NETWORKERS 2004

CISCO OPTIMIZED EDGE ROUTING (OER)

SESSION RST-4311

Agenda

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- The Challenge
- What Is Cisco OER?
- Configuration
- Monitoring
- Deployment
- Trouble Shooting
- Conclusion

Typical Internet Load-Sharing

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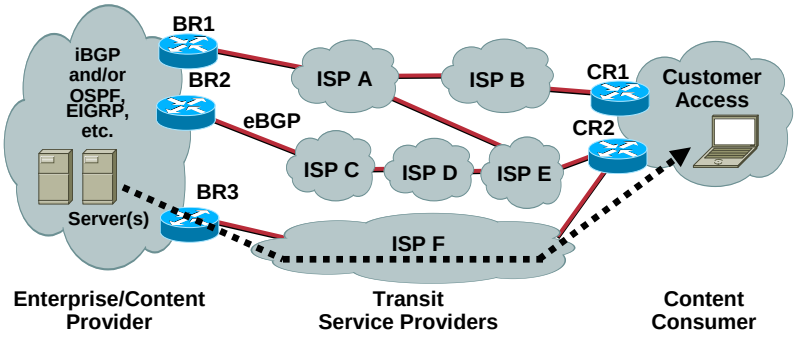

All Other Factors Being Equal, the Path from the Enterprise to the Content Consumer will be via ISP F (Fewest AS-PATH Hops)

But, What If…

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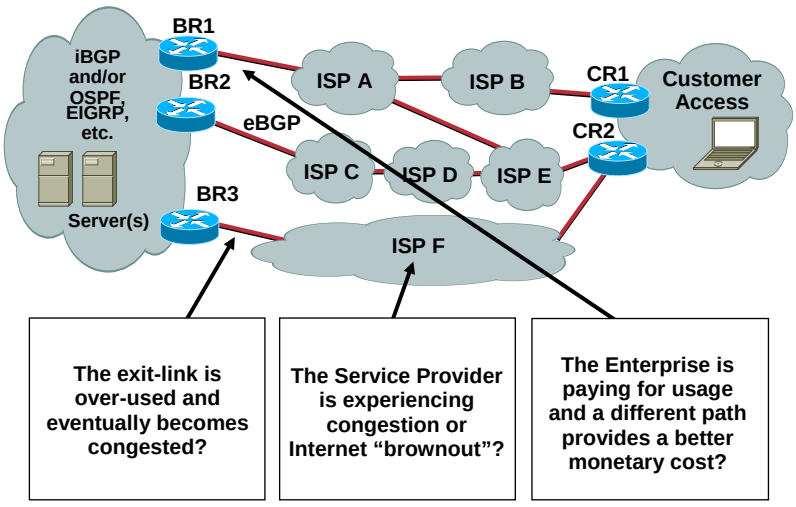

The Problem

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- Traditional routing metrics
  - Provide reliable reachability information
  - Cannot enforce performance
- BGP is especially challenging
  - Routing decisions are usually based on fewest AS-PATHs
  - Does not reveal information about the quality or performance of those paths
- No visibility into business requirements
  - Managing bandwidth monetary cost
  - Performing optimal load-distribution

The Solution: Cisco Optimized Edge Routing

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- Automatic policy-based distribution of traffic
  - Prefixes: reachability, delay, packet loss
  - Links: load, distribution, monetary cost
- Provides functionality unavailable with traditional routing metrics
  - Performance-based load distribution
  - Performance degradation protection
  - Enhanced reachability monitoring
  - Preference of most cost-effective links

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What Is Cisco OER?

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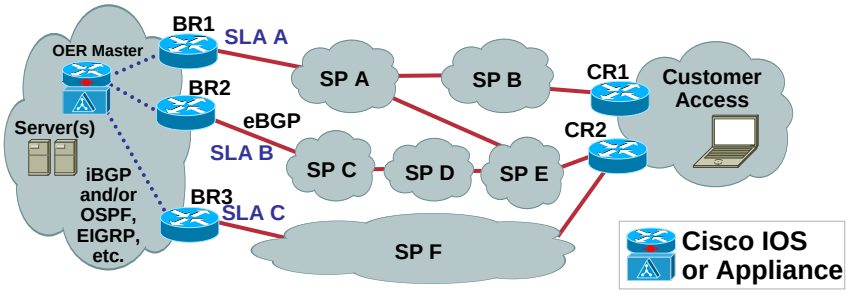
- Automatic outbound route optimization for multi-homed enterprises by selecting “optimal” exit according to performance, cost, and load distribution policy *



* OER 1.0

Cisco OER In-a-Nutshell

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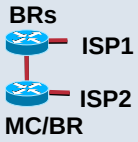
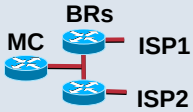
OER PRODUCT FAMILY, CONFIGURATIONS AND PLATFORMS

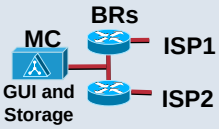
CONFIG A



CONFIG B



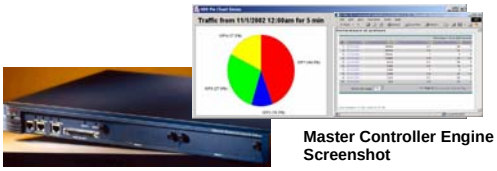
CONFIG C



17xx, 26xx, 36xx, 37xx, 72xx, 73xx, 75xx in 12.3(8)T
Catalyst 65xx/76xx in 12.2S (Planned)

Optimized Exit Path By

1. **Latency**
2. **Packet Loss**
3. **Reachability**
4. **Cost**
5. **Load Sharing**



Cisco OER Mater Controller Engine

Master Controller Engine Screenshot

What Does Cisco OER Do?

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For a Prefix and Configured Policy, Select Optimal Exit For…

- **Avoiding brown-outs**
- **Performance**
- **Minimizing ISP bandwidth cost**
- **Link Utilization**
- **Per-prefix load sharing**
- **Resolving link selection conflicts based on policy preference**

Cisco OER Key Features

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- Automatic performance route optimization and policy-based load sharing
- Multiple platforms—17xx, 26xx, 36xx, 37xx, 72xx, 73xx, 75xx (Cisco IOS 12.3(8)T)
- Multiple routing protocols
  - BGP and Static routing
- Support Internet-bound traffic
- Passive monitoring and Active probing
- Manual configured prefix lists
- Automatic inclusion of prefixes via Top Talker
  - Top Throughput
  - Top Latency
- Prefix splitting

Cisco OER Key Features (Cont.)

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- OER observation/control mode
- Support of multiple link billing models
  - Fixed-rate
  - Tier-based with bursting
- Syslog export of observation and control management information
- 30-day history of observation and control management information on appliance
- CLI configurations and reporting for Cisco IOS-based solution
- GUI configurations and reporting for Master Controller Engine

How Does Cisco OER Do It? (Monitor)

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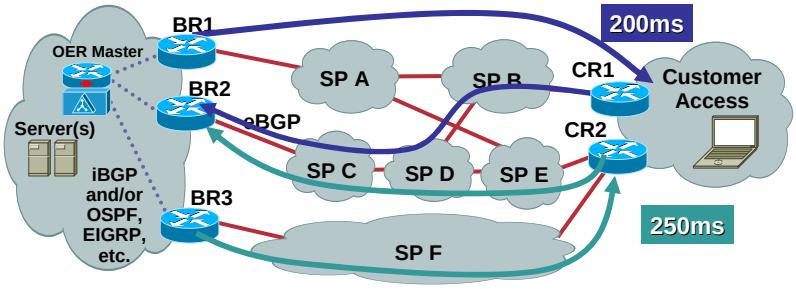

- Which prefixes? Config or automatically learned (Top Talker)
- What does OER monitor? TCP SYN-ACK delay, throughput, packet loss, reachability
- How does OER monitor? Passively using NetFlow, actively using SAA
  - No Netflow or SAA config required
- Accumulate monitored information in database

How Does Cisco OER Do It? (Control)

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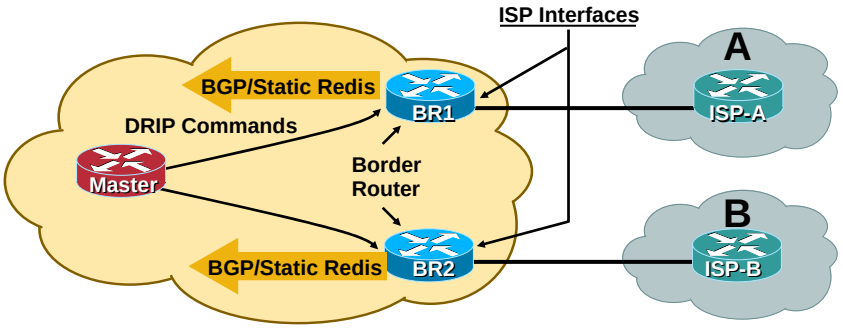
Changes the Exit Route for a Prefix by…



- Modifying BGP local preference
  - Local preference must be highest
- Installing a static route
  - Redistribute static config required
- Report any route changes

Agenda

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Out-of-the-Box OER

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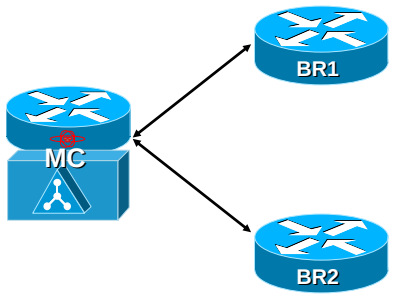

- OER optimization enabled on all routers
- Latency and automatic top talker detection via NetFlow
- Latency verified/augmented by active probing
- Performance optimization and load sharing
- Delay > default delay value
- Link utilization > threshold
- Syslog functionality
- CLI and GUI configuration/reporting and history

Basic Cisco IOS Configuration

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Master Controller

```
key chain key1
 key 1
  key-string border1
key chain key2
 key 1
  key-string border2

oer master
 port 7777
 logging
 border 1.1.1.1 key-chain key1
  interface Ethernet8/0 internal
  interface Serial12/0 external
 border 1.1.1.2 key-chain key2
  interface Ethernet8/0 internal
  interface Ethernet0/0 external
 learn
  throughput
 mode route control
interface Ethernet6/0
 ip address 1.1.1.3 255.255.255.0
```

Border Router

```
key chain key1
 key 1
  key-string border1

oer border
 logging
 local Ethernet6/0
 port 7777
 master 1.1.1.3 key-chain key1

interface Ethernet6/0
 ip address 1.1.1.1 255.255.255.0

router bgp 100
 network 10.10.10.0 mask 255.255.255.0
 network 30.30.30.0 mask 255.255.255.0
 neighbor 10.10.10.2 remote-as 100
 neighbor 10.10.10.2 send-community
 neighbor 30.30.30.2 remote-as 300
 neighbor 30.30.30.2 send-community
```


Advanced Master Controller Configuration

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```
MC(config-oer-mc)#?
OER master controller configuration commands:
  active-probe           Manually create an active probe for a known target
  backoff                Specify backoff timer parameters
  border                 Enter OER managed border router configuration submode
  default                Set a command to its defaults
  delay                  Specify delay parameters
  exit                   Exit from OER master controller configuration submode
  holddown               Specify hold-down timer parameter
  keepalive              Specify keepalive interval
  learn                  Enter Top Talker and Delay learning submode
  logging                Event Logging
  loss                   Specify loss parameters
  max-range-utilization  Configure the maximum range for utilization of all exits
  mode                   Specify OER operating mode settings
  no                     Negate a command or set its defaults
  periodic               Specify periodic rotation timer value
  resolve                Specify OER policy resolver settings
  shutdown               Disable OER master controller functionality
  unreachable            Specify unreachable parameters
```

Active Probe Configuration
Master Submode

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active-probe {echo ip-address **| tcp-conn** ip-address **target-port** number **| udp-echo** ip-address **target-port** number**}**

- **Configure ICMP, UDP, or TCP Probes**
- ip-address
  - **IP address of host to probe**
- number
  - **Port number for UDP or TCP probes**
- **udp-echo requires IOS rtr responder on target**
- **Probes sent ~1 per minute**
- **Up to 5 probes per prefix**
- **Probes assigned according to longest match**

Backoff Timer Configuration
Master Submode, oer-map

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backoff min-timer max-timer **[**step-timer**]**

- **Time to wait after failing to find good or best exit**
- min-timer **is starting value**
- max-timer **is maximum value**
- **Increase Backoff by** step-timer **if no best exit**
- **If good or best exit found, reset to** min-timer

Border Configuration
Master Submode

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border ip-address **[key-chain** key-name**]**

- **Identify an OER border router and enter border configuration mode**
- **key-chain**
  - **Required only on initial configuration**
- ip-address **must be reachable from Master Controller**
- **Border submode configuration options**

```
MC(config-oer-mc)#border 2.2.2.3
MC(config-oer-mc-br)#?
OER managed border router configuration commands:
  default     Set a command to its defaults
  exit        Exit from OER managed border router configuration submode
  interface   Specify an OER managed border router interface
  no          Negate a command or set its defaults
```


Interface Config
Master-Border Submode

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interface type number **external | internal**

- **Identify interesting interfaces on the Border Router**
- **external**
  - **Interface connects outside Area**
- **internal**
  - **Interface connects inside Area**
- **Passive measurements on flows to/from internal/external**
- **Other interfaces ignored**
- **external enters external interface submode**

```
MC(config-oer-mc-br-if)#?
OER Interface/Exit subcommands:
  max-xmit-utilization  Specify the threshold utilization for an external
                        interface
  no                    Negate or set default values of a command
```

Maximum Transmit Utilization Policy
Master-Border-Interface-External Submode

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max-xmit-utilization absolute kbps **| percentage** value

- **Highest In-Policy transmit throughput**
- **5 minute output rate > absolute** kbps **, exit is OOP**
- **Tx Load > percentage** value**, exit is OOP**
- **Move prefixes away from exit to achieve In-Policy**

Link Policy Example

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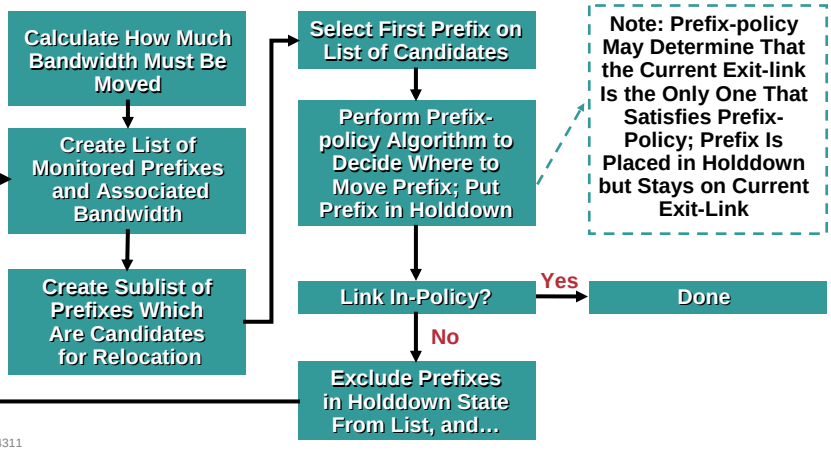
The Customer Has Configured a Load Policy of 90% Maximum Utilization for an Exit Link; Current Utilization Is 95%, so the Link Is Out-of-Policy



Holddown Timer Configuration
Master Submode, oer-map

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holddown timer

- **Minimum time between exit changes**
- **Enforces route dampening**
- **If prefix unreachable, holddown is ignored**

Keepalive Timer Configuration
Master Submode

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keepalive timer

- **Time between sending keepalives**
- **No keepalive config required on Border**
- **Keepalives sent from Master Controller and Border Router**
- **no keepalive disables keepalives**
- **If no keepalive received for 3 * timer seconds, teardown the Master to Border communications**
- **Default keepalive enabled with 5 seconds.**

Learn Configuration
Master Submode

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learn

- Learn prefixes
  - Enter learn configuration submode
- OER learns prefixes based on:
  - Highest Throughput
  - Longest Delay
- learn configuration submode commands

```
MC(config-oer-mc-learn)#?
OER Top Talker and Delay learning subcommands:
  aggregation-type   Type of prefix to aggregate
  delay              Learn top prefixes based on delay
  exit               Exit from Top Talker configuration submode
  monitor-period     Period to monitor prefix for learning
  no                 Negate or set default values of a command
  periodic-interval  Interval before learning restarts
  prefixes           Number of prefixes to learn
  protocol           Learn top prefixes based on protocol
  throughput         Learn top prefixes based on throughput
```


Learned Prefix Boundaries
Master-Learn Submode

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aggregation-type bgp | non-bgp | prefix-length prefix-length

- Identify aggregation boundaries
- All flows monitored
- Learn prefixes according to prefix-length
  - Flows aggregated into prefixes of length 1 to 32
  - If routing table has more specific match, aggregate to it.
- Learn prefixes according to bgp routes
- Learn prefixes according to non-bgp routes
- Default is prefix-length 24

Learn Prefixes by Delay
Master-Learn Submode

Cisco.com

delay

- Learn N longest delay prefixes
  - N specified by **prefixes** in learn submode
- Both ingress and egress flows are aggregated
- Delay is determined by TCP SYN to TCP ACK delay
- Enables netflow on border routers

How Long to Learn?
Master-Learn Submode

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monitor-period minutes

- Specify the prefix learning interval
- Aggregate all flows for minutes on border router
- At the end, report top prefixes to master controller
- Default is 5 minutes

How Often to Learn?
Master-Learn Submode

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periodic-interval minutes

- **Specify the interval between learning periods**
- **No prefixes are learned during this time**
- **At the end, monitoring period begins**
- **Default is 120 minutes**

How Many Prefixes to Learn?
Master-Learn Submode

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prefixes number

- **Specify how many prefixes to learn**
- **Each Border router reports** number **prefixes**
- **Master Controller receives N reports**
  - **N is number of Border Routers**
- **Master Controller sorts (N *** number**) >>** number
- **Delay and throughput reported seperately**
- **Default is 100 prefixes**

Learn Prefixes by Throughput
Master-Learn Submode

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throughput

- **Learn N highest throughput prefixes**
  - **N specified by prefixes in learn submode**
- **Only egress flows are aggregated**
- **Throughput is # of bytes transmitted during monitor-period**
- **Enables NetFlow on border routers**

Loss Policy Configuration
Master Submode, oer-map

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loss relative average **| threshold** maximum

- **Configure absolute or relative loss policy**
- **Track TCP Sequence number**
- **Absolute**
  - **short term > maximum packets-per-million, prefix is OOP**
- **Relative**
  - **((short term / long term) - 1) * 100) > average , prefix is OOP**
- **Short term is 5 minute average loss in packets-per-million**
- **Long term is 60 minute average loss in packets-per-million**
- **No active loss measurement**
- **Default is loss relative 10**

Load Distribution Policy
Master Submode, oer-map

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max-range-utilization maximum

- **Configure maximum range of transmit utilization**
- **max-util is % utilization of highest utilized exit (max-exit)**
- **min-util is % utilization of lowest utilized exit**
- **(max-util - min-util) >** maximum**, max-exit is OOP**
- **Supports exits with different bandwidths**
  - **Comparing % utilization not actual throughput**

Configure OER Modes of Operation
Master Submode, oer-map

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mode monitor {active | both | passive}

- **How to monitor a prefix?**
- **both**
  - **Passively monitor current exit**
  - **When needed, actively probe all exits**
  - **Default value**
- **active**
  - **Actively probe current exit**
  - **When needed, actively probe all exits**
  - **No passive monitoring (no NetFlow)**

Configure OER Modes of Operation
Master Submode, oer-map

Cisco.com

mode monitor {active | both | passive}

- **passive**
  - **Passively monitor current exit**
  - **When needed, passively monitor all exits by changing route through all exits**
  - **No active probing (no SAA)**

Configure OER Modes of Operation (Cont.)
Master Submode, oer-map

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mode route {observe | control | metric {bgp local-pref preference **| static tag** value**}}**

- **Control a prefix exit? How?**
- **observe**
  - **Choose exit according to select-exit mode**
  - **Don't change any routing**
  - **Default value**
- **control**
  - **Choose exit according to select-exit mode**
  - **Change route if better exit found**
  - **Try BGP first, then static route**

Configure OER Modes of Operation (Cont.)
Master Submode, oer-map

Cisco.com

mode route {observe | control | metric {bgp local-pref preference **| static tag** value**}}**

- preference
  - **Local pref value when controlling using BGP**
  - **Default is 5000**
- value
  - **Associates route-map with static route using match tag value**
  - **Default is 5000**

Configure OER Modes of Operation (Cont.)
Master Submode, oer-map

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mode select-exit {best | good}

- **Exit selection method**
- **best**
  - **Choose the best performing exit of all exits**
  - **Prefix may not be In-Policy on the exit**
- **good**
  - **Choose first exit which is In-Policy**
  - **May not be the best exit**
  - **No In-Policy exit found? Don't control the Prefix**
- **resolve identifies priority of exit selection criteria**

Prefix Policy Example

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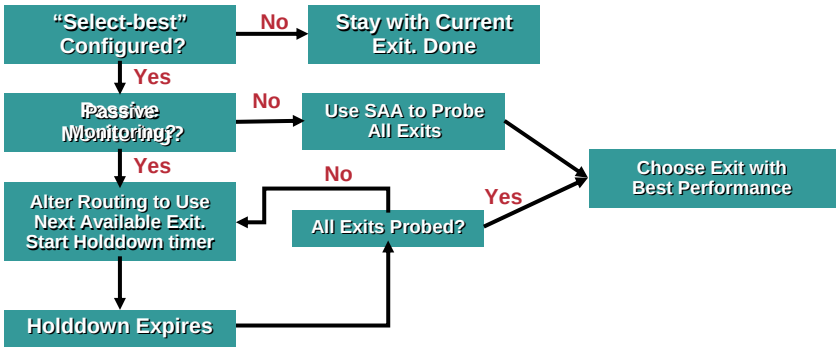
The Customer Has Configured a Policy That Requires a Maximum of 50-millisecond Delay Round-trip Time for Voice Traffic; the Current Measured Delay Is 40-milliseconds, so the Prefix Is Said To Be "In-Policy"



Periodic Timer Configuration
Master Submode, oer-map

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periodic timer

- **Check for best exit every** timer **seconds**
- **Typically OOP event or backoff expiration initiates best exit selection**
- **Periodic timer forces best exit selection**
- **mode select-exit good**

  Is prefix is In-Policy ? Do nothing
- **mode select-exit best**

  Search for best exit

TCP Port Configuration
Master Submode

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port port-number

- **Configure on master controller and border router**
- port-number **is a TCP port number**
- **Used for Master to Border communication**
- **Make sure** port-number **is not used by other applications**

Identify Policy Priorities
Master Submode, oer-map

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resolve {delay priority value **variance** percentage **| loss priority** value **variance** percentage **| range priority** value **| utilization priority** value **variance** percentage**}**

- **Examine policies starting with highest priority**
  - **If single exit identified, then use it**
  - **If multiple exits, go to next lower priority**
  - **If multiple exits after all, randomly choose one**
    - **Favor the current exit**
- **priority 1 is highest configurable priority**
- **Unreachable is highest priority**
  - **priority 0, not configurable**

Identify Policy Priorities
Master Submode, oer-map

Cisco.com

resolve {delay priority value **variance** percentage **| loss priority** value **variance** percentage **| range priority** value **| utilization priority** value **variance** percentage**}**

- **variance** percentage **identifies range of equivalency**

  Exits within the range are treated equivalently

- **Delay range = [lowest delay, (lowest delay * (1 +** percentage**/100))]**
- **Loss range = [lowest loss, (lowest loss * (1 +** percentage **/100))]**
- **Utilization range = [lowest utilization, (lowest utilization * (1 +** percentage**/100)]**

Shutdown OER Operation
Master Submode, Border submode

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shutdown

- **Stop OER operation**
- **Free CPU and dynamic memory resources**
- **Configuration unchanged**
- **Support on master controller and border router**

Unreachable Policy Configuration
Master Submode, oer-map

Cisco.com

unreachable relative average **| threshold** maximum

- **Configure absolute or relative policy**
- **Absolute**

  short term > maximum flows-per-million, prefix is OOP
- **Relative**

  ((short term / long term) - 1) * 100) > average , prefix is OOP
- **Short term is 5 minute avg of unreachable flows-per-million**
- **Long term is 60 minute avg of unreachable flows-per-million**
- **All exits In-Policy are considered for best exit**
- **Default is unreachable relative 50**

Identify a Monitored Prefix
Global Configuration

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oer-map MAP sequence-number

- **Prepare to identify specific Monitored Prefix**
- **Apply per-prefix policy**
- **Enter oer-map submode configuration**
- **oer-map configuration subcommands:**

```
default   Set a command to its defaults
exit      Exit from oer-map  configuration submode
match     Match values for OER policy
no        Negate a command or set its defaults
set       Set values for OER policy
```

- **Only one MAP is supported in 12.3(8)T**

Identify a Monitored Prefix (Cont.)
oer-map Submode

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match ip address prefix-list prefix-list-name

match oer learn delay | throughput

- **Identify a prefix for OER to Monitor**
- **Uses standard prefix-list configuration**
- **Single match statement per oer-map**
- **Multiple oer-maps for different policies for different prefixes**

```
ip prefix-list LIST2 seq 5 permit 100.1.0.0/16
ip prefix-list foo seq 5 permit 20.0.0.0/8
ip prefix-list foo seq 10 permit 22.1.0.0/16 le 32
ip prefix-list foo seq 15 deny 10.1.0.0/16
oer-map MAP 20
 match ip address prefix-list LIST2
 set delay threshold 100
oer-map MAP 30
 match ip address prefix-list foo
 set holddown 600
```


Prefix Specific Policy Configuration
oer-map Submode

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```
MC(config-oer-map)#set ?
  backoff      Specify backoff timer parameters
  delay        Specify delay parameters
  holddown     Specify hold-down timer parameter
  loss         Specify loss parameters
  mode         Specify OER operating mode settings
  periodic     Specify periodic rotation timer value
  resolve      Specify OER policy resolver settings
  traceroute   Enable traceroute
  unreachable  Specify unreachable parameters

    oer-map MAP 20
     match ip address prefix-list LIST2
     set delay threshold 100
    oer-map MAP 30
     match ip address prefix-list foo
     set holddown 600
```

Interface Configuration

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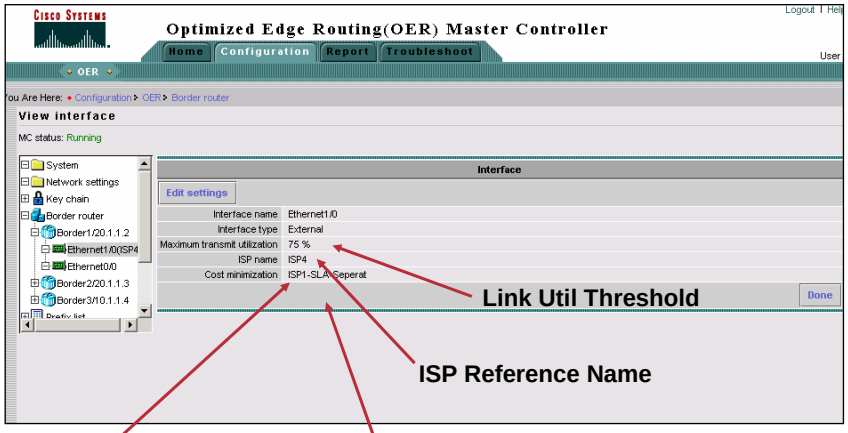

Enable Cost Minimization on This Exit (Only on Engine)

```
MC(config)#oer master
MC(config-oer-mc)#border 20.1.1.3
MC(config-oer-mc-br)#interface e1/0 external
MC(config-oer-mc-br-if)#max-xmit-utilization 75
```


Load Distribution Configuration

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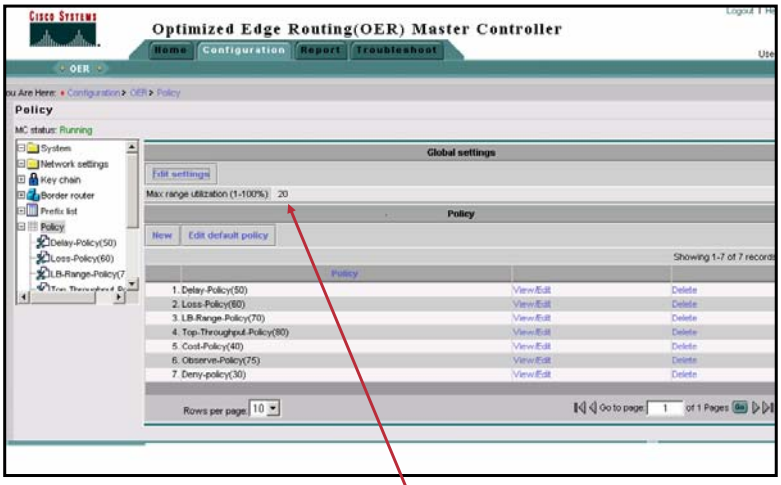

IOS CLI:

```
oer master
 max-range-utilization 20
```

Cost Minimization

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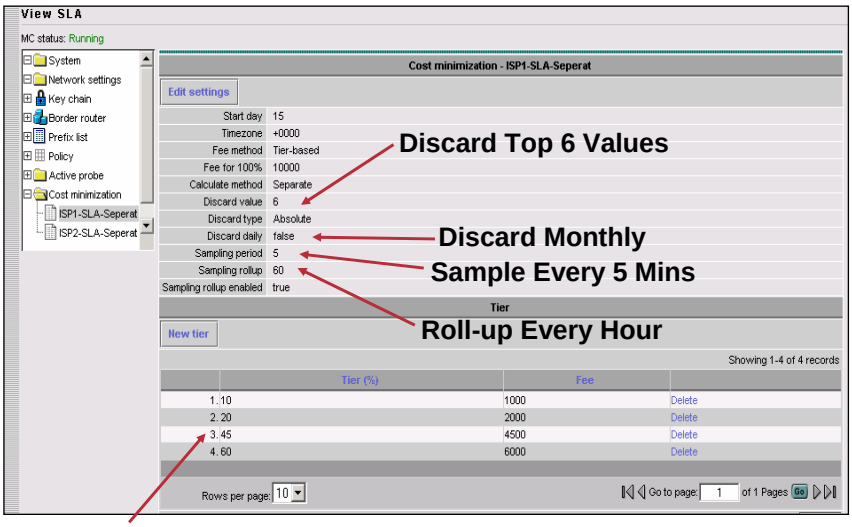

Agenda

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- Conclusion

System Status Commands

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- **All information available on the master**

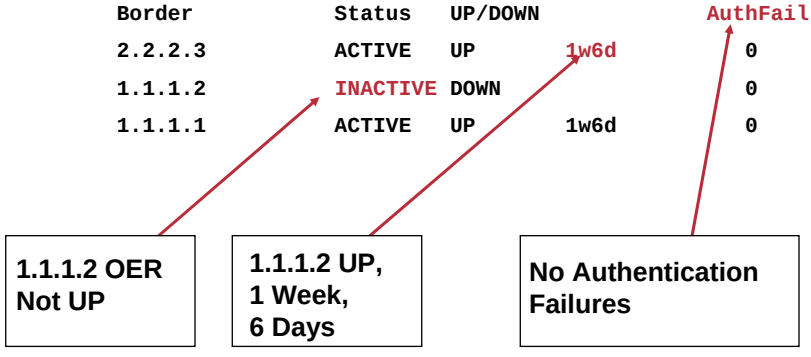
```
MC#sh oer master ?
  active-probes  Display OER active probes collector
                  information
  border         Display OER border router information
  policy         Display policy related information
  prefix         Display OER prefix information
  |              Output modifiers
  <cr>
```


Border Status

Cisco.com

show oer master border [*ip-address*] [**detail**]

```
MC#sh oer master border
Border           Status   UP/DOWN          AuthFail
2.2.2.3          ACTIVE   UP       1w6d    0
1.1.1.2          INACTIVE DOWN             0
1.1.1.1          ACTIVE   UP       1w6d    0
```



Prefix Status

Cisco.com

show oer master prefix [*prefix* [**detail** | **policy**]] | [**detail**] | [**learned** [**delay** | **throughput**]]

```
OER Prefix Statistics:
 Pas - Passive, Act - Active, S - Short term, L - Long term, Dly - Delay (ms),
 Los - Packet Loss (packets-per-million), Un - Unreachable (flows-per-million),
 E - Egress, I - Ingress, Bw - Bandwidth (kbps), N - Not applicable
 U - unknown, * - uncontrolled, + - control more specific, @ - active probe all

Prefix                  State     Time Curr BR         CurrI/F         Protocol
                      PasSDly  PasLDly   PasSUn   PasLUn  PasSLos  PasLLos
                      ActSDly  ActLDly   ActSUn   ActLUn      EBw      IBw
-------------------------------------------------------------------------------
100.1.1.1/32          HOLDDOWN      164 2.2.2.3          Et2/0            BGP
                             34       34         0        0        0        0
                              U        U         0        0        6       15
100.1.2.0/24          INPOLICY        0 1.1.1.1          Se12/0           BGP
                              N        N         N        N        N        N
                             37       39         0        0        N        N
100.1.3.0/24+         HOLDDOWN      117 2.2.2.3          Et2/0            BGP
                              U        U         0        0        0        0
                              U        U         0        0        0        0
100.1.4.0/24          HOLDDOWN      269 1.1.1.1          Se12/0           BGP
                              N        N         N        N        N        N
                              U        U         0        0        N        N
```

34 msec, 5 Minute avg, Passive Delay

39 msec, 60 Minute avg, Active Delay

269 secs to Go in HOLDDOWN State

Control with BGP

Active Probe Status

Cisco.com

show oer master active-probes

```
MC#sh oer master active-probes
        OER Master Controller active-probes

The following Probes exist:

State      Prefix           Type     Target          TPort How
Assigned   100.1.1.1/32     echo     100.1.1.1           N Lrnd
Assigned   100.1.4.0/24     echo     100.1.4.1           N Lrnd
Assigned   100.1.2.0/24     echo     100.1.2.1           N Lrnd
Assigned   100.1.4.0/24     udp-echo 100.1.4.1       65535 Cfgd
Assigned   100.1.3.0/24     echo     100.1.3.1           N Cfgd
Assigned   100.1.2.0/24     tcp-conn 100.1.2.1          23 Cfgd

The following Probes are running:

Border          State    Prefix           Type     Target          TPort
2.2.2.3         ACTIVE   100.1.4.0/24     udp-echo 100.1.4.1       65535
1.1.1.1         ACTIVE   100.1.2.0/24     tcp-conn 100.1.2.1          23
```

UDP Probe

Currently Running Probes

Probe Port #

Learned Probe

OER System Logging

Cisco.com

```
MC#sh log
%OER_MC-5-NOTICE: Passive Unreachable OOP 100.1.3.0/24, No passive data on
  BR 1.1.1.1, intf Se12/0
*May 20 10:57:21.739: %OER_MC-5-NOTICE: Uncontrol prefix 100.1.3.0/24, OOP,
  mode select-exit good
*May 20 11:00:39.771: %OER_MC-5-NOTICE: Route changed 100.1.3.0/24, BR
  2.2.2.3, i/f Et2/0, Reason None, OOP Reason Timer Expired
*May 20 11:01:38.895: %OER_MC-5-NOTICE: Prefix Learning WRITING DATA
*May 20 11:02:41.627: %OER_MC-5-NOTICE: Prefix Learning STARTED
*May 20 11:03:38.735: %OER_MC-5-NOTICE: Route changed 100.1.1.1/32, BR
  2.2.2.3, i/f Et2/0, Reason Utilization, OOP Reason Timer Expired
*May 20 11:06:00.423: %OER_MC-5-NOTICE: Passive Unreachable OOP
  100.1.3.0/24, No passive data on BR 2.2.2.3, intf Et2/0
*May 20 11:06:00.423: %OER_MC-5-NOTICE: Uncontrol prefix 100.1.3.0/24, OOP,
  mode select-exit good
*May 20 11:07:42.583: %OER_MC-5-NOTICE: Prefix Learning WRITING DATA
*May 20 11:08:45.435: %OER_MC-5-NOTICE: Prefix Learning STARTED
*May 20 11:09:10.607: %OER_MC-5-NOTICE: Route changed 100.1.3.0/24, BR
  1.1.1.1, i/f Se12/0, Reason None, OOP Reason Timer Expired
*May 20 11:12:14.823: %OER_MC-5-NOTICE: Route changed 100.1.1.1/32, BR
  1.1.1.1, i/f Se12/0, Reason Delay, OOP Reason Timer Expired
*May 20 11:13:46.383: %OER_MC-5-NOTICE: Prefix Learning WRITING DATA
```

Prefix OOP

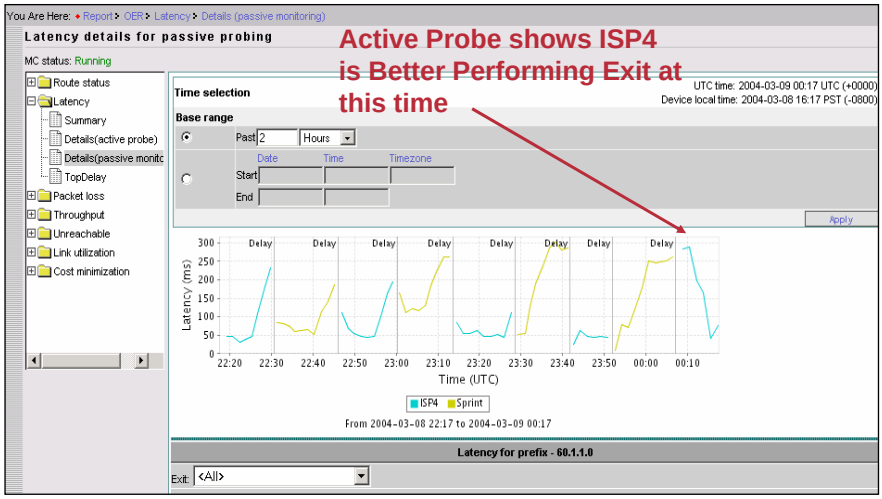
Changed Exit

Not Controlling Prefix

Prefixes were Learned

Latency by Passive Monitoring

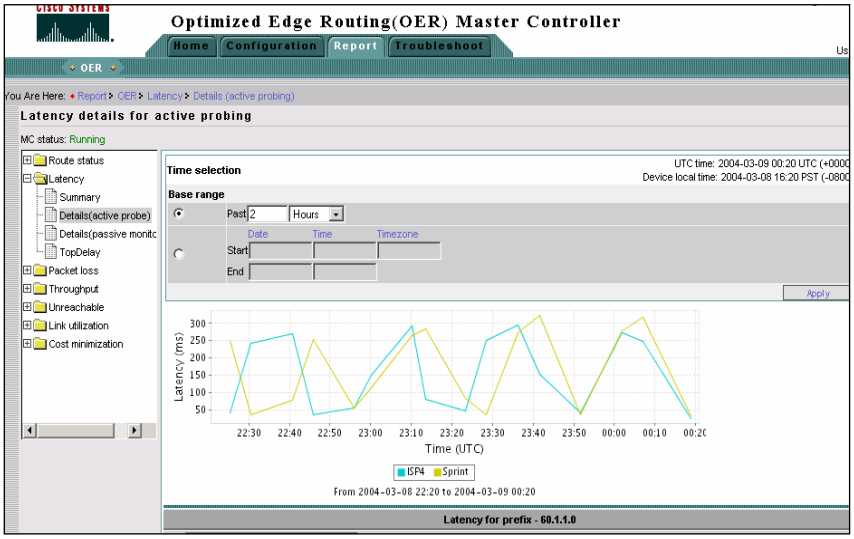
Cisco.com



RST-4311

Latency by Active Probes

Cisco.com



Load Distribution

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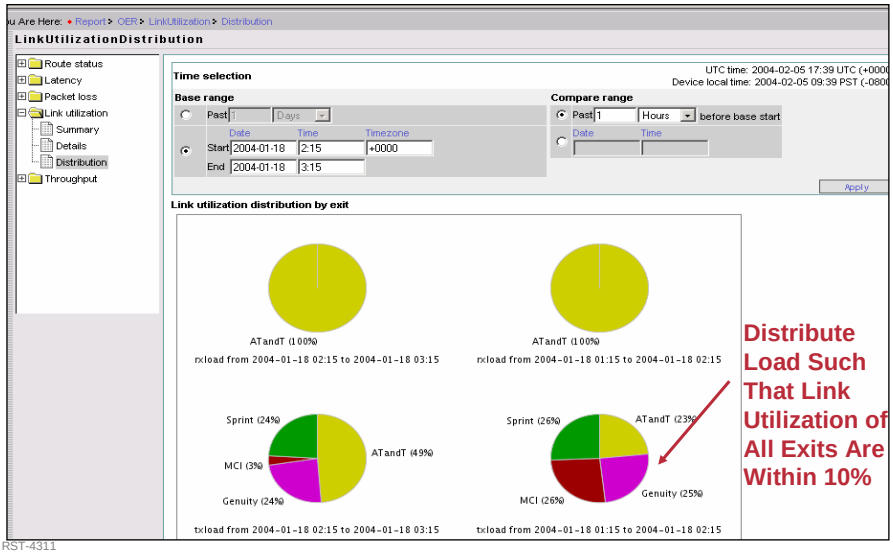
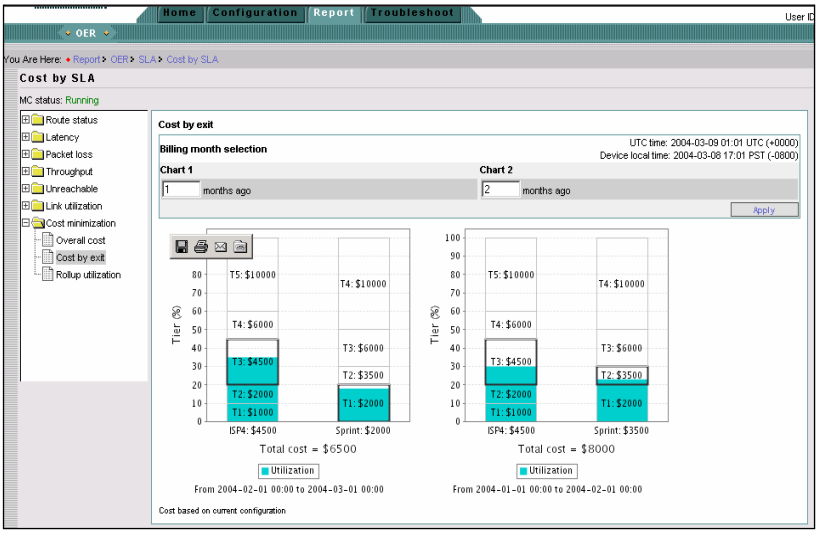
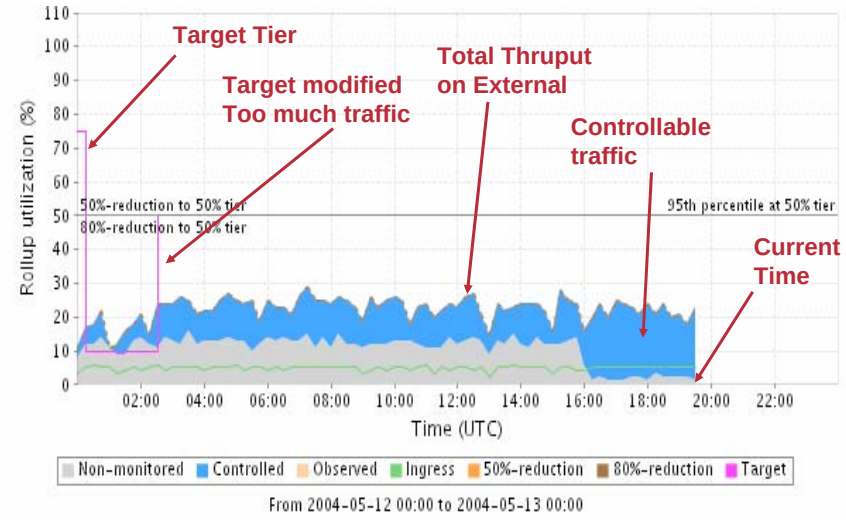


Distribute Load Such That Link Utilization of All Exits Are Within 10%

Cost Minimization



Cost Minimization Report



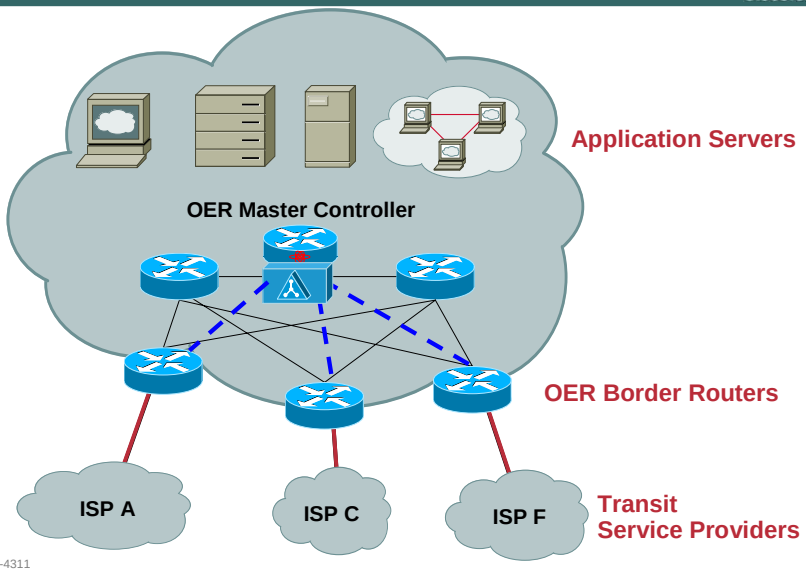
Agenda

Cisco.com

- The Challenge
- What Is Cisco OER?
- Configuration
- Monitoring
- Deployment
- Trouble Shooting
- Conclusion

Cisco OER Internet Example

Cisco.com



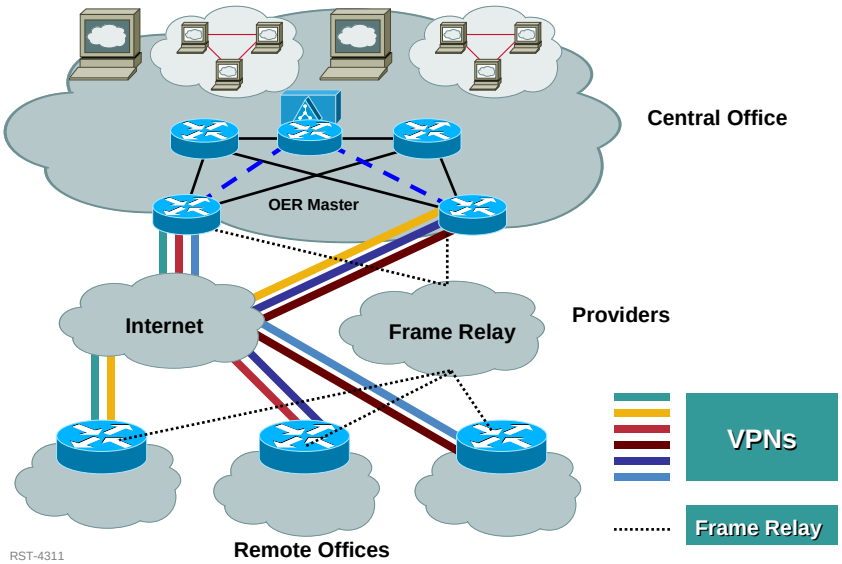
Benefits in Internet Example

Cisco.com

- Load distribution of traffic to remote hosts based on performance or cost criteria
- Automatic rerouting around Internet "brown-outs", during which routes remain intact but hosts are unreachable
- Automatic restoration of traffic once brownout concludes
- Operational savings because complex analysis and tuning of BGP no longer required

Cisco OER VPN Deployment

Cisco.com



Benefits in VPN Example

Cisco.com

- Offers the same benefits as the Internet example
  - Optimal load-distribution
  - Protection against brown-outs
  - Bandwidth cost savings
  - Operational savings
- Additional benefits are applied to a mixture of private (Frame Relay VPN) and public (Internet VPN) infrastructure
- Cisco OER can run at remote offices to provide two-way optimization

Agenda

Cisco.com

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Troubleshooting

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- **MC and BR relationship fail to establish**
  - **show oer master border <detail>**
  - **show oer border**
  - **debug oer cc <detail>**

Troubleshooting

Cisco.com

- **Border Routers fail to learn prefixes**
  - **show oer border passive cache learned**
  - **show ip cache flow**
  - **show ip int <external/internal int_name>**
  - **debug ip flow cache**
  - **debug ip flow export**
  - **debug oer master learn**
  - **debug oer border learn**

Troubleshooting

Cisco.com

- Active Probing fail to start
- probe assignment
  - show oer master active-probe
- prefix/parent route existence
  - show ip bgp on border
  - show ip route on border
  - show ip static-table on border
- next-hop uniqueness
  - show ip route on border
- Probe reachability
  - show oer border active-probe
  - show oer master prefix detail
  - debug oer master collector active-probes <detail>
  - debug oer border active-probes
  - debug rtr trace

Troubleshooting

Cisco.com

- Passive Probing fail to collect measurements
- main cache
  - show ip cache flow
- aggregation cache
  - show oer border passive cache prefix
- monitored prefixes
  - show oer border passive prefixes
- flow direction
  - show oer border
- debug oer master
  - collector netflow

Troubleshooting

Cisco.com

- OER fail to control the bgp/static routes
- prefix/parent route existence
  - show ip bgp on border
  - show ip route on border
  - show ip static-table on border
- path existence
  - Verify next hop points to OER external interface
- may need route policy to make OER selected route as the best path
  - Configure route-map
- Actual traffic flow exit matches oer selected best exit
- show oer border route bgp
- show oer border route static
- debug oer border route bgp
- debug oer border route static

Troubleshooting

Cisco.com

- OER controlled prefix status is incorrect
- policy configuration
  - show oer master
  - show oer master prefix <prefix> policy
- show oer master prefix <detail>
- debug oer master prefix <detail>
- debug oer master exit <detail>

Agenda

Cisco.com

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Key Cisco OER Benefits: Cost

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- **Bandwidth cost minimization**

  Allows companies to minimize traffic sent over expensive links or consolidate multiple flat-rate connections to fewer and lower-cost burstable services

- **Automatic performance optimization**

  Reduces engineering operating expenses associated with manual network performance analysis and tuning of BGP

- **Specific and detailed link cost reporting**

  Reports for traffic distribution and usage before and after route optimization help Enterprise customers manage ISP costs more effectively

Key Cisco OER Benefits: Performance

Cisco.com

- **Improved response time**

  Automated route optimization can detect and route around poorly performing paths by finding an optimal ISP exit

- **Performance optimization**

  Monitor and minimize the impact of network outages (i.e.: high latency or packet loss, “black-hole” conditions) and automatically re-route affected prefixes to an alternate, better performing path

References

Cisco.com

- **Cisco IOS OER Master Controller and Border Router**

  http://www.cisco.com/go/oer

- **In Feature Navigator search for OER**

  http://tools.cisco.com/ITDIT/CFN/Dispatch?act=featSelect&task=init

- **OER Master Controller Engine**

  http://www.cisco.com/en/US/products/ps5870/index.htm

Related Sessions

Cisco.com

- Routing Protocols Deployment
  RST-2T30
- Deployment and Analysis of BGP
  RST-2303
- Introduction to Service Assurance Agent
  NMS-1N04 - Networkers Online
- Netflow for Accounting, Analysis, and Attack
  NMS-2032

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WHY: Win fabulous prizes! Give us your feedback!

WHERE: Go to the Internet stations located throughout the Convention Center

HOW: Winners will be posted on the onsite Networkers Website; four winners per day