



Carrier Grade IPv6 without Service Modules

This module describes how to implement the Carrier Grade IPv6 (CGv6) without Services Modules.

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MAP-E without service modules

This feature configures Mapping of Address and Portal-Encapsulation Mode (MAP-E) CGN solution without service cards (ISM or VSM). The CGN application directly interacts with the line cards to configure MAP-E.

Restrictions for Configuring MAP-E without Service Card on Cisco IOS XR

- MAP-E is supported only on the third generation of Cisco ASR 9000 Series Ethernet line cards.
- MAP-E without service cards can be enabled only in a default VRF.
- If MAP-E or MAP-T is enabled on an interface, other policy based routing (PBR) features such as CLI PBR, BGP Flow Spec, One Platform Kit (onePK), OpenFlow, ingress ACLs and BNG are not supported. This is because only one PBR policy is allowed on the interface per direction.
- In a router, only one mode of either inline-service with service card or inline-service without service card is supported.

Types of exception packets handled only by Service Module:

- IPv6 extension headers.
- V4/V6 fragmented packets.
- ICMP messages (excluding ICMP echo message and reply packets, which are processed by the inline interface for MAP-E)
- TCP Maximum Segment Size and Path MTU checks.
- Packets with Loose Source Route (LSR) and Strict Source Route (SSR) IPv4 options

Configuring MAP-E without service modules

This feature allows to configure Mapping of Address and Portal-Encapsulation Mode (MAP-E) CGN solution without service cards (ISM or VSM). The CGN application directly interacts with the line cards to configure MAP-E.

Configuring MAP-E instances without service modules

Perform these tasks to configure MAP-E without service modules.

SUMMARY STEPS

1. **configure**
2. **service cgv6** *instance-name*
3. **service-inline***interface-name*
4. **service-type map-e** *instance-name*
5. **end** or **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure Example: RP/0/RSP0/CPU0:routerco# configure	Enters global configuration mode.
Step 2	service cgv6 <i>instance-name</i> Example: RP/0/RSP0/CPU0:router(config)# service Cgv6 cgv6-1 RP/0/RSP0/CPU0:router(config-cgv6)#	Configures the instance for the CGv6 application and enters CGv6 configuration mode. Note The maximum number of CGv6 applications allowed for a MAP-E instance is 6.
Step 3	service-inline <i>interface-name</i> Example: RP/0/RSP0/CPU0:router(config-cgv6)#Service-inline interface TenGigE0/0/0/0	Configures the service-inline interface.
Step 4	service-type map-e <i>instance-name</i> Example: RP/0/RSP0/CPU0:router(config-cgv6) #service-type map-e map1 RP/0/RSP0/CPU0:router(config-cgV6-map_e)#	Configures the service type keyword definition for CGv6 MAP-E application.
Step 5	end or commit Example:	Saves configuration changes. • When you issue the end command, the system prompts you to commit changes:

	Command or Action	Purpose
	<pre>RP/0/RSP0/CPU0:router(config-cgv6-map_e)# end or RP/0/RSP0/CPU0:router(config-cgv6-map_e)# Commit</pre>	<p>Uncommitted changes found, commit them before exiting (yes/no/cancel)? [cancel]:</p> <ul style="list-style-type: none"> • Entering yes saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. • Entering no exits the configuration session and returns the router to EXEC mode without committing the configuration changes. • Entering cancel leaves the router in the current configuration session without exiting or committing the configuration changes. <ul style="list-style-type: none"> • Use the commit command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuring cpe domain parameters without service modules

Perform this task to configure cpe domain interface for MAP-E without service modules.

SUMMARY STEPS

1. **configure**
2. **service cgv6** *instance-name*
3. **service-inline** *interface-name*
4. **service-type map-e** *instance-name*
5. **cpe-domain ipv4 prefix** *ipv4 address/prefix* **cpe-domain ipv6 prefix** *ipv6 address/prefix*
6. **end** or **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	<p>configure</p> <p>Example:</p> <pre>RP/0/RSP0/CPU0:routerco# configure</pre>	Enters global configuration mode.
Step 2	<p>service cgv6 <i>instance-name</i></p> <p>Example:</p> <pre>RP/0/RSP0/CPU0:router(config)# service Cgv6 cgv6-1 RP/0/RSP0/CPU0:router(config-cgv6)#</pre>	Configures the instance for the CGv6 application and enters CGv6 configuration mode.

	Command or Action	Purpose
Step 3	service-inline <i>interface-name</i> Example: RP/0/RSP0/CPU0:router(config-cgv6)#Service-inline interface TenGigE0/0/0/0	Configures the service-inline interface.
Step 4	service-type map-e <i>instance-name</i> Example: RP/0/RSP0/CPU0:router(config-cgv6) #service-type map-e map1 RP/0/RSP0/CPU0:router(config-cgv6-map_e) #	Configures the service type keyword definition for CGv6 MAP-E application.
Step 5	cpe-domain ipv4 prefix <i>ipv4 adress/prefix</i> cpe-domain ipv6 prefix <i>ipv6 adress/prefix</i> Example: RP/0/RSP0/CPU0:router(config-cgv6-map_e)#cpe-domain ipv4 prefix 120.2.1.0/24 RP/0/RSP0/CPU0:router(config-cgv6-map_e)#cpe-domain ipv6 prefix 9020:da8:2::/48	Configures the IPv4 or IPv6 prefixes of the CPE domain parameter without service modules.
Step 6	end or commit Example: RP/0/RSP0/CPU0:router(config-cgv6-map_e) # end or RP/0/RSP0/CPU0:router(config-cgv6-map_e) # Commit	Saves configuration changes. <ul style="list-style-type: none"> • When you issue the end command, the system prompts you to commit changes: Uncommitted changes found, commit them before exiting (yes/no/cancel)? [cancel]: <ul style="list-style-type: none"> • Entering yes saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. • Entering no exits the configuration session and returns the router to EXEC mode without committing the configuration changes. • Entering cancel leaves the router in the current configuration session without exiting or committing the configuration changes. • Use the commit command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuring port sharing ratio and contiguous port without service modules

Perform this task to configure port sharing ratio and contiguous port.

SUMMARY STEPS

1. **configure**
2. **service cgv6** *instance-name*
3. **service-inline** *interface-name*
4. **service-type map-e** *instance-name*
5. **cpe-domain ipv4 prefix** *ipv4 address/prefix* **cpe-domain ipv6 prefix** *ipv6 address/prefix*
6. **sharing-ratio** **256**
7. **contiguous-port** **16**
8. **end** or **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure Example: RP/0/RSP0/CPU0:routerco# configure	Enters global configuration mode.
Step 2	service cgv6 <i>instance-name</i> Example: RP/0/RSP0/CPU0:router(config)# service Cgv6 cgv6-1 RP/0/RSP0/CPU0:router(config-cgv6)#	Configures the instance for the CGv6 application and enters CGv6 configuration mode.
Step 3	service-inline <i>interface-name</i> Example: RP/0/RSP0/CPU0:router(config-cgv6)#Service-inline interface TenGigE0/0/0/0	Configures the service-inline interface.
Step 4	service-type map-e <i>instance-name</i> Example: RP/0/RSP0/CPU0:router(config-cgv6) #service-type map-e map1 RP/0/RSP0/CPU0:router(config-cgv6-map_e)#	Configures the service type keyword definition for CGv6 MAP-E application.
Step 5	cpe-domain ipv4 prefix <i>ipv4 address/prefix</i> cpe-domain ipv6 prefix <i>ipv6 address/prefix</i> Example: RP/0/RSP0/CPU0:router(config-cgv6-map_e)#cpe-domain ipv4 prefix 120.2.1.0/24 RP/0/RSP0/CPU0:router(config-cgv6-map_e)#cpe-domain ipv6 prefix 9020:da8:2::/48	Configures the IPv4 or IPv6 prefixes of the CPE domain parameter without service modules.
Step 6	sharing-ratio 256 Example: RP/0/RSP0/CPU0:router(config-cgv6-map_e)#sharing-ratio 256	Configures the port sharing ratio. The value for the port sharing ratio is 256.

	Command or Action	Purpose
Step 7	contiguous-port 16 Example: RP/0/RSP0/CPU0:router(config-cgv6-map_e)#contiguous-ports 16	Configures the contiguous port. The value for the contiguous port is 16.
Step 8	end or commit Example: RP/0/RSP0/CPU0:router(config-cgv6-map_e)# end or RP/0/RSP0/CPU0:router(config-cgv6-map_e)# Commit	Saves configuration changes. <ul style="list-style-type: none"> When you issue the end command, the system prompts you to commit changes: Uncommitted changes found, commit them before exiting (yes/no/cancel)? [cancel]: <ul style="list-style-type: none"> Entering yes saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. Entering no exits the configuration session and returns the router to EXEC mode without committing the configuration changes. Entering cancel leaves the router in the current configuration session without exiting or committing the configuration changes. Use the commit command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuring BR Endpoint Address without modules

Perform this task to configure the BR Endpoint Address without service modules.

SUMMARY STEPS

1. **configure**
2. **service cgv6** *instance-name*
3. **service-inline** *interface-name*
4. **service-type map-e** *instance-name*
5. **cpe-domain ipv4 prefix** *ipv4 address/prefix* **cpe-domain ipv6 prefix** *ipv6 address/prefix*
6. **sharing-ratio** 256
7. **contiguous-port** 16
8. **br-endpoint-address**
9. **end** or **commit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure Example: RP/0/RSP0/CPU0:routerco# configure	Enters global configuration mode.
Step 2	service cgV6 instance-name Example: RP/0/RSP0/CPU0:router(config)# service CgV6 cgV6-1 RP/0/RSP0/CPU0:router(config-cgV6)#	Configures the instance for the CGv6 application and enters CGv6 configuration mode.
Step 3	service-inline interface-name Example: RP/0/RSP0/CPU0:router(config-cgV6)#Service-inline interface TenGigE0/0/0/0	Configures the service-inline interface.
Step 4	service-type map-e instance-name Example: RP/0/RSP0/CPU0:router(config-cgV6) #service-type map-e map1 RP/0/RSP0/CPU0:router(config-cgV6-map_e)#	Configures the service type keyword definition for CGv6 MAP-E application.
Step 5	cpe-domain ipv4 prefix ipv4 adress/prefix cpe-domain ipv6 prefix ipv6 adress/prefix Example: RP/0/RSP0/CPU0:router(config-cgV6-map_e)#cpe-domain ipv4 prefix 120.2.1.0/24 RP/0/RSP0/CPU0:router(config-cgV6-map_e)#cpe-domain ipv6 prefix 9020:da8:2::/48	Configures the IPv4 or IPv6 prefixes of the CPE domain parameter without service modules.
Step 6	sharing-ratio 256 Example: RP/0/RSP0/CPU0:router(config-cgV6-map_e)#sharing-ratio 256	Configures the port sharing ratio. The value for the port sharing ratio is 256.
Step 7	contiguous-port 16 Example: RP/0/RSP0/CPU0:router(config-cgV6-map_e)#contiguous-ports 16	Configures the contiguous port. The value for the contiguous port is 16.
Step 8	br-endpoint-address Example: RP/0/RSP0/CPU0:router(config-cgV6-map_e)#br-endpoint-address 9020:da8:2:ffff::1	Configures the br-endpoint-address.
Step 9	endor commit	Saves configuration changes.

	Command or Action	Purpose
	<p>Example:</p> <pre>RP/0/RSP0/CPU0:router(config-cgv6-map_e)# end or RP/0/RSP0/CPU0:router(config-cgv6-map_e)# Commit</pre>	<ul style="list-style-type: none"> When you issue the end command, the system prompts you to commit changes: Uncommitted changes found, commit them before exiting (yes/no/cancel)? [cancel]: Entering yes saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. Entering no exits the configuration session and returns the router to EXEC mode without committing the configuration changes. Entering cancel leaves the router in the current configuration session without exiting or committing the configuration changes. Use the commit command to save the configuration changes to the running configuration file and remain within the configuration session.

MAP-T without Service Cards

The objective of this feature is to ensure that the Mapping of Address and Port-Translation Mode (MAP-T) CGN solution can be implemented without service cards (VSM/ISM). With this feature, the CGN application directly interacts with the line cards to configure the MAP-T parameters and eliminates the dependency on the service cards.

Restrictions for Configuring MAP-T without Service Card on Cisco IOS XR

- MAP-T is supported only on Cisco ASR 9000 Series 400G and 200G Modular Line Cards and Cisco ASR 9000 Series 4-Port and 8-Port 100 Gigabit Ethernet Line Cards.
- MAP-T without service cards can be enabled only in an L3VPN and a 6VPE cloud set-up.
- If this feature is enabled on an interface, other PBR (policy based routing) features such as CLI PBR, BGP Flow Spec, One Platform Kit (onePK) or OpenFlow may not be functional; this is because only one PBR policy will be allowed on the interface.
- In a router, only one mode of either inline-service with service card or inline-service without service card will be supported.
- At a router level, the max scale limit for CPE domain parameters is 25 and for external domain parameters is 8k. If a single MAP-T instance has utilized 25 of CPE domain and 8k of external domain parameters; it is not possible to configure additional CPE and external domain parameters in the same router.

Configuring MAP-T without Service Cards

To configure a MAP-T without service cards, perform the steps below.

SUMMARY STEPS

1. **configure**
2. **service cgV6** *instance-name*
3. **service-inline interface** *type interface-path-id*
4. **service-type map-t-cisco***instance-name*
5. **cpe-domain ipv4 prefix length** *value*
6. **cpe-domain ipv6 vrf** *vrf-name*
7. **cpe-domain ipv6 prefix length** *value*
8. **sharing ratio***number*
9. **contiguous-ports***number*
10. **cpe-domain-name** *cpe-domain-name* **ipv4 prefix** *address/prefix* **ipv6 prefix** *address/prefix*
11. **ext-domain-name** *ext-domain-name* **ipv6 prefix** *address/prefix* **ipv4-vrf** *vrf-name*
12. Use the **commit** or **end** command.
13. **show policy-map transient type pbr**
14. **show pbr service-node table summary**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure Example: RP/0/RP0/CPU0:router# configure	Enters global configuration mode.
Step 2	service cgV6 <i>instance-name</i> Example: RP/0/RP0/CPU0:router(config)# service cgV6 cgV6-1 RP/0/RP0/CPU0:router(config-cgV6)#	Configures the instance for the CGV6 application and enters CGV6 configuration mode. Note The maximum number of CGV6 applications allowed for a MAP-T instance is 6.
Step 3	service-inline interface <i>type interface-path-id</i> Example: RP/0/RP0/CPU0:router(config-cgV6)# service-inline interface TenGigE0/0/0/0/0 RP/0/RP0/CPU0:router(config-cgV6)#	Specifies an Ethernet interface on which the CGV6 service must be enabled.
Step 4	service-type map-t-cisco <i>instance-name</i> Example: RP/0/RP0/CPU0:router(config-cgV6)# service-type map-t-cisco map1	Configures the service type keyword definition for CGV6 MAP-T application. application.

	Command or Action	Purpose
Step 5	cpe-domain ipv4 prefix length <i>value</i> Example: RP/0/RP0/CPU0:router(config-cgn-map-t-cisco)# cpe-domain ipv4 prefix length 24	Configures the IPv4 prefix of the CPE domain
Step 6	cpe-domain ipv6 vrf <i>vrf-name</i> Example: RP/0/RP0/CPU0:router(config-cgn-map-t-cisco)# cpe-domain ipv6 vrf mapt-v6	Enables Virtual Routing and Forwarding (VRF) for the MAP-T configuration.
Step 7	cpe-domain ipv6 prefix length <i>value</i> Example: RP/0/RP0/CPU0:router(config-cgn-map-t-cisco)# cpe-domain ipv6 prefix length 48	Assigns a value for the ipv6-prefix length to be used as part of the MAP-T instance.
Step 8	sharing ratio <i>number</i> Example: RP/0/RP0/CPU0:router(config-cgn-map-t-cisco)# sharing-ratio 256	Enters global configuration mode.
Step 9	contiguous-ports <i>number</i> Example: RP/0/RP0/CPU0:router(config-cgn-map-t-cisco)# contiguous-ports 8	Specifies the Port Set ID (PSID) configuration.
Step 10	cpe-domain-name <i>cpe-domain-name</i> ipv4 prefix address/prefix ipv6 prefix address/prefix Example: RP/0/RP0/CPU0:router(config-cgn-map-t-cisco)# cpe-domain-name cpe1 ipv4-prefix 10.0.0.1 ipv6-prefix 1000:1000::1	Configures IPv4 and IPv6 prefix for a specific CPE domain.
Step 11	ext-domain-name <i>ext-domain-name</i> ipv6 prefix address/prefix ipv4-vrf <i>vrf-name</i> Example: RP/0/RP0/CPU0:router(config-cgn-map-t-cisco)# ext-domain-name ext1 ipv6-prefix 2000:2000::1/48 ipv4-vrf mapt	Configures IPv6 prefix and IPv4 VRF for the external domain.
Step 12	Use the commit or end command.	commit —Saves the configuration changes and remains within the configuration session. end —Prompts user to take one of these actions: <ul style="list-style-type: none"> • Yes — Saves configuration changes and exits the configuration session. • No —Exits the configuration session without committing the configuration changes.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • Cancel —Remains in the configuration session, without committing the configuration changes.
Step 13	show policy-map transient type pbr Example: RP/0/RP0/CPU0:router#show policy-map transient type pbr	Displays the transient list type pbr of the policy-map.
Step 14	show pbr service-node table summary Example: RP/0/RP0/CPU0:router#show pbr service-node table summary	Displays the output for the class-maps.

Configuration Example

Running Configuration

Verification

The following example shows the configuration of MAP-T without service cards:

```
RP/0/RP0/CPU0:router#show running-config service cgvr6 cgvr6-1
service cgvr6 cgvr6-1
service-inline interface Bundle-Ether2
service-type map-t-cisco mapt1
  cpe-domain ipv4 prefix length 24
  cpe-domain ipv6 vrf SVRF-003
  sharing-ratio 256
  contiguous-ports 8
  cpe-domain-name cpe1 ipv4-prefix 192.1.1.0 ipv6-prefix 2301:d01:1122::
  ext-domain-name ext1 ipv6-prefix 3301:d01:1122::/48 ipv4-vrf VRF-1
!
```

The following example shows the running configuration of MAP-T without service cards:

The following example shows the verification output:

```
RP/0/RP0/CPU0:router#show policy-map transient type pbr
policy-map type pbr CGN_0
handle:0x38000002
table description: L3 IPv4 and IPv6
class handle:0x78000003 sequence 1
  match destination-address ipv4 192.1.1.0 255.255.255.0--->should match the cpe domain
  IPV4 address and mask
  punt service-node index 1001 app-id 0 local-id 0xfal
!
class handle:0x78000004 sequence 1
  match destination-address ipv6 3301:d01:1122::/48--->should match the ext domain IPV6
  address and mask
  punt service-node index 2001 app-id 0 local-id 0x1771
!
class handle:0xf8000002 sequence 4294967295 (class-default)
!
end-policy-map
```

The following example shows the output for the class-maps:

```
RP/0/RP0/CPU0:router#show pbr service-node table summary
```

```
Service node count: 4  
nodeid node0_RSP1_CPU0
```

Name	VIdx	Enc
CGN_1001	1001	cgn
CGN_3001	3001	cgn
CGN_5001	5001	cgn
CGN_7001	7001	cgn