

Gx Diameter Support for ISG sessions

This chapter describes the Gx Diameter Support for Intelligent Services Gateway (ISG) sessions. This feature supports the Gx Diameter interface and the Diameter 3GPP Application Gx interface. The component that initiates the Gx communication is through the Intelligent Services Gateway (ISG). Diameter provides a base protocol that can be extended in order to provide authentication, authorization, and accounting (AAA) services to new access technologies.

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Restrictions for Gx Diameter Support for ISG Sessions

- GX Interface is supported only for IPoE Sessions
- Dynamic policy construction is restricted only for Dynamic Rate Limiting (DRL) and Differentiated Services Code Point (DSCP).
- ISG policies with the same name and different definitions are not supported.
- Gx Diameter in combination with radius is not supported.
- Subscription-ID Grouped AVP is shared only in credit-control messages.

The following base protocol features are not supported in ISG with Diameter:

- Communication with diameter peers that act as proxy, relay or a redirection agent
- Diameter peer discovery
- SCTP as the transport protocol for Diameter messages
- Internet Protocol Security (IPSec)

Information About Gx Diameter Support for ISG Sessions

Overview of the Diameter Protocol

Diameter is a peer-to-peer protocol that consists of a base protocol and a set of applications that allows it to extend its services to provide authentication, authorization, and accounting (AAA) services to new access technologies. The base protocol provides basic mechanisms for reliable transport, message delivery, and error handling and the base protocol must be used in conjunction with a Diameter application. Each application relies on the services of the base protocol to support a specific type of network access. Each application is defined by an application identifier and associated with commands. Each command is defined with mandatory Attribute Value Pairs (AVPs) and non-mandatory AVPs including vendor-specific AVPs.

Diameter allows peers to exchange a variety of messages. The Diameter client generates Diameter messages to the Diameter server to perform the AAA actions for the user. This protocol also supports server-initiated messages, such as a request to cancel the service to a particular user.

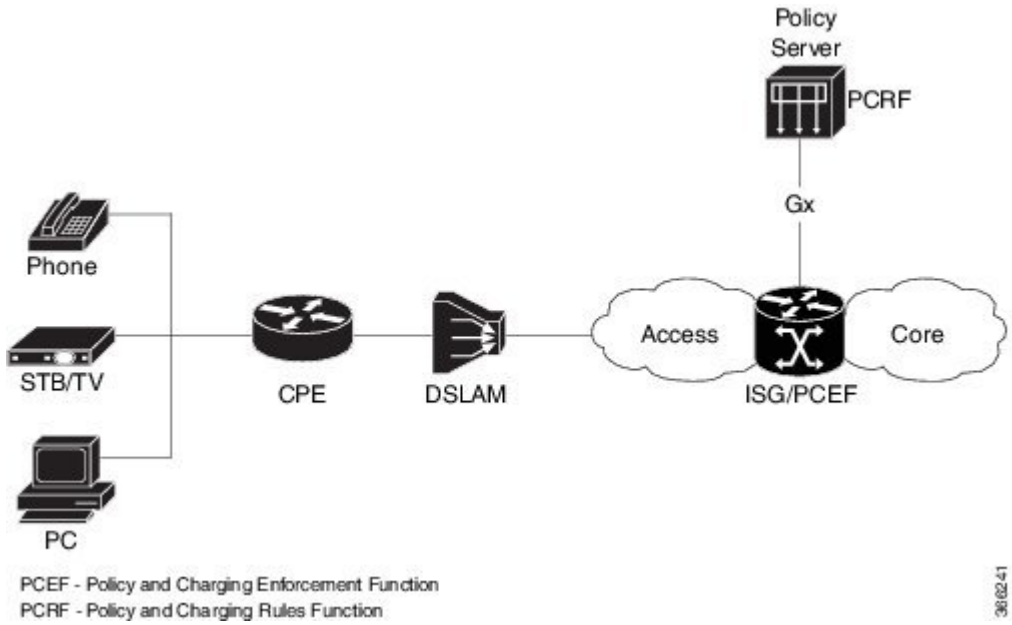
Gx Diameter Interface in ISG

The Gx Interface is located between the Policy and Charging Enforcement function (PCEF) and the Policy and Charging Rules Function (PCRF). Gx reference point is used to provision, modify and remove rules for policy and charging control from the PCRF to the PCEF. The policies downloaded are installed on the ISG session and any monitoring events installed is detected and notified to PCRF.

ISG Supports the download of policy information from radius server and the same is extended to integrate with GX interface for the PCEF functionality.

The following figure shows the network of the Diameter interface in ISG:

Figure 1: Diameter Interface in ISG



Along with the Diameter base protocol, the following Diameter applications are also supported in ISG:

- Diameter Credit Control Application (DCCA)
- Gx interface for Policy Control and Charging

The following table lists Internet Assigned Numbers Authority (IANA)-assigned application IDs for Diameter applications:

Diameter Application	Diameter Application ID
Diameter common message	0x00000000
Diameter policy interface(Gx)	0x01000016 (16777238)

Features supported for ISG with Diameter

These base protocol features are supported in ISG with Diameter:

- Transmission Control Protocol (TCP) as the transport protocol for Diameter messages
- Transport Layer Security (TLS) support over TCP for secure communication
- IPv4 transport stack to the back end Diameter server

Diameter Credit Control Application Application

Diameter Credit-Control Application (DCCA) interface implementation is based on the RFC 4006. The Diameter Gx application handles Gx messages and AVPs specific to Gx and DCCA application to provide support for the PCEF functionality. The DCCA messages supported on the Intelligent Services Gateway(ISG) are:

ISG supports these DCCA messages:

- Credit Control Request (CCR)
- Credit Control Answer (CCA)
- Re-Auth-Request (RAR)
- Re-Auth-Answer (RAA)

Every single CCR must be responded with a separate CCA.

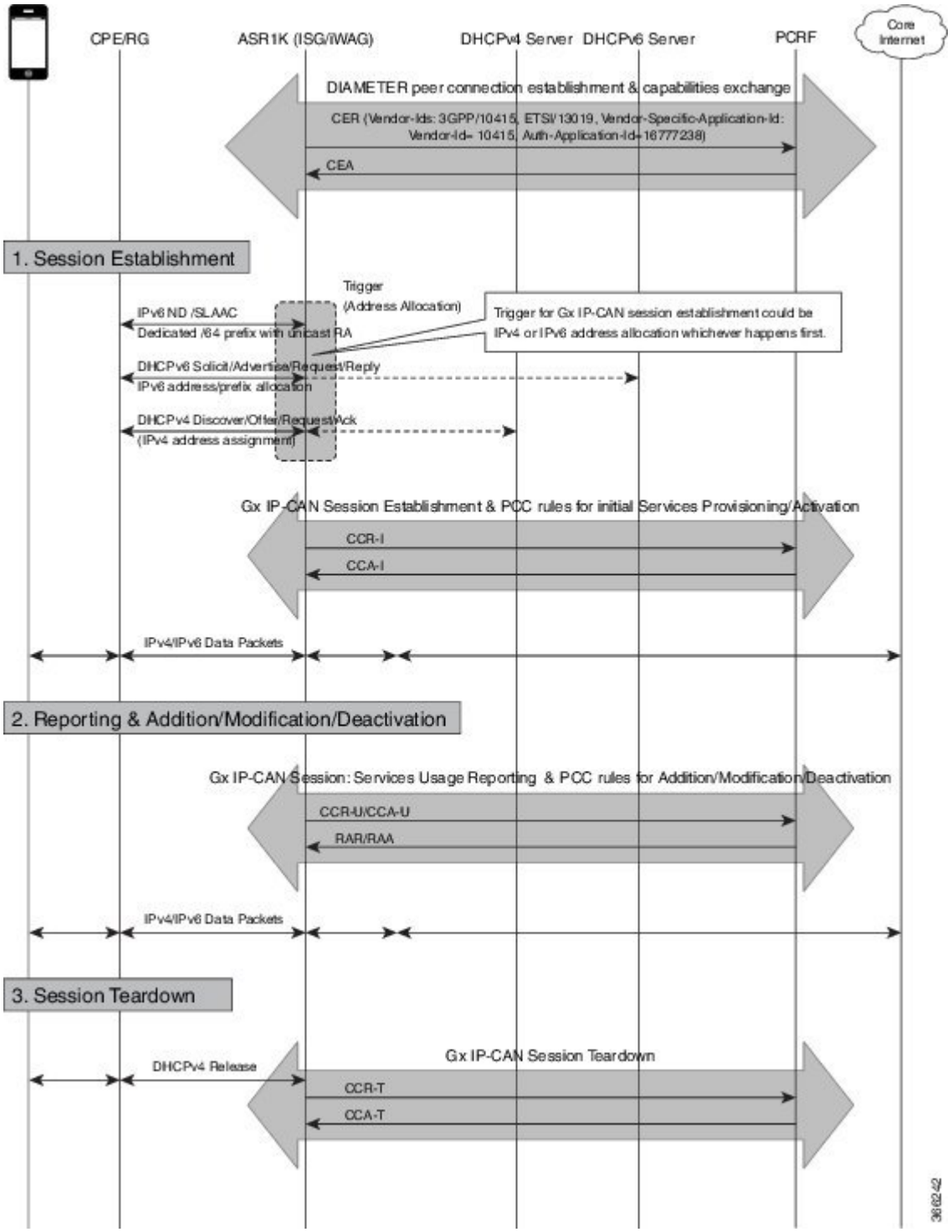
DCCA Session and Services

Each ISG subscriber session is associated with a Diameter IPCAN-session when Gx is enabled. The device implements the state machine for an IPCAN-session as per RFC-4006.

A Diameter session-id uniquely identifies an IPCAN-session.

ISG Diameter Call Flow

The following figure shows a call flow sequence of Gx Diameter:



Supported AVPs for Gx Diameter on ISG

The following table lists the AVPs supported for Gx Diamter on ISG.

AVP			CCR	CCA	RAR	RAA	Description
ID	Name	Type					
8	Framed-IP-Address	OctetString	0-1	0	0	0-1	
97	Framed-IPv6-Prefix	OctetString	0-1	0	0	0-1	
258	Auth-Application-Id	Unsigned32	1	1	1	0	3GPP Gx (16777238)
263	Session-Id	UTF8String	1	1	1	1	
264	Origin-Host	DiameterIdentity	1	1	1	1	
268	Result-Code	Unsigned32	0	1	0	0-1	
279	Failed-AVP	Grouped	0-1	0-n	0	0-1	
281	Error-Message	UTF8String	0	0-1	0	0-1	
283	Destination-Realm	DiameterIdentity	1	0	1	0	
285	Re-Auth-Request-Type	Enumerated	0	0	1	0	
293	Destination-Host	DiameterIdentity	0-1	0	1	0	
295	Termination-Cause	enumerated	0-1	0	0	0	
296	Origin-Realm	DiameterIdentity	1	1	1	1	
297	Experimental-Result	Grouped	0	0-1	0	0-1	
298	• Experimental-Result-Code	Unsigned32	0	n	0	n	
415	CC-Request-Number	Unsigned32	1	1	0	0	
416	CC-Request-Type	Enumerated	1	1	0	0	
443	Subscription-Id	Grouped	0-1	0	0	0	
450	• Subscription-Id-Type • Subscription-Id-Data	Enumerated	0-1	0	0	0	END_USER_NAI (3), END_USER_PRIVATE (4)
444		UTF8String	0-1	0	0	0	user-name@domain, NAS-Port-ID

AVP			CCR	CCA	RAR	RAA	Description
ID	Name	Type					
1001	Charging-Rule-Install • Charging-Rule-Name • Charging-Rule-Definition • Precedence • Flow-Information • Packet-Filter-Identifier • Flow-Direction • QoS-Information • Qos-Class-Identifier • -Max-Requested-Bandwidth-DL • -Max-Requested-Bandwidth-UL	Grouped	0	0-n	0-n	0	
1005		OctetString	0	1	1	0	
1003		Grouped	0	0-1	0-1	0	
1010		Unsigned32	0	1	1	0	
1058		Grouped	0	0-2	0-2	0	
1060		OctetString	0	1-n	1-n	0	
1080		Enumerated	0	1	1	0	
1016		Grouped	0	0-1	0-1	0	
1028		Enumerated	0	0-1	0-1	0	
515		Unsigned32	0	0-1	0-1	0	
516		Unsigned32	0	0-1	0-1	0	
1002	Charging-Rule-Remove • Charging-Rule-Name • Charging-Rule-Base-Name	Grouped	0	0-n	0-n	0	
1004		UTF8String	0	1	1	0	
1005		OctetString	0	1	1	0	
1027	IP-CAN-Type	Enumerated	0-1	0	0	0-1	Non-3GPP-EPS (6) for WiFI & FBA (7) for xDSL, FTTx
1018	Charging-Rule-Report • PCC-Rule-Status • Rule-Failure-Code	Grouped	0-1	0	0	0-1	
1019		Enumerated	0-1	0	0	0-1	
1031		Enumerated	0-1	0	0	0-1	
1045	Session-Release-Cause	Enumerated	0-1	0	0-1	0	
266	Vendor-ID	Unsigned32	0	1	0	1	
1066	Monitoring-Key	OctetString	0	1	1	0	
431	Granted-Service-Unit	Grouped	0	1	1	0	
420	CC-Time	Unsigned32	1	1	1	1	
421	CC-Total-Octets	Unsigned64	1	1	1	1	

AVP			CCR	CCA	RAR	RAA	Description
ID	Name	Type					
412	CC-Input-Octets	Unsigned64	1	1	1	1	
414	CC-Output-Octets	Unsigned64	1	1	1	1	
446	Used-Service-Unit	Grouped	1	0	0	1	
1067	Usage-Monitoring-Information	Grouped	1	1	1	1	
1068	Usage-Monitoring-Level	Enumerated	0	1	1	0	
1069	Usage-Monitoring-Report	Enumerated	0	1	1	0	
1070	Usage-Monitoring-Support	Enumerated	0	1	1	0	
1006	Event-Trigger	Enumerated	1	0	1	0	

RADIUS Server Configuration

Following AVPs for Cisco IOS XE Release 16.7.1 are enabled through RADIUS server configuration. Use **radius-server** command for the configuration.

How to Configure Gx Diameter Support on ISG Sessions

Configuring Diameter peer in ISG

Perform this task to configure the Diameter connection on a ISG router.

The selection of Diameter server is mostly based on the AAA method list configuration.

```
diameter timer watchdog 300
diameter origin realm cisco.com
diameter origin host 10.0.0.1
diameter source interface gigabitethernet 0/0/0
diameter vendor supported 3gpp
diameter vendor app gx
diameter peer PCRF
    address ipv4 10.0.0.2
    transport tcp port port1
    source interface Ethernet0/0
```

Configuring AAA for Diameter Peer in ISG

Perform this task to configure AAA for diameter server group. Prior to this task, you must set up the Diameter peer in ISG device.

```
aaa group server diameter GX_SG
server name PCRF
```

```
aaa authorization policy-if policy_meth group GX_SG
aaa authorization subscriber-service default local
```

Configuring Diameter Interaction for ISG



Note The method-list used aaa configuration and diameter interation configuration must be the same. The control policy should trigger gx session in both session-start and session-restart. In case of session-start, it is recommended to configure **collect identifier source-ip-address** before authorization

Peform the following task to configure Diameter interaction for ISG:

```
policy-map type control GX_TEST
    class type control always event session-start
        5 collect identifier source-ip-address
        10 authorize aaa list policy_meth identifier nas-port
    class type control always event session-restart
        10 authorize aaa list policy_meth identifier nas-port
```

Verifying the Gx Diameter Support for ISG Sessions

The following sample output is from the **show diameter gx session all** command.

```
Device#show diameter gx session all

Current Gx Sessions
ClientID     Session State     Subscription Data            IPCAN Sess ID
115425         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115425;1488824608
115430         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115430;1488824608
115432         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115432;1488824608
115434         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115434;1488824608
115436         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115436;1488824608
115442         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115442;1488824608
115444         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115444;1488824608
115447         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115447;1488824608
115449         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115449;1488824608
115451         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115451;1488824608
115453         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115453;1488824608
115455         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115455;1488824608
115457         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115457;1488824608
115459         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115459;1488824608
115461         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115461;1488824608
115463         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115463;1488824608
115465         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115465;1488824608
115467         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115467;1488824608
115469         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115469;1488824608
115471         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115471;1488824608
115473         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115473;1488824608
115475         OPEN              nas-port:0.0.0.0:0/3/3       device1;0;115475;1488824608
```

The following sample output is from the **show diameter gx session id** command.

```
Device# show diameter gx session id device1;0;4120;1488910407
```

```
Current Gx Sessions
ClientID     Session State     Subscription Data            IPCAN Sess ID
4120    OPEN               nas-port:0.0.0.0:255/0/8/10        device1;0;4120;1488910407
```

The following sample output is from the **show diameter gx statistics** command.

```
Device#show diameter gx statistics

CCR Initial messages                            : 295110
CCR Initial messages sent failed                : 21567
CCR Initial messages timed out                  : 184526
CCR Initial messages retry                      : 165003

CCR Update messages                             : 117667
CCR Update messag sent Failed                   : 0
CCR Update messages timed Out                   : 20828
CCR Update messages retry                       : 20418

CCR Terminate messages                          : 150241
CCR Terminate messages sent failed              : 149331

CCA Initial messages                            : 159270
CCA Initial messages error                      : 0
CCA Initial messages protocol error             : 0
CCA Update messages                             : 109513
CCA Update messages error                       : 2
CCA Update messages protocol error              : 0
CCA Terminate messages                          : 67679
CCA Terminate messages error                    : 0
CCA Terminate messages protocol error           : 0

RAR received messages                           : 0
RAR received messages error                     : 0
RAA sent messages                               : 0
RAA sent messages Error                         : 0

DIAMETER End User Service Denied                : 0
DIAMETER Credit Control Not Applicable          : 0
DIAMETER Credit Limit Reached                   : 0
DIAMETER Unknown Session Id                     : 0
DIAMETER Authorization Rejected                 : 0
DIAMETER Invalid AVP Value                      : 0
DIAMETER User Unknown                           : 0

Number of sessions currently up                 : 9308
Number of sessions closed                       : 141268
Highest number of sessions ever up at one time  : 159270
Number of sessions failed to come up            : 157407
Number of Unknown request messages              : 0
```

Examples: Configuring Gx Diameter Support for ISG Sessions

The following example shows the AVP representation of pre-defined policy.

```
Policy-Install
Charging-Rule-Install
    Charging-Rule-Name = TC_SERVICE1
```

```
    Charging-Rule-Name = ISG_L4R_SRV

Policy-Remove
Charging-Rule-Remove
    Charging-Rule-Name = TC_SERVICE2
    Charging-Rule-Name = TC_SERVICE1

Install and Remove
Charging-Rule-Insall
   Charging-Rule-Name = TC_SERVICE2
Charging-Rule-Remove
   Charging-Rule-Name = ISG_L4R_SRV
```

The following example shows the ISG-TC service representation of pre-defined policy.

```
policy-map type service TC_SERVICE1
    class type traffic VLAN_EFv4
        accounting aaa list EF_acct
        police input 300000
        police output 300000
    !
policy-map type service TC_SERVICE2
    class type traffic VLAN_EF
        accounting aaa list EF_acct
        police input 300000
        police output 300000
  !
Policy-map type service ISG_L4R_SRV
    Class type traffic class1
        Redirect to ip 10.10.10.10
```

The following example shows the AVP representation of static and dynamic policy.

```
Charging-Rule-Install
    Charging-Rule-Name = TC_SERVICE1

   Charging-Rule-Definition
      Charging-Rule-Name = TC_SERVICE2
      Flow-Information
         Flow-Direction = UPLINK
        Packet-Filter-Identifier = CS1_V6
      Qos-Information
         Max-Requested-Bandwidth-UL = 50000
```

The following example shows ISG-TC service for static and dynamic policy.

```
policy-map type service TC_SERVICE1
    class type traffic VLAN_EFv4
        police input 300000
        police output 300000
!
policy-map type service TC_SERVICE2
   class type traffic VLAN_CS1_V6
      police input 50000
!
class-type traffic match-any VLAN_CS1_V6
   match access-group input name CS1_V6
!
ipv6 access-list CS1_V6
```

```
permit ipv6 any any dscp cs1
```

Additional References

Related Documents

Related Topic	Document Title
ISG commands	Cisco IOS Intelligent Services Gateway Command Reference

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Finding Feature Information for Gx Diameter Support for ISG Sessions

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for Gx Diameter Support for ISG Sessions

Feature Name	Releases	Feature Configuration Information
Gx Diameter Support for ISG Sessions	Cisco IOS XE Everest 16.5.1b	Diameter provides a base protocol that can be extended in order to provide authentication, authorization, and accounting (AAA) services to new access technologies. This chapter provides information about Diameter protocol and its support in ISG. The following command was introduced by this feature: **diameter timer watchdog** , **diameter origin realm** , **diameter origin host** , **diameter source interface** , **diameter vendor supported** , **diameter peer**,**show diameter gx session all**, **show diameter gx session id**, **show diameter gx statistics**