.1.96/27    193.1.1.1              0             0 12345 i
*> 193.2.2.0/27     193.1.1.1                            0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                            0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                            0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                            0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 i
*> 193.5.5.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 123 i
*> 193.7.7.0/27     193.1.1.1                            0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.32/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.64/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 345 i
*> 193.7.7.96/27    193.1.1.1                            0 12345 21345 31245 31245 31245 41235 345 i
*> 193.12.12.0/27   11.12.8.12             0             0 4231 i
*> 193.12.12.32/27  11.12.8.12             0             0 4231 i
*> 193.12.12.64/27  11.12.8.12             0             0 4231 i
*> 193.12.12.96/27  11.12.8.12             0             0 4231 i
R8#
```

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Regular expressions example-before this on R3 we reconfigured AS-Path prepend on just 1

-It will deny all that has any AS number more than 3 times in AS Path
-Permit all

R8(config)#no ip as-path access-list 1 permit .*
R8(config)#no ip as-path access-list 1 deny ^[0-5]+$
R8(config)#ip as-path access-list 1 deny _([0-9]+)_\1_\1_
R8(config)#ip as-path access-list 1 permit .*

In this case router will use routes that are comming from R9

```
R8#
*Nov 18 11:16:02.683: %SYS-5-CONFIG_I: Configured from console by console
R8#sh ip bgp
BGP table version is 38, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0                  0         32768 i
*> 193.1.1.0/27     193.1.1.1                0             0 12345 i
*> 193.1.1.32/27    193.1.1.1                0             0 12345 i
*> 193.1.1.64/27    193.1.1.1                0             0 12345 i
*> 193.1.1.96/27    193.1.1.1                0             0 12345 i
*> 193.2.2.0/27     193.1.1.1                              0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                              0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                              0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                              0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                              0 12345 21345 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                              0 12345 21345 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                              0 12345 21345 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                              0 12345 21345 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                              0 12345 21345 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                              0 12345 21345 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                              0 12345 21345 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                              0 12345 21345 31245 31245 41235 i
*> 193.6.6.0/27     193.1.1.1                              0 12345 21345 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                              0 12345 21345 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                              0 12345 21345 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                              0 12345 21345 31245 31245 123 i
*> 193.7.7.0/27     193.1.1.1                              0 12345 21345 31245 31245 41235 345 i
*> 193.7.7.32/27    193.1.1.1                              0 12345 21345 31245 31245 41235 345 i
*> 193.7.7.64/27    193.1.1.1                              0 12345 21345 31245 31245 41235 345 i
*> 193.7.7.96/27    193.1.1.1                              0 12345 21345 31245 31245 41235 345 i
*> 193.12.12.0/27   11.12.8.12               0             0 4231 i
*> 193.12.12.32/27  11.12.8.12               0             0 4231 i
*> 193.12.12.64/27  11.12.8.12               0             0 4231 i
*> 193.12.12.96/27  11.12.8.12               0             0 4231 i
R8#
```

Regular expressions example

```
R8#sh ip bgp
BGP table version is 42, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0                  0          32768 i
*> 193.1.1.0/27     193.1.1.1                0              0 12345 i
*> 193.1.1.32/27    193.1.1.1                0              0 12345 i
*> 193.1.1.64/27    193.1.1.1                0              0 12345 i
*> 193.1.1.96/27    193.1.1.1                0              0 12345 i
*> 193.2.2.0/27     193.1.1.1                               0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                               0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                               0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                               0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                               0 12345 21345 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                               0 12345 21345 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                               0 12345 21345 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                               0 12345 21345 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                               0 12345 21345 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                               0 12345 21345 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                               0 12345 21345 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                               0 12345 21345 31245 31245 41235 i
*> 193.5.5.0/27     193.1.1.1                               0 12345 21345 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27    193.1.1.1                               0 12345 21345 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27    193.1.1.1                               0 12345 21345 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27    193.1.1.1                               0 12345 21345 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27     193.1.1.1                               0 12345 21345 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                               0 12345 21345 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                               0 12345 21345 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                               0 12345 21345 31245 31245 123 i
*> 193.7.7.0/27     193.1.1.1                               0 12345 21345 31245 31245 41235 345 i
*> 193.7.7.32/27    193.1.1.1                               0 12345 21345 31245 31245 41235 345 i
*> 193.7.7.64/27    193.1.1.1                               0 12345 21345 31245 31245 41235 345 i
*> 193.7.7.96/27    193.1.1.1                               0 12345 21345 31245 31245 41235 345 i
*> 193.12.12.0/27   11.12.8.12               0              0 4231 i
*> 193.12.12.32/27  11.12.8.12               0              0 4231 i
*> 193.12.12.64/27  11.12.8.12               0              0 4231 i
*> 193.12.12.96/27  11.12.8.12               0              0 4231 i
R8#
```

ALGEBRA

Regular expressions
example-before this we added a new AS 789 and set AS Path prepend to 4

-It will deny all that has any AS containing numbers between 6 and 9 (included) more than 3 times in AS Path attribute
-Permit all

```
R8(config)#no ip as-path access-list 1 deny _([0-9]+)_\1_\1_
R8(config)#no ip as-path access-list 1 permit .*
R8(config)#ip as-path access-list 1 deny _([6-9]+)_\1_\1_
R8(config)#ip as-path access-list 1 permit .*
```
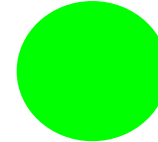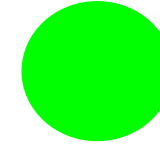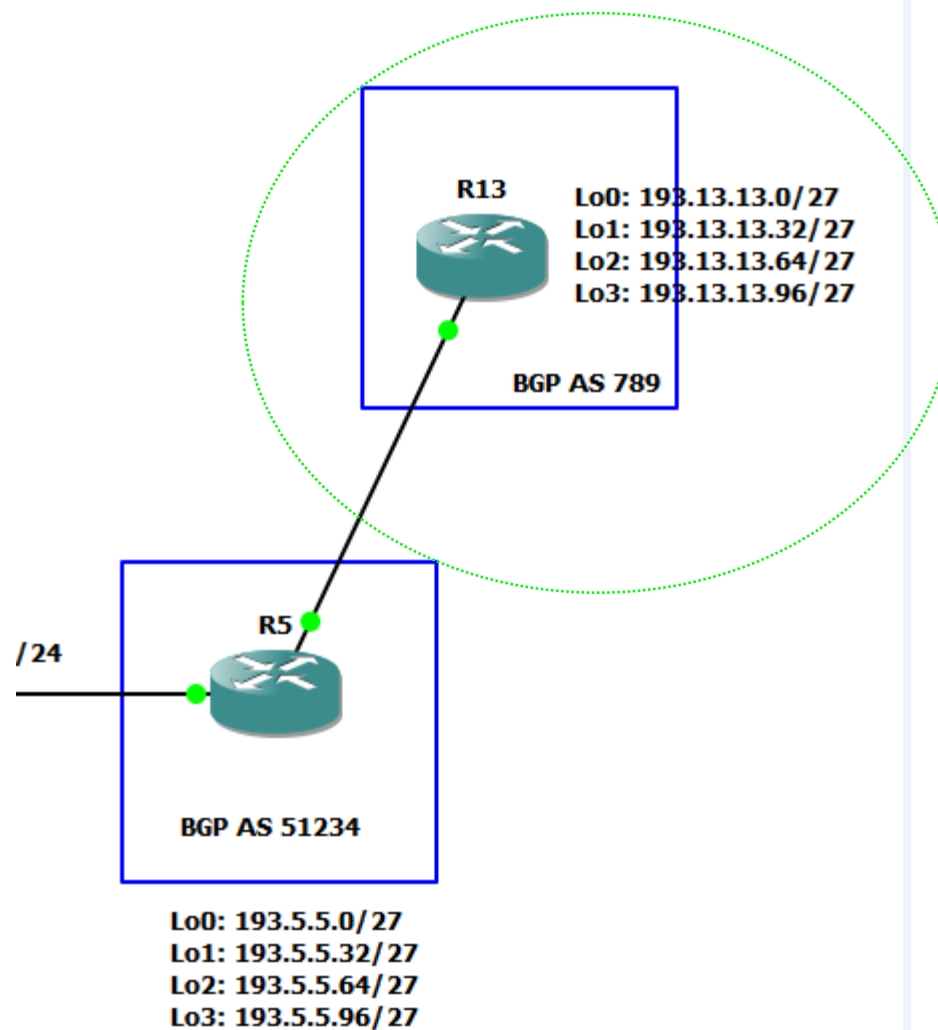
```
R8#sh ip bgp
BGP table version is 70, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop         Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0              0         32768 i
*> 193.1.1.0/27     193.1.1.1            0             0 12345 i
*> 193.1.1.32/27    193.1.1.1            0             0 12345 i
*> 193.1.1.64/27    193.1.1.1            0             0 12345 i
*> 193.1.1.96/27    193.1.1.1            0             0 12345 i
*> 193.2.2.0/27     193.1.1.1                          0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                          0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                          0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                          0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                          0 12345 21345 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                          0 12345 21345 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                          0 12345 21345 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                          0 12345 21345 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                          0 12345 21345 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                          0 12345 21345 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                          0 12345 21345 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                          0 12345 21345 31245 31245 41235 i
*> 193.5.5.0/27     193.1.1.1                          0 12345 21345 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27    193.1.1.1                          0 12345 21345 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27    193.1.1.1                          0 12345 21345 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27    193.1.1.1                          0 12345 21345 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27     193.1.1.1                          0 12345 21345 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                          0 12345 21345 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                          0 12345 21345 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                          0 12345 21345 31245 31245 123 i
*> 193.7.7.0/27     193.1.1.1                          0 12345 21345 31245 31245 41235 345 i
*> 193.7.7.32/27    193.1.1.1                          0 12345 21345 31245 31245 41235 345 i
*> 193.7.7.64/27    193.1.1.1                          0 12345 21345 31245 31245 41235 345 i
*> 193.7.7.96/27    193.1.1.1                          0 12345 21345 31245 31245 41235 345 i
*> 193.12.12.0/27   11.12.8.12           0             0 4231 i
*> 193.12.12.32/27  11.12.8.12           0             0 4231 i
*> 193.12.12.64/27  11.12.8.12           0             0 4231 i
*> 193.12.12.96/27  11.12.8.12           0             0 4231 i
R8#
```

ALGEBRA

Regular expressions example-before this we added a new AS 789 and set AS Path prepend to 4

R13
Lo0: 193.13.13.0/27
Lo1: 193.13.13.32/27
Lo2: 193.13.13.64/27
Lo3: 193.13.13.96/27

BGP AS 789

R5

/24

BGP AS 51234

Lo0: 193.5.5.0/27
Lo1: 193.5.5.32/27
Lo2: 193.5.5.64/27
Lo3: 193.5.5.96/27

ALGEBRA

Regular expressions example-before this we added a new AS 789 and set AS Path prepend to 4

```
BGP table version is 66, local router ID is 99.8.8.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop         Metric LocPrf Weight Path
*> 99.8.8.0/24      0.0.0.0               0         32768 i
*> 193.1.1.0/27     193.1.1.1             0             0 12345 i
*> 193.1.1.32/27    193.1.1.1             0             0 12345 i
*> 193.1.1.64/27    193.1.1.1             0             0 12345 i
*> 193.1.1.96/27    193.1.1.1             0             0 12345 i
*> 193.2.2.0/27     193.1.1.1                           0 12345 21345 i
*> 193.2.2.32/27    193.1.1.1                           0 12345 21345 i
*> 193.2.2.64/27    193.1.1.1                           0 12345 21345 i
*> 193.2.2.96/27    193.1.1.1                           0 12345 21345 i
*> 193.3.3.0/27     193.1.1.1                           0 12345 21345 31245 31245 i
*> 193.3.3.32/27    193.1.1.1                           0 12345 21345 31245 31245 i
*> 193.3.3.64/27    193.1.1.1                           0 12345 21345 31245 31245 i
*> 193.3.3.96/27    193.1.1.1                           0 12345 21345 31245 31245 i
*> 193.4.4.0/27     193.1.1.1                           0 12345 21345 31245 31245 41235 i
*> 193.4.4.32/27    193.1.1.1                           0 12345 21345 31245 31245 41235 i
*> 193.4.4.64/27    193.1.1.1                           0 12345 21345 31245 31245 41235 i
*> 193.4.4.96/27    193.1.1.1                           0 12345 21345 31245 31245 41235 i
*> 193.5.5.0/27     193.1.1.1                           0 12345 21345 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.32/27    193.1.1.1                           0 12345 21345 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.64/27    193.1.1.1                           0 12345 21345 31245 31245 41235 51234 51234 51234 i
*> 193.5.5.96/27    193.1.1.1                           0 12345 21345 31245 31245 41235 51234 51234 51234 i
*> 193.6.6.0/27     193.1.1.1                           0 12345 21345 31245 31245 123 i
*> 193.6.6.32/27    193.1.1.1                           0 12345 21345 31245 31245 123 i
*> 193.6.6.64/27    193.1.1.1                           0 12345 21345 31245 31245 123 i
*> 193.6.6.96/27    193.1.1.1                           0 12345 21345 31245 31245 123 i
*> 193.7.7.0/27     193.1.1.1                           0 12345 21345 31245 31245 41235 345 i
*> 193.7.7.32/27    193.1.1.1                           0 12345 21345 31245 31245 41235 345 i
*> 193.7.7.64/27    193.1.1.1                           0 12345 21345 31245 31245 41235 345 i
*> 193.7.7.96/27    193.1.1.1                           0 12345 21345 31245 31245 41235 345 i
*> 193.12.12.0/27   11.12.8.12            0             0 4231 i
*> 193.12.12.32/27  11.12.8.12            0             0 4231 i
*> 193.12.12.64/27  11.12.8.12            0             0 4231 i
*> 193.12.12.96/27  11.12.8.12            0             0 4231 i
*> 193.13.13.0/27   193.1.1.1                           0 12345 21345 31245 31245 41235 51234 51234 51234 789 789 789 i
*> 193.13.13.32/27  193.1.1.1                           0 12345 21345 31245 31245 41235 51234 51234 51234 789 789 789 i
*> 193.13.13.64/27  193.1.1.1                           0 12345 21345 31245 31245 41235 51234 51234 51234 789 789 789 i
*> 193.13.13.96/27  193.1.1.1                           0 12345 21345 31245 31245 41235 51234 51234 51234 789 789 789 i
R8#
```

Regular expressions example- End topology