CISCO SYSTEMS

New BGP Features

ISP/IXP Workshops

New Features

- Most features be in 12.2S and 12.3T/12.4T IOS branches
- Some features will also be in 12.0S and 12.4
- For details on the exact release that introduces feature X please contact your account team
  - Or look at the Cisco IOS Feature Navigator
  - (cco.cisco.com/go/fn)

Agenda

- Not so new features
  - Peer Templates
  - Update Groups
  - Scalability Improvements
  - Named Extended Community Lists
  - Sequenced Extended Community Lists
  - New AFI/SAFI support
- TCP Developments
- BGP Scanner
- OER
- Miscellaneous

Not so new features

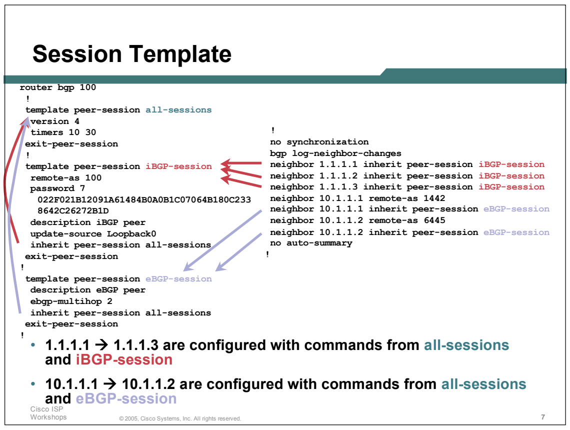
- “New Features” from last few years
- Many of these were introduced in 12.0(24)S and 12.2(25)S
- A lot of people still don’t know about these

BGP Peer Templates

- Used to group common configurations
  - Uses peer-group style of syntax
  - Much more flexible than peer-groups
- Hierarchical policy configuration mechanism
  - A peer-template may be used to provide policy configurations to an individual neighbor, a peer-group or another peer-template
  - The more specific user takes precedence if policy overlaps
    - individual neighbor → peer-group → peer-template

BGP Peer Templates

- First appeared in 12.0(24)S and 12.2(25)S
  - Integrated in 12.3T, now in 12.4
- Two types of templates
- Session Template
  - Can inherit from one session-template
  - Used to configure parameters which are independent of the AFI (address-family-identifier)
  - e.g. remote-as, ebgp-multihop, passwords, etc
- Peer/policy Template
  - Can inherit from multiple peer/policy templates
  - Used to configure AFI dependant parameters
  - Filters, next-hop-self, route-reflector-client, etc

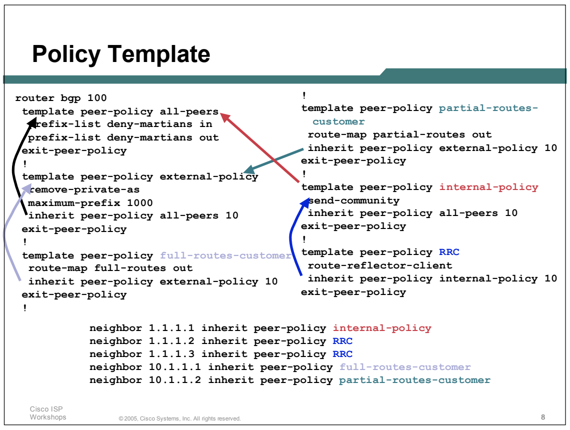


Session Template

```
router bgp 100
 !
 template peer-session all-sessions
  version 4
  timers 10 30
 exit-peer-session
 !
 template peer-session iBGP-session
  remote-as 100
  password 7
   022F021B12091A61484B0A0B1C07064B180C233
   8642C26272B1D
  description iBGP peer
  update-source Loopback0
  inherit peer-session all-sessions
 exit-peer-session
!
 template peer-session eBGP-session
  description eBGP peer
  ebgp-multihop 2
  inherit peer-session all-sessions
 exit-peer-session
!
```

```
!
no synchronization
bgp log-neighbor-changes
neighbor 1.1.1.1 inherit peer-session iBGP-session
neighbor 1.1.1.2 inherit peer-session iBGP-session
neighbor 1.1.1.3 inherit peer-session iBGP-session
neighbor 10.1.1.1 remote-as 1442
neighbor 10.1.1.1 inherit peer-session eBGP-session
neighbor 10.1.1.2 remote-as 6445
neighbor 10.1.1.2 inherit peer-session eBGP-session
no auto-summary
!
```

- 1.1.1.1 → 1.1.1.3 are configured with commands from all-sessions and iBGP-session
- 10.1.1.1 → 10.1.1.2 are configured with commands from all-sessions and eBGP-session

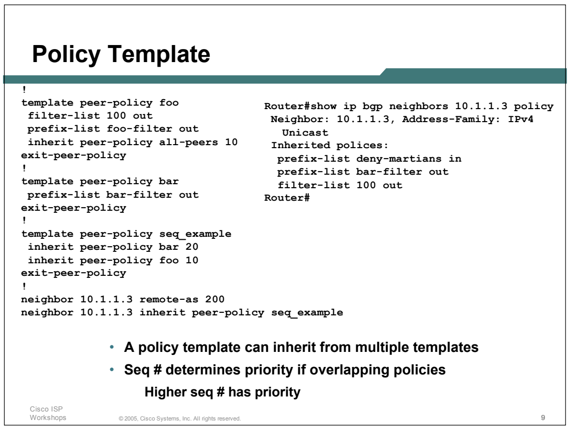


Policy Template

```
router bgp 100
 template peer-policy all-peers
  prefix-list deny-martians in
  prefix-list deny-martians out
 exit-peer-policy
 !
 template peer-policy external-policy
  remove-private-as
  maximum-prefix 1000
  inherit peer-policy all-peers 10
 exit-peer-policy
 !
 template peer-policy full-routes-customer
  route-map full-routes out
  inherit peer-policy external-policy 10
 exit-peer-policy
 !
```

```
!
template peer-policy partial-routes-
  customer
 route-map partial-routes out
 inherit peer-policy external-policy 10
exit-peer-policy
!
template peer-policy internal-policy
 send-community
 inherit peer-policy all-peers 10
exit-peer-policy
!
template peer-policy RRC
 route-reflector-client
 inherit peer-policy internal-policy 10
exit-peer-policy
```

```
neighbor 1.1.1.1 inherit peer-policy internal-policy
neighbor 1.1.1.2 inherit peer-policy RRC
neighbor 1.1.1.3 inherit peer-policy RRC
neighbor 10.1.1.1 inherit peer-policy full-routes-customer
neighbor 10.1.1.2 inherit peer-policy partial-routes-customer
```

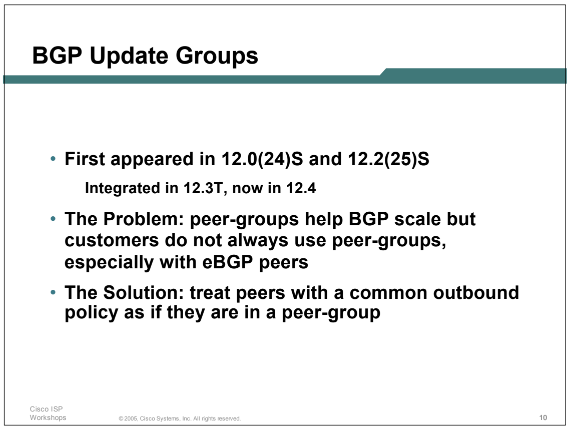


Policy Template

```
!
template peer-policy foo
 filter-list 100 out
 prefix-list foo-filter out
 inherit peer-policy all-peers 10
exit-peer-policy
!
template peer-policy bar
 prefix-list bar-filter out
exit-peer-policy
!
template peer-policy seq_example
 inherit peer-policy bar 20
 inherit peer-policy foo 10
exit-peer-policy
!
neighbor 10.1.1.3 remote-as 200
neighbor 10.1.1.3 inherit peer-policy seq_example
```

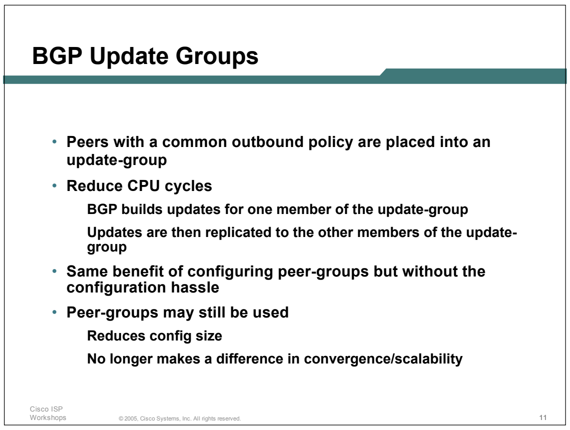
```
Router#show ip bgp neighbors 10.1.1.3 policy
 Neighbor: 10.1.1.3, Address-Family: IPv4
   Unicast
 Inherited polices:
  prefix-list deny-martians in
  prefix-list bar-filter out
  filter-list 100 out
Router#
```

- A policy template can inherit from multiple templates
- Seq # determines priority if overlapping policies
  - Higher seq # has priority



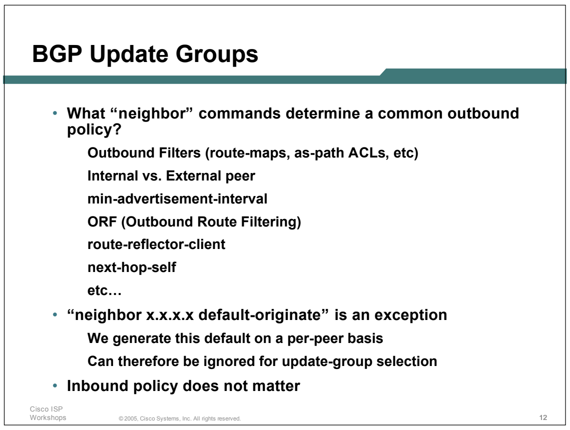
BGP Update Groups

- First appeared in 12.0(24)S and 12.2(25)S
  - Integrated in 12.3T, now in 12.4
- The Problem: peer-groups help BGP scale but customers do not always use peer-groups, especially with eBGP peers
- The Solution: treat peers with a common outbound policy as if they are in a peer-group



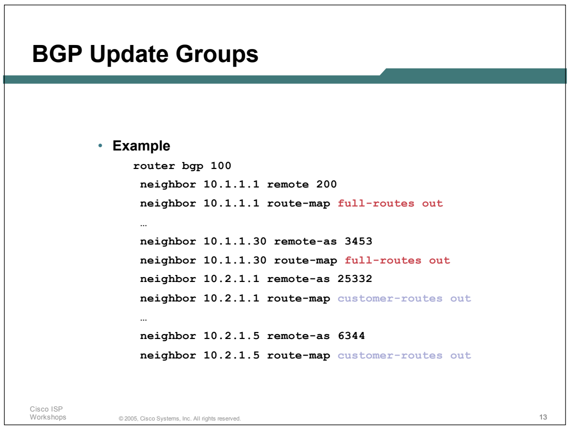
BGP Update Groups

- Peers with a common outbound policy are placed into an update-group
- Reduce CPU cycles
  - BGP builds updates for one member of the update-group
  - Updates are then replicated to the other members of the update-group
- Same benefit of configuring peer-groups but without the configuration hassle
- Peer-groups may still be used
  - Reduces config size
  - No longer makes a difference in convergence/scalability



BGP Update Groups

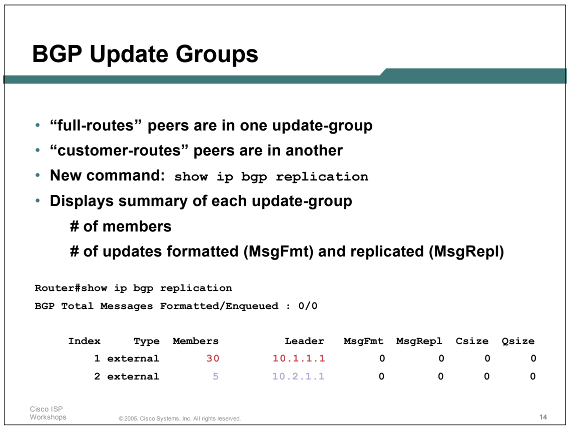
- What “neighbor” commands determine a common outbound policy?
  - Outbound Filters (route-maps, as-path ACLs, etc)
  - Internal vs. External peer
  - min-advertisement-interval
  - ORF (Outbound Route Filtering)
  - route-reflector-client
  - next-hop-self
  - etc…
- “neighbor x.x.x.x default-originate” is an exception
  - We generate this default on a per-peer basis
  - Can therefore be ignored for update-group selection
- Inbound policy does not matter



BGP Update Groups

- **Example**

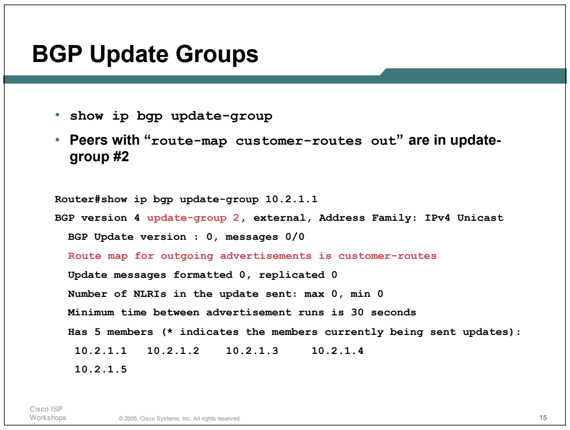
```
router bgp 100
 neighbor 10.1.1.1 remote 200
 neighbor 10.1.1.1 route-map full-routes out
 …
 neighbor 10.1.1.30 remote-as 3453
 neighbor 10.1.1.30 route-map full-routes out
 neighbor 10.2.1.1 remote-as 25332
 neighbor 10.2.1.1 route-map customer-routes out
 …
 neighbor 10.2.1.5 remote-as 6344
 neighbor 10.2.1.5 route-map customer-routes out
```



BGP Update Groups

- **“full-routes” peers are in one update-group**
- **“customer-routes” peers are in another**
- **New command:** `show ip bgp replication`
- **Displays summary of each update-group**
  - **# of members**
  - **# of updates formatted (MsgFmt) and replicated (MsgRepl)**

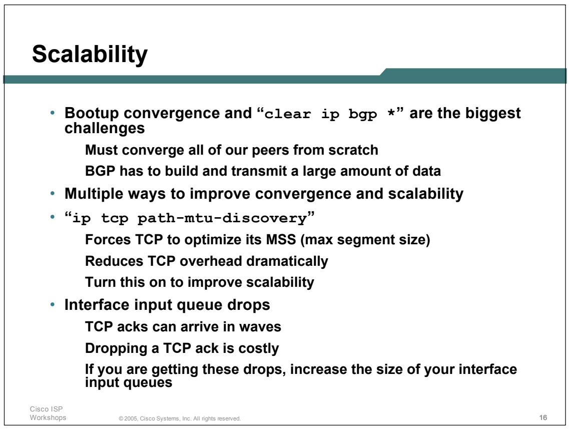
```
Router#show ip bgp replication
BGP Total Messages Formatted/Enqueued : 0/0

     Index     Type  Members          Leader   MsgFmt  MsgRepl  Csize  Qsize
         1 external       30        10.1.1.1        0        0      0      0
         2 external        5        10.2.1.1        0        0      0      0
```



BGP Update Groups

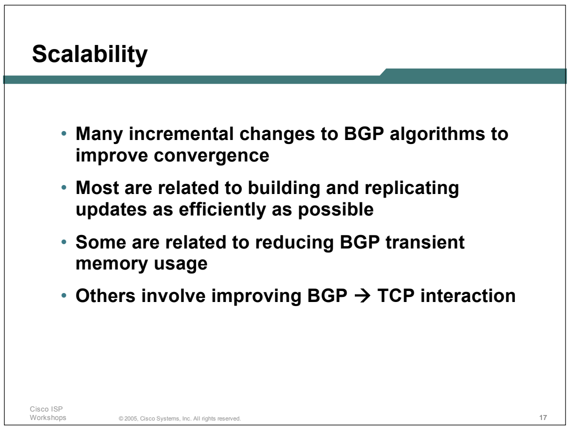
- `show ip bgp update-group`
- **Peers with “`route-map customer-routes out`” are in update-group #2**

```
Router#show ip bgp update-group 10.2.1.1
BGP version 4 update-group 2, external, Address Family: IPv4 Unicast
  BGP Update version : 0, messages 0/0
  Route map for outgoing advertisements is customer-routes
  Update messages formatted 0, replicated 0
  Number of NLRIs in the update sent: max 0, min 0
  Minimum time between advertisement runs is 30 seconds
  Has 5 members (* indicates the members currently being sent updates):
   10.2.1.1   10.2.1.2    10.2.1.3     10.2.1.4
   10.2.1.5
```



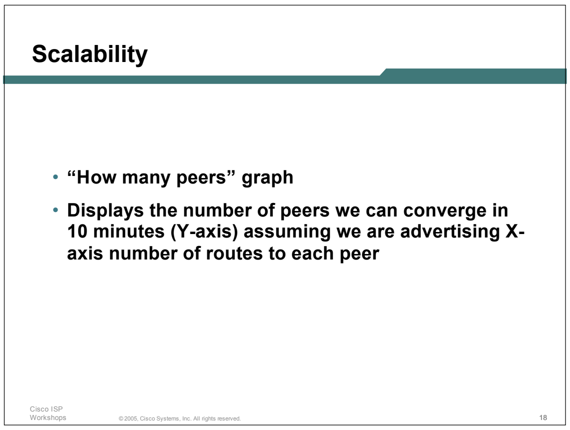
Scalability

- **Bootup convergence and “`clear ip bgp *`” are the biggest challenges**
  - **Must converge all of our peers from scratch**
  - **BGP has to build and transmit a large amount of data**
- **Multiple ways to improve convergence and scalability**
- **“`ip tcp path-mtu-discovery`”**
  - **Forces TCP to optimize its MSS (max segment size)**
  - **Reduces TCP overhead dramatically**
  - **Turn this on to improve scalability**
- **Interface input queue drops**
  - **TCP acks can arrive in waves**
  - **Dropping a TCP ack is costly**
  - **If you are getting these drops, increase the size of your interface input queues**



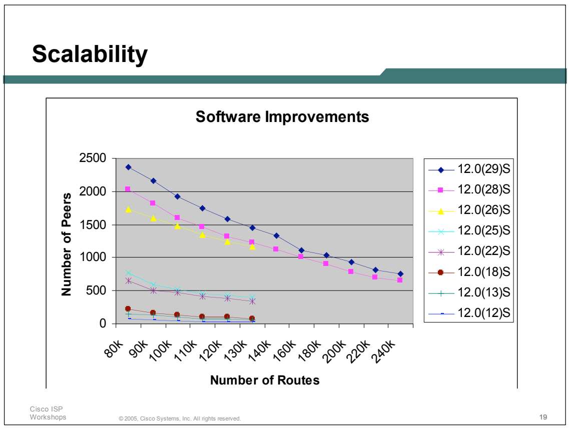
Scalability

- **Many incremental changes to BGP algorithms to improve convergence**
- **Most are related to building and replicating updates as efficiently as possible**
- **Some are related to reducing BGP transient memory usage**
- **Others involve improving BGP → TCP interaction**



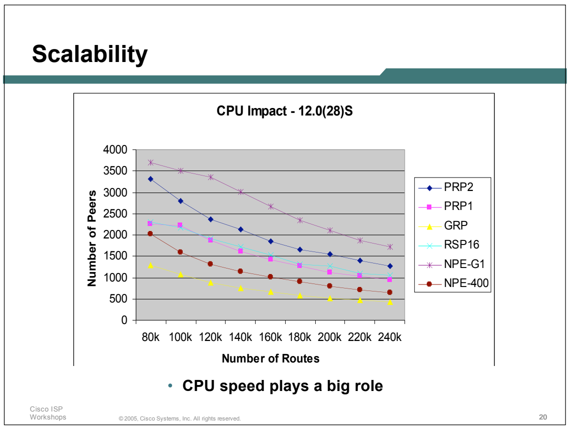
Scalability

- **“How many peers” graph**
- **Displays the number of peers we can converge in 10 minutes (Y-axis) assuming we are advertising X-axis number of routes to each peer**



Scalability

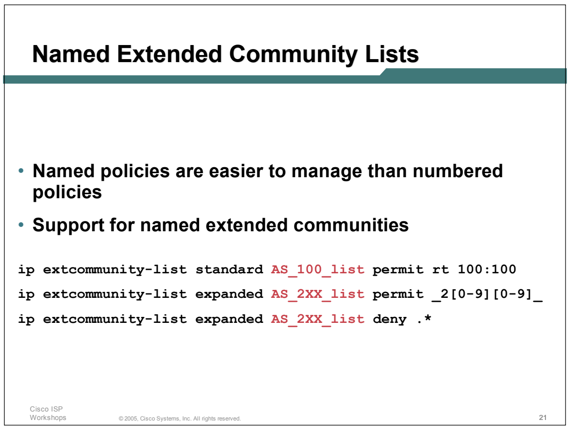
Software Improvements



Scalability

CPU Impact - 12.0(28)S

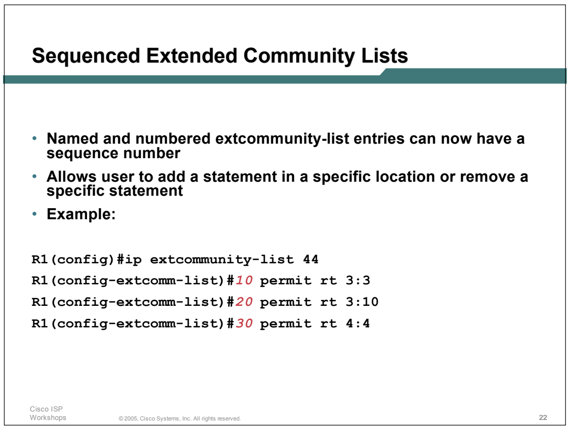
- CPU speed plays a big role



Named Extended Community Lists

- Named policies are easier to manage than numbered policies
- Support for named extended communities

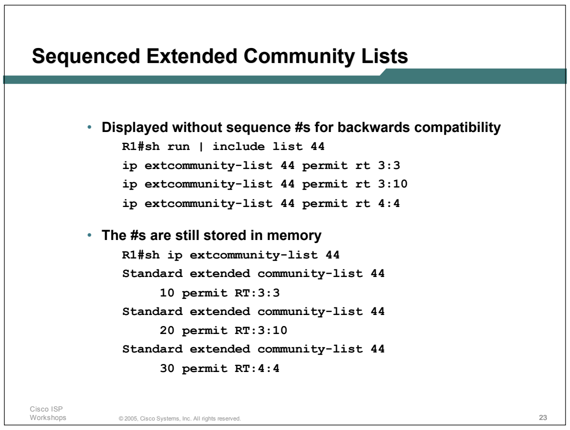
```
ip extcommunity-list standard AS_100_list permit rt 100:100
ip extcommunity-list expanded AS_2XX_list permit _2[0-9][0-9]_
ip extcommunity-list expanded AS_2XX_list deny .*
```



Sequenced Extended Community Lists

- Named and numbered extcommunity-list entries can now have a sequence number
- Allows user to add a statement in a specific location or remove a specific statement
- Example:

```
R1(config)#ip extcommunity-list 44
R1(config-extcomm-list)#10 permit rt 3:3
R1(config-extcomm-list)#20 permit rt 3:10
R1(config-extcomm-list)#30 permit rt 4:4
```



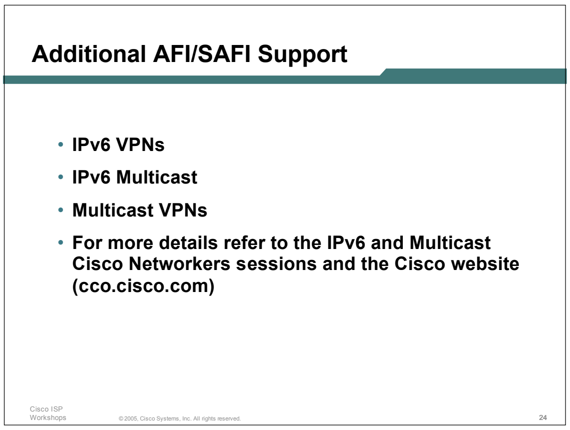
Sequenced Extended Community Lists

- Displayed without sequence #s for backwards compatibility

```
R1#sh run | include list 44
ip extcommunity-list 44 permit rt 3:3
ip extcommunity-list 44 permit rt 3:10
ip extcommunity-list 44 permit rt 4:4
```

- The #s are still stored in memory

```
R1#sh ip extcommunity-list 44
Standard extended community-list 44
     10 permit RT:3:3
Standard extended community-list 44
     20 permit RT:3:10
Standard extended community-list 44
     30 permit RT:4:4
```



Additional AFI/SAFI Support

- IPv6 VPNs
- IPv6 Multicast
- Multicast VPNs
- For more details refer to the IPv6 and Multicast Cisco Networkers sessions and the Cisco website (cco.cisco.com)

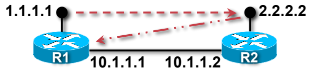
Agenda

- Not so new features
- TCP Developments
  - Source/Destination Address Matching
  - Active vs Passive Sessions
  - BTDH - BGP TTL Security Hack
  - TCP PMTU - TCP Path MTU Discovery
- BGP Scanner
- OER
- Miscellaneous

Source/Destination Address Matching

- Both peers must now agree on peering addresses
- IP Addresses
  - Destination IP is specified via "`neighbor x.x.x.x`"
  - Source IP is outbound interface by default
  - Source IP may be specified via
    - "`neighbor x.x.x.x update-source` *`interface`*"
- TCP port numbers
  - Destination will be port 179
  - Source port is random for added security

Source/Destination Address Matching



- Both sides must agree on source/destination addresses
- R1 to R2 connection

```
neighbor 2.2.2.2 remote-as 100
neighbor 2.2.2.2 update-source loopback 0
```

- R2 to R1 connection

```
neighbor 10.1.1.1 remote-as 100
neighbor 10.1.1.1 update-source loopback 0
```

- R1 and R2 do not agree on what addresses to use
  - BGP will tear down the TCP session due to the conflict
  - Points out configuration problems and adds some security

Source/Destination Address Matching

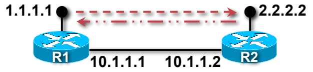
- R2 attempts to open a session to R1

```
BGP: 10.1.1.1 open active, local address 2.2.2.2
```

- R1 denies the session because of the address mismatch
- "`debug ip bgp`" on R1 shows

```
BGP: 2.2.2.2 passive open to 10.1.1.1
BGP: 2.2.2.2 passive open failed - 10.1.1.1 is not
update-source Loopback0's address (1.1.1.1)
```

Source/Destination Address Matching



- R1 to R2 connection

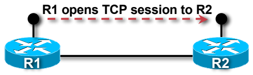
```
neighbor 2.2.2.2 remote-as 100
neighbor 2.2.2.2 update-source loopback 0
```

- R2 to R1 connection

```
neighbor 1.1.1.1 remote-as 100
neighbor 1.1.1.1 update-source loopback 0
```

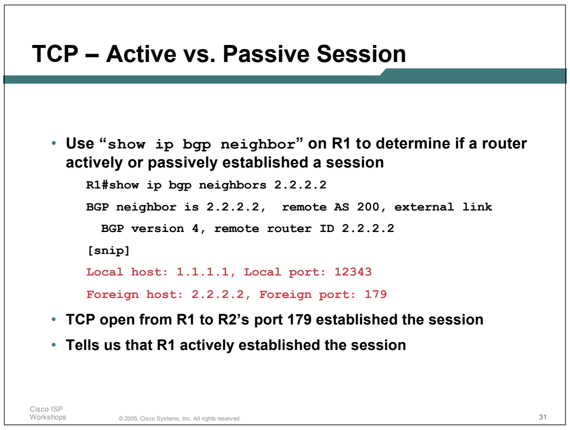
- Routers agree on source/destination address
  - BGP will accept this TCP session

TCP – Active vs. Passive Session



- Active Session – If the TCP session initiated by R1 is the one used between R1 & R2 then R1 "actively" established the session.
- Passive Session – For the same scenario R2 "passively" established the session.
- R1 Actively opened the session
- R2 Passively accepted the session
- Can be configured on R2:

```
neighbor x.x.x.x transport connection-mode [active|passive]
```

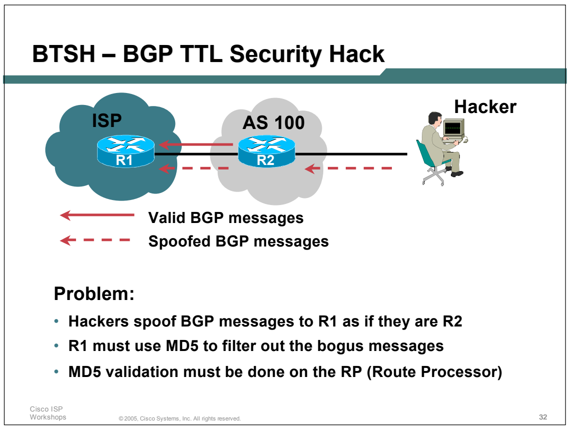


TCP – Active vs. Passive Session

- Use “`show ip bgp neighbor`” on R1 to determine if a router actively or passively established a session

```
R1#show ip bgp neighbors 2.2.2.2
BGP neighbor is 2.2.2.2,  remote AS 200, external link
  BGP version 4, remote router ID 2.2.2.2
[snip]
Local host: 1.1.1.1, Local port: 12343
Foreign host: 2.2.2.2, Foreign port: 179
```

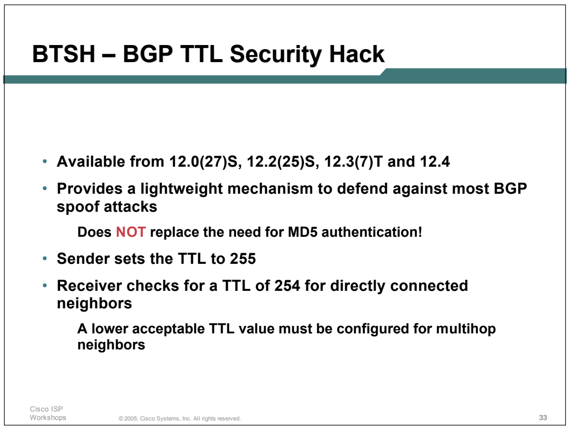
- TCP open from R1 to R2’s port 179 established the session
- Tells us that R1 actively established the session



BTSH – BGP TTL Security Hack

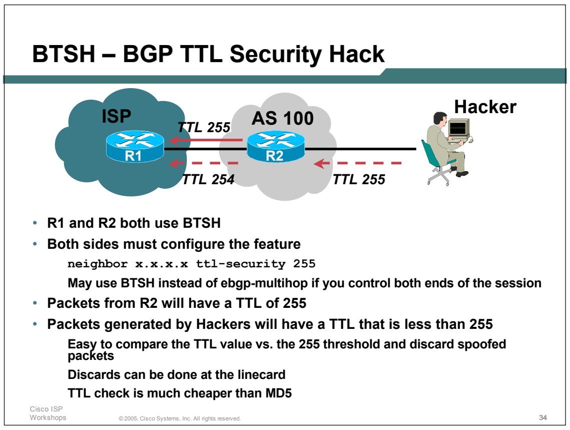
Problem:

- Hackers spoof BGP messages to R1 as if they are R2
- R1 must use MD5 to filter out the bogus messages
- MD5 validation must be done on the RP (Route Processor)



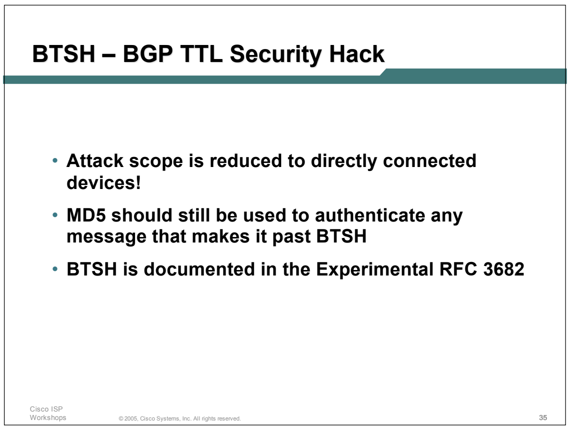
BTSH – BGP TTL Security Hack

- Available from 12.0(27)S, 12.2(25)S, 12.3(7)T and 12.4
- Provides a lightweight mechanism to defend against most BGP spoof attacks
  - Does NOT replace the need for MD5 authentication!
- Sender sets the TTL to 255
- Receiver checks for a TTL of 254 for directly connected neighbors
  - A lower acceptable TTL value must be configured for multihop neighbors



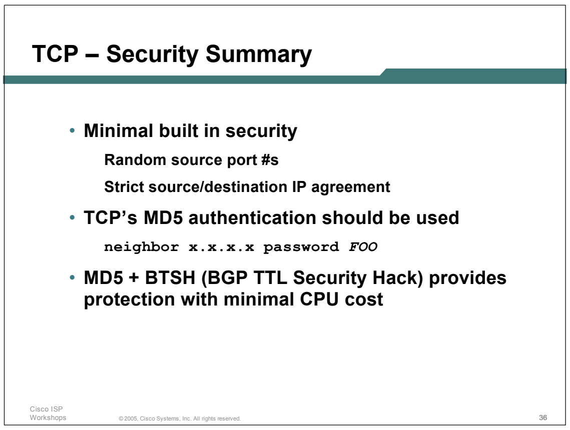
BTSH – BGP TTL Security Hack

- R1 and R2 both use BTSH
- Both sides must configure the feature
  - `neighbor x.x.x.x ttl-security 255`
  - May use BTSH instead of ebgp-multihop if you control both ends of the session
- Packets from R2 will have a TTL of 255
- Packets generated by Hackers will have a TTL that is less than 255
  - Easy to compare the TTL value vs. the 255 threshold and discard spoofed packets
  - Discards can be done at the linecard
  - TTL check is much cheaper than MD5



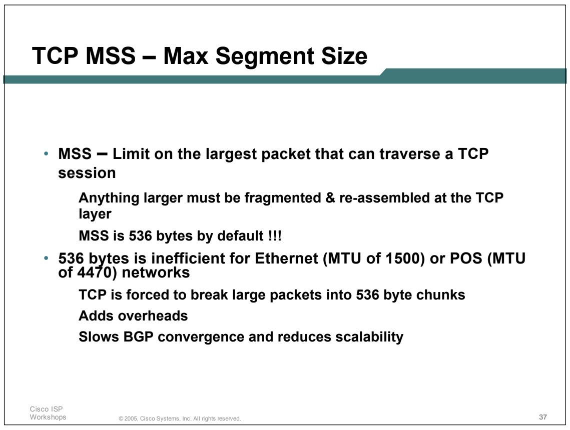
BTSH – BGP TTL Security Hack

- Attack scope is reduced to directly connected devices!
- MD5 should still be used to authenticate any message that makes it past BTSH
- BTSH is documented in the Experimental RFC 3682



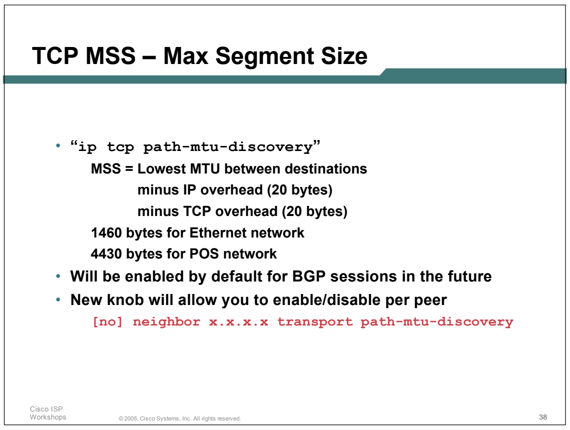
TCP – Security Summary

- Minimal built in security
  - Random source port #s
  - Strict source/destination IP agreement
- TCP’s MD5 authentication should be used
  - `neighbor x.x.x.x password` *`FOO`*
- MD5 + BTSH (BGP TTL Security Hack) provides protection with minimal CPU cost



TCP MSS – Max Segment Size

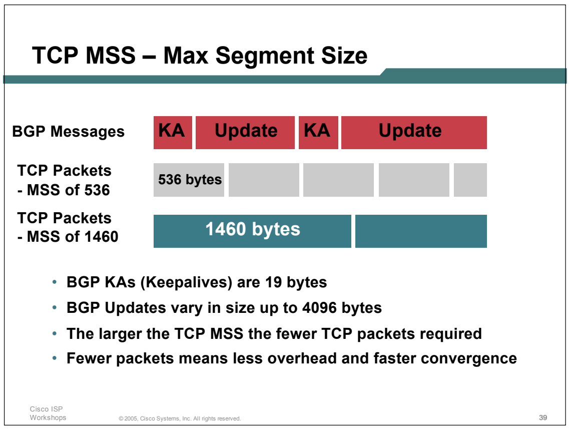
- MSS – Limit on the largest packet that can traverse a TCP session
  - Anything larger must be fragmented & re-assembled at the TCP layer
  - MSS is 536 bytes by default !!!
- 536 bytes is inefficient for Ethernet (MTU of 1500) or POS (MTU of 4470) networks
  - TCP is forced to break large packets into 536 byte chunks
  - Adds overheads
  - Slows BGP convergence and reduces scalability



TCP MSS – Max Segment Size

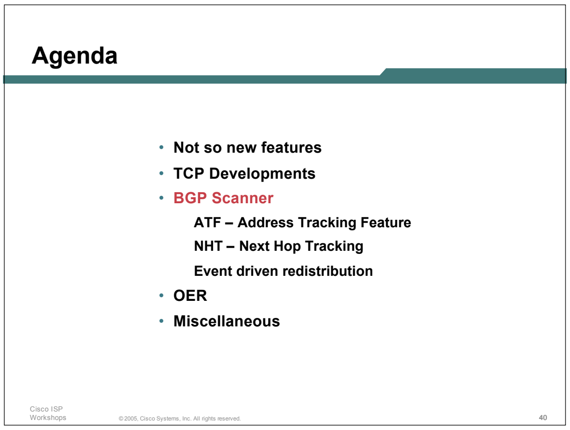
- "`ip tcp path-mtu-discovery`"
  - MSS = Lowest MTU between destinations
    - minus IP overhead (20 bytes)
    - minus TCP overhead (20 bytes)
  - 1460 bytes for Ethernet network
  - 4430 bytes for POS network
- Will be enabled by default for BGP sessions in the future
- New knob will allow you to enable/disable per peer

```
[no] neighbor x.x.x.x transport path-mtu-discovery
```



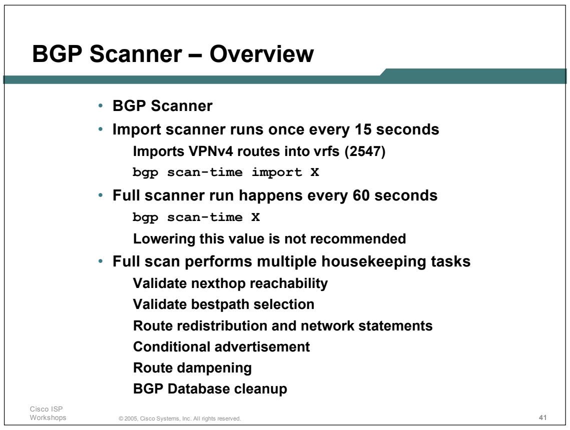
TCP MSS – Max Segment Size

- BGP KAs (Keepalives) are 19 bytes
- BGP Updates vary in size up to 4096 bytes
- The larger the TCP MSS the fewer TCP packets required
- Fewer packets means less overhead and faster convergence



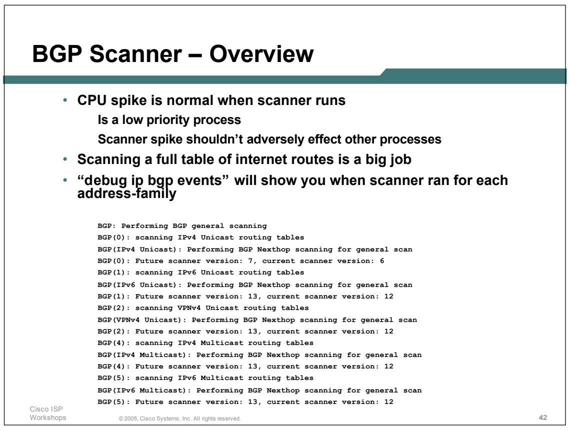
Agenda

- Not so new features
- TCP Developments
- BGP Scanner
  - ATF – Address Tracking Feature
  - NHT – Next Hop Tracking
  - Event driven redistribution
- OER
- Miscellaneous



BGP Scanner – Overview

- BGP Scanner
- Import scanner runs once every 15 seconds
  - Imports VPNv4 routes into vrfs (2547)
  - `bgp scan-time import X`
- Full scanner run happens every 60 seconds
  - `bgp scan-time X`
  - Lowering this value is not recommended
- Full scan performs multiple housekeeping tasks
  - Validate nexthop reachability
  - Validate bestpath selection
  - Route redistribution and network statements
  - Conditional advertisement
  - Route dampening
  - BGP Database cleanup



BGP Scanner – Overview

- CPU spike is normal when scanner runs
  - Is a low priority process
  - Scanner spike shouldn't adversely effect other processes
- Scanning a full table of internet routes is a big job
- "debug ip bgp events" will show you when scanner ran for each address-family

```
BGP: Performing BGP general scanning
BGP(0): scanning IPv4 Unicast routing tables
BGP(IPv4 Unicast): Performing BGP Nexthop scanning for general scan
BGP(0): Future scanner version: 7, current scanner version: 6
BGP(1): scanning IPv6 Unicast routing tables
BGP(IPv6 Unicast): Performing BGP Nexthop scanning for general scan
BGP(1): Future scanner version: 13, current scanner version: 12
BGP(2): scanning VPNv4 Unicast routing tables
BGP(VPNv4 Unicast): Performing BGP Nexthop scanning for general scan
BGP(2): Future scanner version: 13, current scanner version: 12
BGP(4): scanning IPv4 Multicast routing tables
BGP(IPv4 Multicast): Performing BGP Nexthop scanning for general scan
BGP(4): Future scanner version: 13, current scanner version: 12
BGP(5): scanning IPv6 Multicast routing tables
BGP(IPv6 Multicast): Performing BGP Nexthop scanning for general scan
BGP(5): Future scanner version: 13, current scanner version: 12
```

ATF – Address Tracking Filter

- Available from 12.0(28)S
  - (CSCec17043, CSCee70421)
- ATF is a middle man between clients that use the RIB and the FIB
  - Clients could be BGP, OSPF, EIGRP, etc
- The client tells ATF what prefixes he is interested in
- ATF tells the client when one of these prefixes has a RIB change

BGP NHT – Next Hop Tracking

- Integrated in 12.0(28)S
  - (CSCec18878, CSCec55381)
  - Enabled by default
  - `[no] bgp nexthop trigger enable`
- BGP registers all nexthops with ATF
  - Hidden command will let you see a list of nexthops
  - `show ip bgp attr nexthop`
- ATF will let BGP know when a route change occurs for a nexthop
- ATF notification will trigger a lightweight “BGP Scanner” run
  - Only bestpath will be calculated
  - None of the other standard stuff that BGP does in scanner will happen

Next Hop Tracking

- BGP will scan the table and recalculate bestpaths
- No longer have to wait as long as 60 seconds for BGP to scan the table and recalculate bestpaths
- Once an ATF notification is received BGP waits 5 seconds before triggering NHT scan
  - bgp nexthop trigger delay <0-100>
  - May lower default value as we gain experience
- Allows BGP to react quickly to IGP changes
  - Tuning your IGP for fast convergence is highly recommended

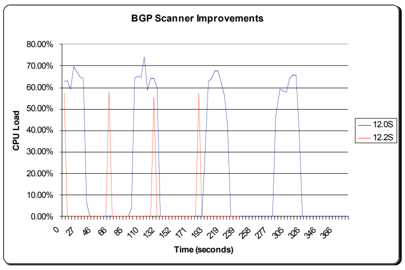
Next Hop Tracking

- Damping library is used to prevent triggered scans from happening too often
  - “`show ip bgp internal`” shows when the next scan can run
- New commands
  - bgp nexthop trigger enable
  - bgp nexthop trigger delay <0-100>
  - show ip bgp attr next-hop ribfilter
  - debug ip bgp events nexthop
  - debug ip bgp rib-filter
- Normal BGP scan still happens every 60 seconds
- Normal scanner does not evaluate best path at each net if NHT is enabled

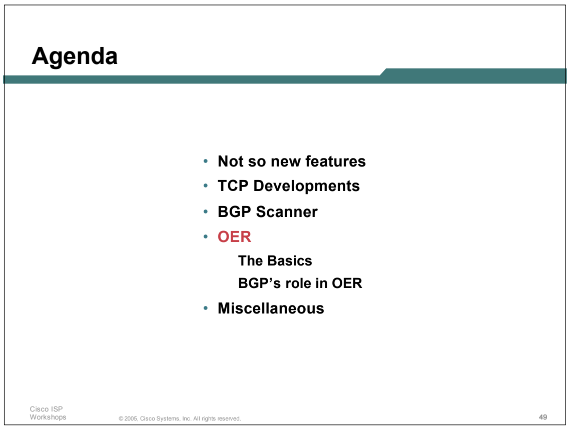
Event Driven Route Origination

- Improvements have been made to reduce CPU impact
  - Route redistribution is now fully event driven
  - Network statements are now fully event driven
- Nexthop Tracking (NHT)
  - NHT detects that our route to one of our BGP nexthops has changed
  - NHT triggers a lightweight scanner run that only validates nexthop reachability and recalculates bestpaths
  - Nexthop and bestpath validation no longer happens in scanner every 60 seconds

BGP Scanner

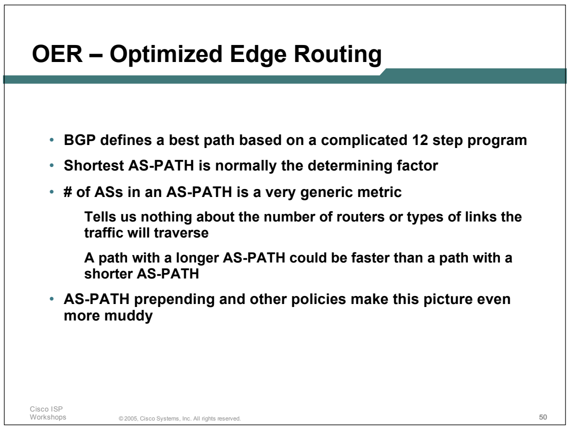


- 7200 with NPE-G1
- 900k routes in the BGP table
- BGP Scanner in 12.2S uses much less CPU



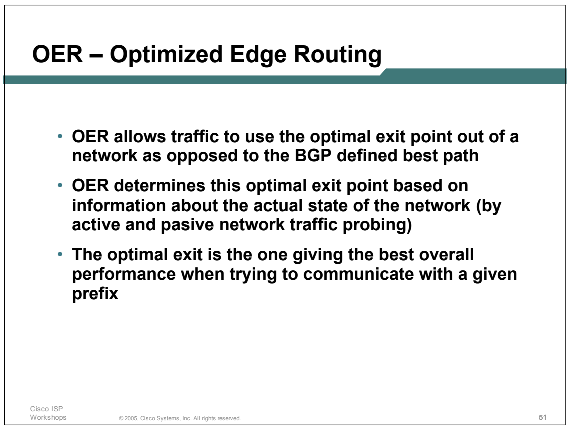
Agenda

- Not so new features
- TCP Developments
- BGP Scanner
- OER
  - The Basics
  - BGP's role in OER
- Miscellaneous



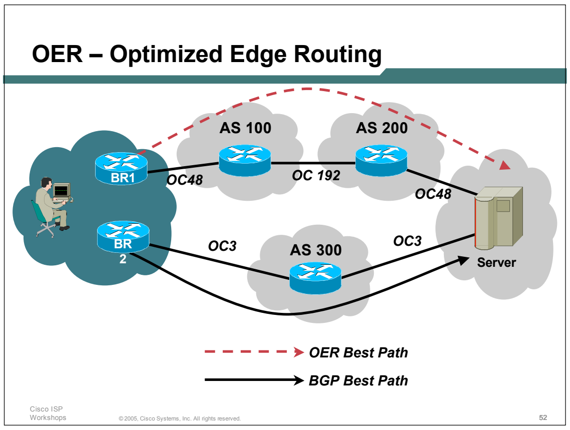
OER – Optimized Edge Routing

- BGP defines a best path based on a complicated 12 step program
- Shortest AS-PATH is normally the determining factor
- # of ASs in an AS-PATH is a very generic metric
  - Tells us nothing about the number of routers or types of links the traffic will traverse
  - A path with a longer AS-PATH could be faster than a path with a shorter AS-PATH
- AS-PATH prepending and other policies make this picture even more muddy

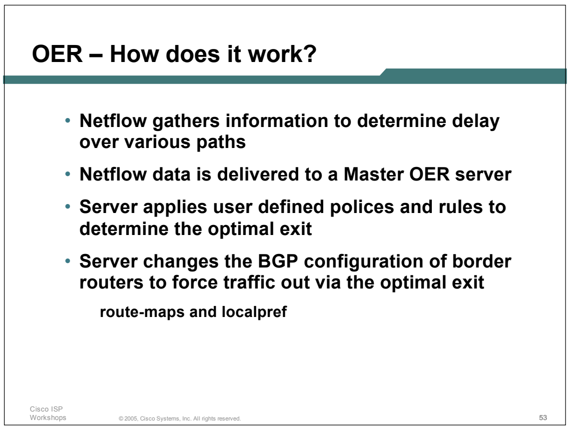


OER – Optimized Edge Routing

- OER allows traffic to use the optimal exit point out of a network as opposed to the BGP defined best path
- OER determines this optimal exit point based on information about the actual state of the network (by active and pasive network traffic probing)
- The optimal exit is the one giving the best overall performance when trying to communicate with a given prefix

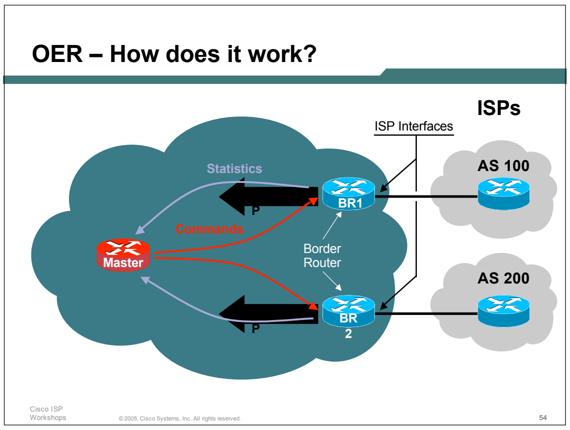


OER – Optimized Edge Routing



OER – How does it work?

- Netflow gathers information to determine delay over various paths
- Netflow data is delivered to a Master OER server
- Server applies user defined polices and rules to determine the optimal exit
- Server changes the BGP configuration of border routers to force traffic out via the optimal exit
  - route-maps and localpref



OER – How does it work?

OER – Server Settings

- The Master server determines the optimal path by using the Netflow data with user defined policy

  Low delay

  Low packet loss

  Cost Minimization

  History

  etc.

OER – More Information?

- This was OER from 100,000 feet
- Cisco Networkers has an entire session dedicated to OER!

  RST-4311

Agenda

- Not so new features
- TCP Developments
- BGP Scanner
- OER
- Miscellaneous

  FSD – Fast Session Deactivation

  EIGRP PE/CE

  Restart after max-prefix exceeded

  Last AS prepend

  eBGP disable-connected-check

  RIB Modify

FSD

- FSD – Fast Session Deactivation
- Register peers' addresses with ATF
- ATF will let BGP know if there is a change to a peer's address
- If we loose our route to the peer from the RIB, tear down the session

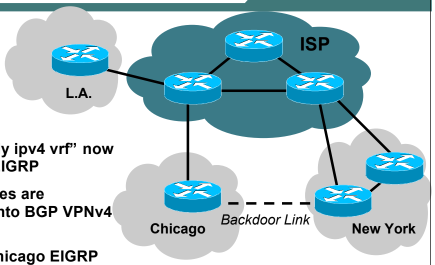
  No need to wait for the hold timer to expire!

FSD

- Ideal for IBGP peers and multihop eBGP peers
- Can tear down BGP sessions at IGP convergence speed
- Off by default

```
neighbor x.x.x.x fall-over
```

EIGRP PE/CE



- "address-family ipv4 vrf" now supported in EIGRP
- EIGRP vrf routes are redistributed into BGP VPNv4 and vice versa
- The LA, NY, Chicago EIGRP networks are connected via 2547 VPNs

EIGRP PE/CE

- EIGRP will prefer routes learned via the ISP over the backdoor routes (use of cost-communities)
- All EIGRP metrics are preserved across the ISP backbone!

  If New York redistributes 10.0.0.0/8 from RIP to EIGRP then LA will see the EIGRP route as an external with the proper metric

  Accomplished by using BGP extended communities to carry the EIGRP information through the backbone

Restart after Max Prefix exceeded

- `neighbor x.x.x.x maximum-prefix 100`

  Session will be shutdown if peer exceeds limit (100 prefixes)

  Manual intervention required to re-establish connection
- New “`restart`” keyword

  Specify # of minutes to wait before automatically restarting the session
- Do not set the restart timer too low

  Frequently flapping sessions could result in dampening

  Give your neighboring operators time to correct the problem
- `neighbor x.x.x.x maximum-prefix 100 restart 30`

  Session will automatically attempt to re-establish after 30 minutes

Last AS Prepend

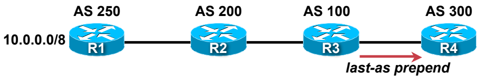
- New knob for route-map as-path prepending

  Only applicable on route-maps applied to neighbor statements
- `set as-path prepend last-as X`

  Prepends the last-as (leftmost AS in the AS_PATH) X times
- BGP now sanity checks route-map match and set statements

```
R3(config-router)#redist static route-map foo

% "foo" used as redistribute static into bgp route-map,
set as-path prepend last-as not supported
```

Last AS Prepend



- R3 is configured to last-as prepend towards R4

```
router bgp 100
    neighbor R4 route-map foo out
route-map foo permit 10
    set as-path prepend last-as 2
```

- R4 sees the as-path as if R2 prepended

```
R4# show ip bgp 10.0.0.0/8
BGP routing table entry for 10.0.0.0/8, version 41
100 200 200 200 250
    20.255.255.2 from 20.255.255.1 (1.1.1.1)
      Origin incomplete, localpref 100, valid, external, best
```

eBGP disable-connected-check

- eBGP peers must meet one of the following criteria

  Are directly connected which is verified by comparing the eBGP peer’s address with our connected subnets

  Are configured for ebgp-multihop which disables the connected subnet check
- Single hop eBGP loopback peering does not fit either rule very well

  Default TTL (Time To Live) is 1

  ⇒ “`neighbor x.x.x.x ebgp-multihop 1`” is silently ignored by the parser

  “`neighbor x.x.x.x ebgp-multihop 2`” must be used here

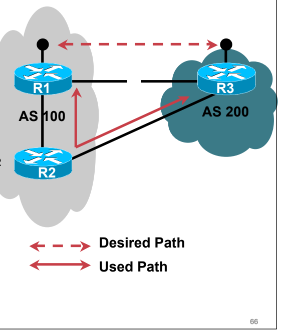
eBGP disable-connected-check

- R1 and R3 are eBGP peers that are loopback peering
- Older code must use the following in R1 and R3

```
neighbor x.x.x.x ebgp-multihop 2
```

- Small security hole

  If the R1 to R3 link goes down the session could establish via R2

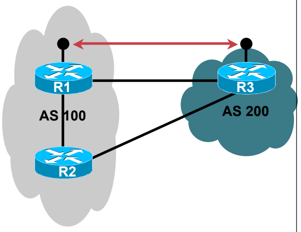


eBGP disable-connected-check

- New code does not need an ebgp-multihop statement

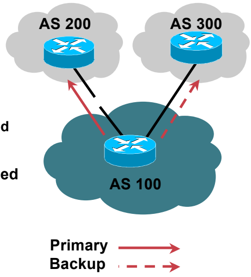
  Instead use:

  ```
  neighbor x.x.x.x disable-
  connected-check
  ```
- TTL is 1
- Session cannot establish via R2
- If R1 to R3 link is down so is the BGP session
- Closes security hole!



RIB Modify

- AS 100 is dual peering
  - AS 200 is primary
  - AS 300 is backup
- Upon AS 200 failure
  - All routes via AS 200 will be deleted
  - Routes via AS 300 will be added
- Brief period where traffic is dropped during transition



RIB Modify

- RIB Modify lets us modify the route in place
- No longer need to do a delete/add
- We modify the AS 200 route with the AS 300 route
- Zero traffic is dropped during the transition!

BGPv4 Soft-Notification

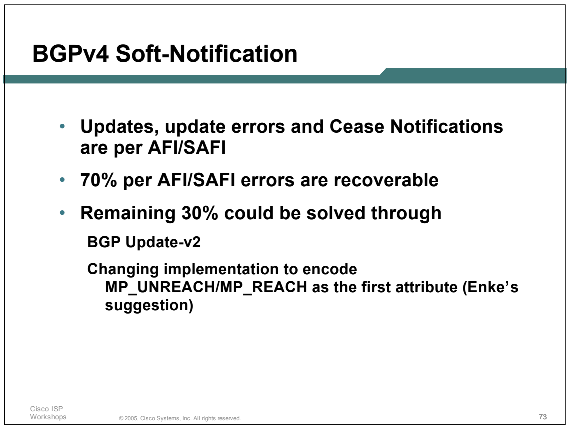
- A NOTIFICATION message resets the BGP session
- The error may apply to only a particular AFI/SAFI
- The #AFI/SAFIs has increased in the recent times
- Affects stability and robustness of BGP Networks

BGPv4 Soft-Notification

- Need a per AFI/SAFI NOTIFICATION that
  - Will not reset the BGP session
  - Will soft-reset the affected AFI/SAFI
  - Has a mechanism to soft-shut/soft-unshut an AFI/SAFI
  - Has a mechanism to synchronize AFI/SAFI states on sender and receiver
  - Would introduce a new Capability

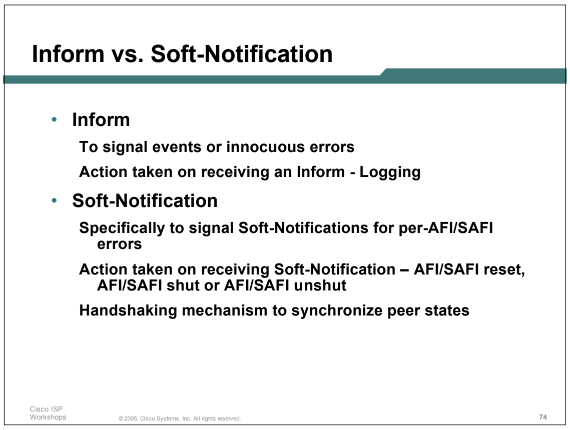
BGPv4 Soft-Notification

- A New BGP Message Type
- No BGP session-reset
- Will soft-reset the affected AFI/SAFI
- Handshaking mechanism to synchronize the AFI/SAFI states between the BGP Speakers sending/receiving the Soft-Notification Message



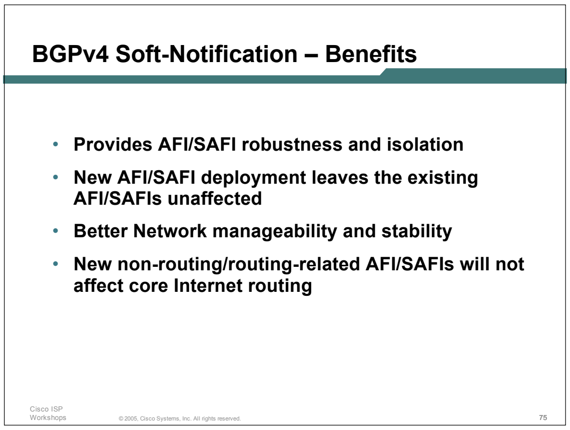
BGPv4 Soft-Notification

- Updates, update errors and Cease Notifications are per AFI/SAFI
- 70% per AFI/SAFI errors are recoverable
- Remaining 30% could be solved through
  - BGP Update-v2
  - Changing implementation to encode MP_UNREACH/MP_REACH as the first attribute (Enke's suggestion)



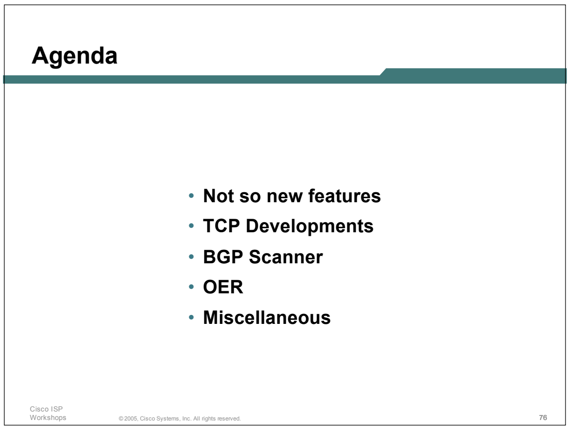
Inform vs. Soft-Notification

- Inform
  - To signal events or innocuous errors
  - Action taken on receiving an Inform - Logging
- Soft-Notification
  - Specifically to signal Soft-Notifications for per-AFI/SAFI errors
  - Action taken on receiving Soft-Notification – AFI/SAFI reset, AFI/SAFI shut or AFI/SAFI unshut
  - Handshaking mechanism to synchronize peer states



BGPv4 Soft-Notification – Benefits

- Provides AFI/SAFI robustness and isolation
- New AFI/SAFI deployment leaves the existing AFI/SAFIs unaffected
- Better Network manageability and stability
- New non-routing/routing-related AFI/SAFIs will not affect core Internet routing



Agenda

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Cisco Systems

New BGP Features

ISP/IXP Workshops