

# X.25 Closed User Groups

---

This feature module describes the X.25 Closed User Groups (CUGs) feature. It includes information on the benefits of the new feature, supported platforms, related documents, and so forth.

This document includes the following sections:

- Feature Overview on page 1
- Supported Platforms on page 5
- Supported Standards, MIBs, and RFCs on page 6
- Prerequisites on page 6
- Configuration Tasks on page 7
- Configuration Examples on page 10
- Command Reference on page 13
- Debug Commands on page 20
- Glossary on page 28

## Feature Overview

Until now, the Cisco X.25 implementation acted only as an extension between X.25 devices and an X.25 PDN, as a way of remaining minimally intrusive on the X.25 behavior that would occur if the DTE devices were directly connected. Now, Cisco has introduced a conforming closed user groups (CUGs) service that can be configured for those DTE devices that require this service from the routers, allowing Cisco routers to perform this function normally provided by a PDN.

A CUG is a collection of DTE devices for which the network controls access between two members and between a member and a non-member. An X.25 network can support up to 10,000 CUGs (numbered between 0 and 9999), each of which can have any number of member DTE devices. An individual DTE becomes a member of a specific network CUG by subscription. The subscription data includes the local number the DTE will use to identify the network CUG (which may or may not be the same as the network number, as determined by network administration and the DTE device's requirements), and any restriction that prohibits the DTE from placing a call within the CUG or, conversely, prohibits the network from presenting a call within the CUG to the DTE.

With the X.25 CUGs feature, the router's X.25 DCE interfaces can be configured to perform the standard CUG access controls normally associated with a direct attachment to an X.25 network POP. The router's DCE interface acts as the boundary between the DTE and the network, and CUG use

ensures that only those incoming and outgoing SVCs consistent with the configured CUG subscriptions are permitted. X.25 CUG configuration commands on the router are specified at every POP, and CUG security decisions are made solely from those commands.

CUG security depends on CUG decisions made by the two POPs used to connect an SVC through the network, so CUG security depends on the collective configuration of all POPs that define the network boundary. The standalone interface configuration determines if the POP will permit user access for a given incoming or outgoing call within the authorized CUG.

CUGs are a network service to allow various network subscribers (DTE devices) to be segregated into private subnetworks with limited incoming or outgoing access, which means that a DTE must obtain membership from its network service (POP) for the set of CUGs it needs access to. A DTE may subscribe to none, one, or several CUGs at the same time. A DTE that does not require CUG membership for access is considered to be in the open part of the network. Each CUG typically permits subscribing users to connect to each other, but precludes connections with non-subscribing DTE devices.

However, CUG behavior is highly configurable. For instance, a CUG configuration may subscribe a DTE to a given CUG, but bar it from originating calls within the CUG or, conversely, bar it from receiving calls identified as being within the CUG. CUG configuration can also selectively permit the DTE to originate calls to a DTE on the open network, or permit the DTE to receive calls from a DTE on the open network.

CUG access control is first applied when the originating DTE places a call to the POP, and again when the destination DTE device's POP receives the call for presentation. Changes to the POP CUG subscriptions will not affect any SVCs that have already been established.

When a DTE belongs to more than one CUG, it must specify its preferential CUG, unless a call is specifically aimed at devices outside the CUG network. However, the number of CUGs to which a DTE can belong depends on the size of the network. Unsubscribing from one CUG or the overall CUG service will not result in the termination of the SVC connections.

CUG behavior is a cooperative process between two network devices. The DCE offers this service to the connecting subscribers via the DTE. There is no global database regarding CUG membership, therefore, the Cisco router uses information configured for the various X.25 devices and the encoded CUG information in the outgoing and incoming packets.

The X.25 CUGs feature is used for additional X.25 access protection and security. In a setup where DTE devices are attached to a PDN, you can derive a private subnetwork by subscribing your DTE devices to a set of CUGs, which allows closer control of your DTE devices, such as permitting or restricting which DTE can talk to other DTE devices and for what particular purpose. For example, a distinct CUG can be defined to handle each of the different modes of connectivity, such as:

- Datagram encapsulation operation between all company sites
- PAD services for customers seeking public information
- PAD services for system administration internal access to consoles
- QLLC access restricted to the company financial centers

One site could have different CUG subscriptions, depending on connectivity requirements. These sites could all have restrictions regarding which other company devices can be reached (within a CUG), whether a device is permitted to call the open network for a given function, and whether a public terminal can access the device for a given function.

By default, no CUG behavior is implemented. Therefore, in order to observe CUG restrictions, all users attached to the network must be subscribed to CUG behavior (CUG membership) even if they are not subscribed to a specific CUG.

Figure 1 shows two CUGs (CUG 1 and CUG 2). DTE devices A, B, and C are members of CUG 1. They can initiate and receive calls only from the other members of CUG 1. They are therefore members of a private subnet and cannot be accessed by other DTE devices. DTE A is also a member of CUG 2 with DTE D, but DTE D cannot send calls to or receive calls from DTE B or DTE C. The routers connected to each DTE check each call they receive to determine if that call is intended for their CUG. If not, the router will reject that call.

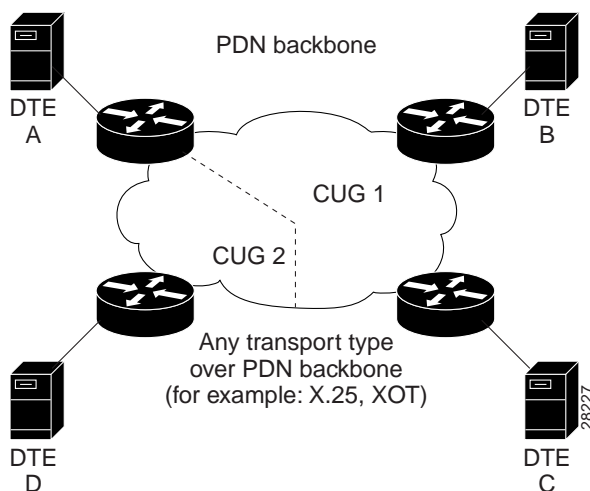
You can subscribe to multiple CUGs per interface, but each CUG that is permitted must be specifically configured. All CUGs are sorted by their local identifier. The main limitation to the number of CUGs configured is the amount of non-volatile memory available to store the configuration. Having subscribed to a CUG, the DTE indicates which CUG is being called. If the DTE does not indicate a CUG, its DCE will determine which CUG is used and if the call should be allowed.

---

**Note** CUG service is implemented at the DCE interface, and as such, specifies a network function. For a summary of DCE operations, refer to *ITU-T 1996 Recommendation X.301* tables 7-6 and 7-8.

---

**Figure 1** DTE Devices A, B, C, and D Connecting to CUGs 1 and 2 over a PDN



## Point of Presence

X.25 is not a POP by default, and POP behavior does not automatically enforce CUG security. Within PDNs, all devices are connected by POPs, which are open entry points into a network and, as such, pose a potential security risk.

When you enable X.25 CUG service you are configuring your network like a PDN, and so for every POP with attachments in the network you must configure CUG security, especially on those POPs that do not subscribe to CUGs, because they could act as a “back door” into your CUGs.

For details on configuring CUG security on your network POPs, see the “Configuration Tasks” section.

---

**Note** If you do not configure CUG security on your network POPs, you are creating a security risk for your network. Configuration must be done manually for every POP in your network.

---

## CUG Membership Selection

CUG membership selection occurs from the calling DTE in an outgoing (call request) packet to specify the CUG membership selected for the call. CUG membership selection is requested or received by a DTE only after the DTE has subscribed to one or more of the following facilities:

- Relevant CUG service
- Outgoing access CUG, which allows the source DTE to identify the CUG within which it is placing the call
- Incoming access CUG, which allows the destination DTE to identify the CUG that both DTE devices belong to

## Preferential CUGs

A DTE that subscribes to more than one CUG (and permits neither incoming nor outgoing access from or to the open network) must designate a preferential CUG. Its use is assumed when no CUG selection is enabled in the outgoing call (call request) or incoming call. Using a preferential CUG achieves a higher level of security. Preferential CUG designation is for DTE devices to operate without requiring a CUG selection facility in every outgoing call, or for DTE devices not capable of encoding a CUG selection.

Preferential CUG designation options are as follows:

- If no preferential CUG has been designated and a CUG member presents a call without specifying a receiving CUG, the call will be rejected, unless incoming access from the open network is configured.
- If a preferential CUG has been designated and the user presents a call without specifying a CUG, the call will be directed to the preferential CUG.
- If outgoing access is permitted on your CUG and you present an outgoing call without designating a preferential CUG, then your CUG assumes the call is either meant for the open network or the preferential CUG.
- A single CUG specified at a DCE interface is treated as the preferential CUG.

## Incoming and Outgoing Access CUGs

CUG service with incoming access allows you to receive incoming calls from the open part of the network, and from DTE devices belonging to other outgoing access CUGs. If the DTE does not subscribe to incoming access, any incoming call without the CUG membership selection facility will not be accepted.

A CUG with outgoing access allows you to make outgoing calls to the open part of the network, and to DTE devices with incoming access capability. Subscribing to the outgoing access CUG allows a DTE to belong to one or more CUGs, and originate calls to DTE devices in the open part of the network (DTE devices not belonging to any CUGs), and DTE devices belonging to incoming access CUGs. If the DTE has not subscribed to outgoing access, the outgoing packets must contain a valid CUG membership selection facility. If not present, the local DCE defaults to the preferential CUG, or rejects the call if a preferential CUG is not specified.

## Incoming and Outgoing Calls Barred within a CUG

When a DTE wishes to only initiate outgoing calls, it initiates incoming calls barred. With this CUG option subscribed to, a subscriber DTE is permitted to only originate calls but not receive calls within the CUG. The DCE will clear an incoming call before it reaches the DTE.

If a DTE subscribes to the outgoing calls barred option, it is permitted to receive calls but not originate calls within the CUG. An attempted outgoing call will be cleared by the DCE, which in turn will notify the DTE of its actions.

## Benefits

### Additional Security

When you implement X.25 CUG service, you get additional X.25 access protection. You can create a private subnetwork and thus control your DTE devices more closely by subscribing the DTE devices to a set of CUGs and restricting access.

### Access Control

You can control CUG access type by implementing either plain CUG access where communication only occurs within your CUG, or full PDN access where communication is more extensive over the network.

### Protocol Translation

X.25 CUG service can be applied to X.25 calls needing protocol translation.

## Restrictions

- CUG service is not supported on XOT connections.
- CUG behavior is applicable to all DCE-type X.25 service end stations.

## Related Documents

- *ITU-T 1988 Recommendation X.25* (sections 6.14.1 to 6.14.8 and 7.2.2.3 to 7.2.2.4)
- *ITU-T 1996 Recommendation X.301* (section 7.6)

## Supported Platforms

- Cisco 1600 series
- Cisco 1700 series
- Cisco 2500 series
- Cisco 2600 series
- Cisco 3600 series

- Cisco 4000 series (Cisco 4000, 4000-M, 4500, 4500-M, 4700, 4700-M)
- Cisco 7200 series
- Cisco 7500 series
- Cisco MC3810 multiservice concentrator

# Supported Standards, MIBs, and RFCs

## Standards

- This feature conforms to the following ITU-T X.25 recommendations:
  - Sections 6.14
  - Tables 6-3 and 6-4
- This feature conforms to the following ITU-T X.301 recommendations:
  - Sections 7.6
  - Tables 7-6 and 7-8
  - Figures 7-6, 7-7, and 7-8

## MIBs

- None

For descriptions of supported MIBs and how to use MIBs, see the Cisco MIB web site on CCO at <http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>.

## RFCs

- None

## Prerequisites

Answers to the following questions, will help you determine how to set up your CUG service and CUGs:

- Do you want to permit incoming public access for the DTE?
  - If so, configure the **x25 subscribe cug-service incoming-access** command on the DCE, so that the CUG service allows incoming calls to the DTE.
- Do you want to permit outgoing public access for the DTE?
  - If so, configure the **x25 subscribe cug-service outgoing-access** command on the DCE, so that the CUG service allows public outgoing calls from the DTE to the open network.
- Will the CUG users require restricted access to the PDN?

If so, configure the **x25 subscribe local-cug** command for mapping the local CUG to the network CUG for the same CUG entity. To obtain full access to the PDN, the CUG service will need to be subscribed to both incoming and outgoing access.

If you want a secure CUG with no access to the PDN, subscribe the CUG to no incoming or outgoing access, and configure it to only communicate with other attachments within CUGs that it has defined.

After establishing that you want PDN CUG access, you must then answer these questions:

- Can the user place calls within the CUG?

The default is set for users to be able to place calls. If you do not want this setting, use the **no-outgoing** keyword.

- Can the user receive calls within the CUG?

The default is set for users to be able to receive calls. If you do not want this setting, use the **no-incoming** keyword.

- Do you want a subscribed CUG to be assumed when a CUG member places a call without specifying a CUG?

If so, use the **preferential** keyword.

## Configuration Tasks

See the following sections for a selection of configuration tasks for the X.25 CUGs feature:

- Configuring X.25 CUG Service, Access, and Properties (Required)
- Configuring a POP with No CUG Access (Optional)
- Configuring a POP with Access Restricted to One CUG (Optional)
- Configuring a POP with Multiple CUGs and No Public Access (Optional)
- Configuring a POP with Multiple CUGs and Public Access (Optional)

## Configuring X.25 CUG Service, Access, and Properties

---

**Note** If you do not wish to enable the **x25 subscribe cug-service** command, you will automatically be subscribed to CUG service the first time you subscribe to a CUG (the **x25 subscribe local-cug** command), with CUG service default settings of no incoming and no outgoing access.

---

You must establish X.25 DCE encapsulation and X.25 CUG service on the interface to enable this feature. Within the **x25 subscribe cug-service** command, establish the type of CUG public access (incoming or outgoing) you want. If you do not enter this command, the default will be enabled.

To set up the individual CUGs, use the **x25 subscribe local-cug** command to specify each local CUG and map it to a network CUG, setting the access properties of the local CUG—no-incoming, no-outgoing, preferential, all, or none—at the same time.

To configure X.25 CUG service, access and properties, use the following commands:

Step	Command	Purpose
1	Router(config)# <b>interface</b> <i>number</i>	Selects the interface to be configured.
2	Router(config-if)# <b>encapsulation x25 dce</b>	Enables X.25 DCE network operation.
3	Router(config-if)# <b>x25 subscribe cug-service</b> [ <b>incoming-access</b>   <b>outgoing-access</b> ]	Enables and controls standard CUG behavior on an X.25 DCE interface.
4	Router(config-if)# <b>x25 subscribe local-cug</b> <i>number</i> <b>network-cug</b> <i>number</i> [ <b>no-incoming</b>   <b>no-outgoing</b>   <b>preferential</b> ]	Maps the desired local CUG number to its corresponding network CUG.

## Configuring a POP with No CUG Access



**Caution** This configuration is critical to enforce full CUG security on your network. You must conduct this configuration on every POP in your network. If you do not configure this for all POPs in your network you will not have a secure network, which could result in a security breach.

With this POP configuration of no individual CUG subscriptions, the POP is a member of the open network. Even though it does not have a CUG attached, you must configure CUG security on it to ensure that the rest of your network remains secure. The POP has CUG incoming access and outgoing access permitted—the least restrictive setting. The POP will allow calls that do not require CUG authorization to and from the open network, but will refuse any CUG specified calls because the POP does not belong to a CUG. A call from an intranetwork connection with no CUG selected is permitted as incoming access from the open network, but a call that requires CUG access will be refused.

To configure a POP with no CUG access, use the following commands:

Step	Command	Purpose
1	Router(config)# <b>interface</b> <i>number</i>	Selects the interface to be configured.
2	Router(config-if)# <b>encapsulation x25 dce</b>	Enables X.25 DCE network operation.
3	Router(config-if)# <b>x25 subscribe cug-service</b> <b>incoming-access</b> <b>outgoing-access</b>	Permits incoming and outgoing CUG access on an X.25 DCE interface.

## Configuring a POP with Access Restricted to One CUG

With this POP configuration of having one CUG subscribed, it is important to have no public access permitted on it. This is done by configuring the default setting (no incoming and no outgoing access) for the **x25 subscribe cug-service** command. When an outgoing call not specifying a CUG is made, the POP assumes the call to be for its one subscribed CUG. An incoming call that does not specify that CUG is rejected. This single CUG configuration assumes the CUG to be the preferential CUG.

To configure a POP with access restricted to one CUG, use the following commands:

Step	Command	Purpose
1	Router(config)# <b>interface</b> <i>number</i>	Selects the interface to be configured.
2	Router(config-if)# <b>encapsulation x25 dce</b>	Enables X.25 DCE network operation.

Step	Command	Purpose
3	Router(config-if)# <b>x25 subscribe cug-service</b>	Sets default behavior on an X.25 DCE interface.
4	Router(config-if)# <b>x25 subscribe local-cug</b> <i>number</i> <b>network-cug</b> <i>number</i> [no-incoming   no-outgoing   preferential]	Maps the desired local CUG number to its corresponding network CUG.

## Configuring a POP with Multiple CUGs and No Public Access

With this POP configuration of multiple CUGs and no public access permitted, the only difference from the previous configuration is that one of the CUGs must be chosen as preferential. If you do not specify a preferential CUG, no calls can be made or accepted. Notice the omission of the keywords with the **x25 subscribe cug-service** command. This omission enables the default settings of no incoming and no outgoing access.

To configure a POP with multiple CUGs and no public access, use the following commands:

Step	Command	Purpose
1	Router(config)# <b>interface</b> <i>number</i>	Selects the interface to be configured.
2	Router(config-if)# <b>encapsulation x25 dce</b>	Enables X.25 DCE network operation.
3	Router(config-if)# <b>x25 subscribe cug-service</b>	Sets default CUG behavior on an X.25 DCE interface.
4	Router(config-if)# <b>x25 subscribe local-cug</b> <i>number</i> <b>network-cug</b> <i>number</i> [no-incoming   no-outgoing   preferential]	Maps the desired local CUG number to its corresponding network CUG.
5	Router(config-if)# <b>x25 subscribe local-cug</b> <i>number</i> <b>network-cug</b> <i>number</i> [no-incoming   no-outgoing   preferential]	Configures another CUG interface.

## Configuring a POP with Multiple CUGs and Public Access

This POP is being configured for public access to members of several CUGs, and to originate and receive calls from the open network (that is, to or from users that do not subscribe to one of the CUGs this POP subscribes to). This is the least restrictive setting. Configuring the POP with multiple CUGs and public access is achieved using the **x25 subscribe cug-service** command with keywords **incoming-access** and **outgoing-access** being added to allow calls to be made and received to and from outside hosts not in the specified CUG network.

To set up the individual CUGs, use the **x25 subscribe local-cug** command to specify each local CUG and map it to a network CUG, setting the access properties of the local CUG—no-incoming, no-outgoing, preferential, all, or none—at the same time.

An outgoing call may select any of the local CUGs or not. When no CUG is selected, it is assumed the call is intended for the open network. The call will be refused if it specifies a different local CUG to one that the POP is subscribed to. An incoming call may or may not select related network CUGs. If no CUG is selected, the call is accepted as coming from the open network. A call that requires access to a different CUG will be refused.

To configure a POP with multiple CUGs and public access, use the following commands:

Step	Command	Purpose
1	Router(config)# <b>interface</b> <i>number</i>	Selects the interface to be configured.
2	Router(config-if)# <b>encapsulation x25 dce</b>	Enables X.25 DCE network operation.

Step	Command	Purpose
3	Router(config-if)# <b>x25 subscribe cug-service incoming-access outgoing-access</b>	Permits incoming and outgoing CUG access on an X.25 DCE interface.
4	Router(config-if)# <b>x25 subscribe local-cug</b> <i>number</i> <b>network-cug</b> <i>number</i> [ <b>no-incoming</b>   <b>no-outgoing</b>   <b>preferential</b> ]	Maps the desired local CUG number to its corresponding network CUG.
5	Router(config-if)# <b>x25 subscribe local-cug</b> <i>number</i> <b>network-cug</b> <i>number</i> [ <b>no-incoming</b>   <b>no-outgoing</b>   <b>preferential</b> ]	Configures another CUG interface.

## Verifying X.25 CUG Service

To show current settings of the X.25 CUGs feature, use the **show x25 cug** (either keyword **local-cug** or **network-cug** must be designated) command in EXEC mode. In the following example local CUGs 100, 200, 300, and 5000 are shown mapped to their related network CUGs 11, 22, 33, and 55, respectively, all with incoming and outgoing public access, and with network CUG 55 being set as the preferential:

```
Router# show x25 cug local-cug
X.25 Serial0, 4 CUGs subscribed with incoming and outgoing public access
  local-cug 100 <-> network-cug 11
  local-cug 200 <-> network-cug 22
  local-cug 300 <-> network-cug 33
  local-cug 5000 <-> network-cug 55, preferential
```

## Troubleshooting Tips for X.25 CUG Service

The **debug x25 events** command can be used to verify if and when CUG calls are being made, and how the CUGs are behaving. The following example shows messages concerning a DCE rejecting a call because CUG 40 is not configured at the DCE interface, either by design or administrative mistake:

```
Router# debug x25 events
00:48:33:Serial1:X.25 I R1 Call (14) 8 lci 1024
00:48:33:  From (3):111 To (3):444
00:48:33:  Facilities:(2)
00:48:33:  Closed User Group (basic):40
00:48:33:  Call User Data (4):0x01000000 (pad)
00:48:33:  X.25 Incoming Call packet, Closed User Group (CUG) protection, selected
network CUG not subscribed
00:48:33:  Serial1:X.25 O R1 Clear (5) 8 lci 1024
00:48:33:  Cause 11, Diag 65 (Access barred/Facility code not allowed)
```

## Configuration Examples

This section provides the following configuration examples:

- X.25 CUG Service, Access, and CUG Properties
- POP with No CUG Access
- POP with Access Restricted to One CUG
- POP with Multiple CUGs and no Public Access
- POP with Multiple CUGs and Public Access

## X.25 CUG Service, Access, and CUG Properties

In the following example, X.25 CUG service is being subscribed on serial 0, which then permits the subscription to local CUGs (5000, 100, 200, and 300). Subscription to local CUGs cannot be achieved without subscription to X.25 CUG service (although this occurs automatically—with CUG service default settings of no incoming and no outgoing access—the first time you subscribe to a specific CUG using the **x25 subscribe local-cug** command).

Local CUG 5000 has been designated as the preferential CUG, which means that it will be used when a call with no CUG membership selection was made. These local CUGs all belong to different network identifiers (IDs) (local 5000 = network 55; local 100 = network 11; local 200 = network 22; local 300 = network 33), but they could also subscribe to the same network ID if desired.

```
Router(config)# interface serial0
Router(config-if)# encapsulation x25 dce
Router(config-if)# x25 subscribe cug-service incoming-access outgoing-access
Router(config-if)# x25 subscribe local-cug 5000 network-cug 55 preferential
Router(config-if)# x25 subscribe local-cug 100 network-cug 11
Router(config-if)# x25 subscribe local-cug 200 network-cug 22
Router(config-if)# x25 subscribe local-cug 300 network-cug 33
```

## POP with No CUG Access

In the following example, serial interface 0 is being configured as a POP for a user that has no access to any of the CUGs in the network, but full public access (incoming and outgoing access)—the least restrictive setting.

```
Router(config)# interface serial0
Router(config-if)# encapsulation x25 dce
Router(config-if)# x25 subscribe cug-service incoming-access outgoing-access
```

## POP with Access Restricted to One CUG

In the following example, serial interface 0 is configured as a POP with access only to members of its own CUG and no public access. The POP is being configured for CUG service security using the most restrictive settings (the default) of the **x25 subscribe cug-service** command—no incoming and no outgoing access permitted. Local CUG 5000, which is associated with network 55, is being subscribed to this POP.

An outgoing call from the DTE may select local CUG 5000 or not. Because there is only one CUG subscribed, its use is implicit and will always select its related network CUG 55. An outgoing call that specifies a different local CUG will be refused. An incoming call must specify network CUG 55, otherwise the call will be refused.

```
Router(config)# interface serial0
Router(config-if)# encapsulation x25 dce
Router(config-if)# x25 subscribe cug-service
Router(config-if)# x25 subscribe local-cug 5000 network-cug 55
```

## POP with Multiple CUGs and no Public Access

In the following example, serial interface 0 is being configured as a POP with access to members of several CUGs, using the most restrictive settings (the default) of the **x25 subscribe cug-service** command—no incoming and no outgoing access permitted. Local CUGs (5000, 100, 200, and 300) are then subscribed to this POP. Local CUG 5000 has been designated as the preferential CUG, which means that it will be used when a call with no CUG membership selection was made.

These local CUGs all belong to different networks (local 5000 = network 55; local 100 = network 11; local 200 = network 22; local 300 = network 33), but they could also subscribe to the same network if desired.

An outgoing call from the DTE may select any of the local CUGs (5000, 100, 200, and 300) or not. Because there is a preferential CUG (5000), its use will be implicit when no CUG is specified. The related network CUG (55) will be selected when switched to an intra-network connection. A call specifying a different local CUG will be refused. An incoming call must select one of the network CUGs (55, 11, 22, or 33), otherwise the call will be refused.

```
Router(config)# interface serial0
Router(config-if)# encapsulation x25 dce
Router(config-if)# x25 subscribe cug-service
Router(config-if)# x25 subscribe local-cug 5000 network-cug 55 preferential
Router(config-if)# x25 subscribe local-cug 100 network-cug 11
Router(config-if)# x25 subscribe local-cug 200 network-cug 22
Router(config-if)# x25 subscribe local-cug 300 network-cug 33
```

## POP with Multiple CUGs and Public Access

In the following example, serial interface 0 is being configured as a POP with public access to members of several CUGs, and to originate and receive calls from the open network (that is, to or from users that do not subscribe to one of the CUGs this POP subscribes to).

An outgoing call from the DTE may select any of the local CUGs (1, 2, 3, or 4) or not. When no CUG is selected, it is assumed the call is intended for the open network. When a CUG is selected, the related network CUG will be selected when switched to an intra network connection. The call will be refused if it specifies a different local CUG to one that the POP is subscribed to.

An incoming call to the DTE from an intra network connection may select related network CUGs (101, 202, 303, or 404) or no CUG. If no CUG is selected, the call is accepted as coming from the open network. A call that requires access to a different CUG will be refused.

```
Router(config)# interface serial0
Router(config-if)# encapsulation x25 dce
Router(config-if)# x25 subscribe cug-service incoming-access outgoing-access
Router(config-if)# x25 subscribe local-cug 1 network-cug 101
Router(config-if)# x25 subscribe local-cug 2 network-cug 202
Router(config-if)# x25 subscribe local-cug 3 network-cug 303
Router(config-if)# x25 subscribe local-cug 4 network-cug 404
```

## Command Reference

This section documents new commands. All other commands used with this feature are documented in the Cisco IOS Release 12.0 command reference publications.

- **show x25 cug**
- **x25 subscribe cug-service**
- **x25 subscribe local-cug**

In Cisco IOS Release 12.0(1)T or later, you can search and filter the output for **show** and **more** commands. This functionality is useful when you need to sort through large amounts of output, or if you want to exclude output that you do not need to see.

To use this functionality, enter a **show** or **more** command followed by the “pipe” character (`|`), one of the keywords **begin**, **include**, or **exclude**, and an expression that you want to search or filter on:

*command / {begin | include | exclude} regular-expression*

Following is an example of the **show atm vc** command in which you want the command output to begin with the first line where the expression “PeakRate” appears:

**show atm vc /begin PeakRate**

For more information on the search and filter functionality, refer to the Cisco IOS Release 12.0(1)T feature module titled *CLI String Search*.

## show x25 cug

To display information about all or specific (defined by the local or network closed user group (CUG) number) CUGs, use the **show x25 cug EXEC** command.

```
show x25 cug {local-cug number | network-cug number}
```

### Syntax Description

<b>local-cug</b>	Locally significant CUG identifier.
<i>number</i>	Local CUG number (0 to 9999).
<b>network-cug</b>	Network translated CUG identifier.
<i>number</i>	Network CUG number (0 to 9999).

### Command Modes

EXEC

### Command History

Release	Modification
12.0(7)T	This command was introduced.

### Usage Guidelines

You must designate either **local-cug** or **network-cug** with this command. Within these designations you can view all CUGs or a specific CUG defined by its local or network CUG identifier.

### Examples

The following is sample output from the **show x25 cug local-cug** command, displaying information about all local CUGs on X.25 serial interface 0. Four CUGs have been subscribed to on serial interface 0, and they all have been configured for incoming and outgoing public access.

```
Router# show x25 cug local-cug
X.25 Serial0, 4 CUGs subscribed with incoming and outgoing public access
  local-cug 100 <-> network-cug 11
  local-cug 200 <-> network-cug 22
  local-cug 300 <-> network-cug 33
  local-cug 5000 <-> network-cug 55, preferential
```

The following is sample output from the **show x25 cug network-cug** command specifically for network number 33 showing local CUG 300 is associated with it:

```
Router# show x25 cug network-cug 33
network-cug 33 <-> local-cug 300
```

Table 1 describes the fields shown in the display for the **show x25 cug** command.

**Table 1** show x25 cug Field Descriptions

Field	Description
X.25 Serial 0	DCE interface with X.25 CUG service subscription.
local-cug	Local CUG details.
network-cug	Network CUG details.
preferential	Identifies which CUG, if any, is preferential. A single CUG listed for an interface is assumed to be preferential.

## Related Commands

Command	Description
<b>x25 subscribe cug-service</b>	Enables and controls standard CUG behavior on an X.25 DCE interface.
<b>x25 subscribe local-cug</b>	Configures an interface for CUG subscription.

## x25 subscribe cug-service

To enable and control standard closed user group (CUG) behavior on an X.25 data communications equipment (DCE) interface, use the **x25 subscribe cug-service** interface configuration command. To disable standard CUG behavior on an X.25 DCE interface, use the **no** form of this command.

**x25 subscribe cug-service** [**incoming-access** | **outgoing-access**]

**no x25 subscribe cug-service** [**incoming-access** | **outgoing-access**]

### Syntax Description

<b>incoming-access</b>	(Optional) Allows incoming access from the open network to the data terminating equipment (DTE).
<b>outgoing-access</b>	(Optional) Allows outgoing access from the DTE to the open network.

### Default

No incoming-access and no-outgoing-access. (This is the most restrictive setting.)

### Command Modes

Interface configuration

### Command History

Release	Modification
12.0(7)T	This command was introduced.

### Usage Guidelines

When entering this command, specify either **incoming-access** or **outgoing-access**, unless you intend to have neither incoming nor outgoing access on that interface.

This command assumes that an X.25 network connection is being implemented and observes rules defined by X.25 and X.301 for CUG access. This command is enabled on a per-interface basis. Use this command to modify existing specified options without otherwise affecting the CUGs already defined. The following restrictions apply:

- Disabling this command deconfigures all of the CUGs defined for the device and disables all CUG-related commands, but does not terminate the associated CUG switched virtual circuit (SVC) connections.
- The DTE cannot call the open part of the network unless the **outgoing-access** option is configured. Even if **outgoing-access** is permitted, the DCE will enforce any additional CUG requirements when handling an outgoing call (call request) from the DTE.
- The DTE will not receive calls from the open part of the network unless the **incoming-access** option is configured. Even if **incoming-access** is permitted, the DCE will enforce any additional CUG requirements before presenting an incoming call to the DTE.

## Examples

The following example subscribes both incoming and outgoing CUG service on the interface:

```
Router(config)# interface serial0
Router(config-if)# encapsulation x25 dce
Router(config-if)# x25 subscribe cug-service incoming-access outgoing-access
```

## Related Commands

Command	Description
<b>show x25 cug</b>	Displays information about CUG services.
<b>x25 subscribe local-cug</b>	Configures an interface for CUG subscription.
<b>x25 map</b>	(With CUG encoding option.) Sets up the LAN protocols-to-remote host mapping.
<b>x25 facility</b>	(With the CUG keyword.) Forces facilities on a per-call basis for calls originated by the router (switched calls are not affected).

## x25 subscribe local-cug

To configure a data circuit-terminating equipment (DCE) X.25 interface for a specific closed user group (CUG) subscription, use the **x25 subscribe local-cug** interface configuration command. To disable the interface for a specific CUG subscription, use the **no** form of this command.

**x25 subscribe local-cug** *number* **network-cug** *number* [**no-incoming** | **no-outgoing** | **preferential**]

**no x25 subscribe local-cug** *number* **network-cug** *number* [**no-incoming** | **no-outgoing** | **preferential**]

### Syntax Description

<b>local-cug</b>	Locally significant CUG identifier.
<i>number</i>	Specific local CUG number (0 to 9999).
<b>network-cug</b>	Network translated CUG identifier.
<i>number</i>	Specific network CUG number (0 to 9999).
<b>no-incoming</b>	(Optional) Calls to data terminal equipment (DTE) barred within the specified CUG, unless <b>x25 subscribe cug-service incoming-access</b> is configured.
<b>no-outgoing</b>	(Optional) Calls from DTE barred within the specified CUG, unless <b>x25 subscribe cug-service outgoing-access</b> is configured.
<b>preferential</b>	(Optional) Specified on only one CUG, and is the assumed CUG when none is provided in call setup. (A single CUG listed at the interface is automatically considered a preferential CUG.)

### Default

Incoming and outgoing access. (Preferential - if this is the only CUG specified on the interface.)

### Command Modes

Interface configuration

### Command History

Release	Modification
12.0(7)T	This command was introduced.

### Usage Guidelines

The first **x25 subscribe local-cug** command in a group of configurations will automatically enable CUG service behavior on the interface, if it is not already enabled, with the default settings of no public access.

A CUG number only has local significance. Because CUG service is a cooperative process between the network attachments (DCE devices), the local CUG number may need to be translated into a number that is significant to the network as a whole. For instance, two DTE devices may use CUG numbers 1 and 5 to refer to the global CUG number 1043 of the network. In this instance, both DCE devices would be configured to translate between the local CUG number of their DTE and the network CUG number. Duplicate network CUG identifiers are permitted for different local CUG identifiers.

A DTE subscription to a CUG that also includes the **no-incoming** option prevents incoming calls on that CUG (however, the DTE may still receive calls within other CUGs to which it is subscribed, or from the open network if incoming public access is subscribed).

CUG subscription of a DTE will not permit an outgoing call (call request) from the CUG if the **no-outgoing** option is configured.

The CUG will be assumed to be set to “preferential” if there is only one CUG subscribed on that interface.

## Examples

The following example subscribes local CUGs 5000, 100, 200, and 300 to networks 55, 11, 22, and 33, respectively, with local CUG 5000 being set as the preferential CUG:

```
Router(config)# interface serial0
Router(config-if)# encapsulation x25 dce
Router(config-if)# x25 subscribe cug-service incoming-access outgoing-access
Router(config-if)# x25 subscribe local-cug 5000 network-cug 55 preferential
Router(config-if)# x25 subscribe local-cug 100 network-cug 11
Router(config-if)# x25 subscribe local-cug 200 network-cug 22
Router(config-if)# x25 subscribe local-cug 300 network-cug 33
```

## Related Commands

Command	Description
<b>show x25 cug</b>	Displays information about CUG services.
<b>x25 subscribe cug-service</b>	Enables and controls standard CUG behavior on an X.25 DCE interface.
<b>x25 map</b>	(With CUG encoding option.) Sets up the LAN protocols-to-remote host mapping.
<b>x25 facility</b>	(With the CUG keyword.) Forces facilities on a per-call basis for calls originated by the router (switched calls are not affected).

## Debug Commands

This section documents the modified **debug x25** command related to the X.25 CUGs feature. All other commands used with this feature are documented in the Cisco IOS Release 12.0 command reference publications.

## debug x25

To display information about X.25 traffic, use one of the following **debug x25** commands. The commands allow you to display all information or an increasingly restrictive part of the information.



**Caution** This command is processor intensive and can render the router useless. Use this command only when the aggregate of all reportable X.25 traffic is fewer than five packets per second (pps). The generic forms of this command should be restricted to low-speed, low-usage links running at less than 19.2 kbps. Because the **debug x25 vc** command and the **debug x25 vc events** command display traffic for only a small subset of virtual circuits, they are safer to use under heavy traffic conditions, as long as events for that virtual circuit are fewer than 25 pps.

To display information about all X.25 traffic, including traffic for X.25, Connection-Mode Network Service (CMNS), and X.25 over TCP (XOT) services, use the **debug x25 EXEC** command (default **all**). Use the **no** form of this command to disable debugging output.

**[no] debug x25**

To display information about all X.25 traffic except data and resource record packets, use the **debug x25 events** command. Use the **no** form of this command to disable debugging output.

**[no] debug x25 events**

To display information about a specific X.25 service class, use the following form of the **debug x25 EXEC** command. Use the **no** form of this command to disable debugging output.

**[no] debug x25 [only | cmns | xot] [events | all]**

To display information about a specific X.25 or CMNS context, use the following form of the **debug x25 EXEC** command. Use the **no** form of this command to disable debugging output.

**[no] debug x25 interface {serial-interface | cmns-interface mac mac-address} [events | all]**

To display information about a specific X.25 or CMNS virtual circuit, use the following form of the **debug x25 EXEC** command. Use the **no** form of this command to disable debugging output.

**[no] debug x25 interface {serial-interface | cmns-interface mac mac-address} vc number [events | all]**

To display information about traffic for all virtual circuits using a given number, use the following form of the **debug x25 EXEC** command. The **no** form of this command removes the filter for a particular virtual circuit from the **debug x25 all** or **debug x25 events** output. Use the **no** form of this command to disable debugging output.

**[no] debug x25 vc number [events | all]**

To display information about traffic to or from a specific XOT host, use the following form of the **debug x25 xot EXEC** command. Use the **no** form of this command to disable debugging output.

**[no] debug x25 xot [remote ip-address [port number]] [local ip-address [port number]] [events | all]**

Use the **debug x25 EXEC** command with the **aodi** keyword to display information about an interface running PPP over an X.25 session. The **no** form of this command disables debugging output. Use the **no** form of this command to disable debugging output.

**[no] debug x25 aodi**

Syntax Description

<b>events</b>	(Optional) Displays all traffic except Data and Receiver Ready (RR) packets.
<b>all</b>	(Optional) Displays all traffic.
<b>only   cmns   xot</b>	(Optional) Displays information about the specified services: X.25 only, CMNS, or XOT.
<i>serial-interface</i>	X.25 serial interface.
<i>cmns-interface</i> <b>mac</b> <i>mac-address</i>	MAC address of the CMNS interface and remote host. The interface type can be Ethernet, Token Ring, or FDDI.
<b>vc number</b>	Virtual circuit number, in the range 1 to 4095.
<b>remote ip-address</b> [ <b>port number</b> ]	(Optional) Remote IP address and, optionally, a port number in the range 1 to 65535.
<b>local ip-address</b> [ <b>port number</b> ]	(Optional) Local host IP address and, optionally, a port number in the range 1 to 65535.
<b>aodi</b>	Causes the <b>debug x25</b> command to display Always On/Dynamic ISDN (AO/DI) events and processing information.

Default

all

Command History

Release	Modification
10.0	This command was introduced.
12.0(5)T	For DNS-based X.25 routing, additional functionality was added to the <b>debug x25 events</b> command to describe the events occurring while resolving the X.25 address to an IP address using a DNS server. The <b>debug domain</b> command can be used along with <b>debug x25 events</b> to observe the whole DNS-based X.25 routing data flow. (For more details, see “debug x25 events for DNS-Based X.25 Routing” in the “Examples” section.)
12.0(7)T	For the X.25 CUGs feature, functionality was added to the <b>debug x25 events</b> command to describe events occurring during CUG activity. (For more details, see “debug x25 events for X.25 CUGs” in the “Examples” section.)

Usage Guidelines

This command is particularly useful for diagnosing problems encountered when placing calls. The **debug x25 all** output includes data, control messages, and flow control packets for all virtual circuits of the router.

All **debug x25** command forms can take either the **events** or **all** keyword. The keyword **all** is the default and causes all packets meeting the other debug criteria to be reported. The keyword **events** omits reports of any Data or Receiver Ready (RR) flow control packets; the normal flow of data and RR packets is commonly large and less interesting to the user, so event reporting can significantly decrease the processor load induced by debug reporting.

The **debug x25 interface** command is useful for diagnosing problems encountered with a single X.25 or CMNS host or virtual circuit.

Because no interface is specified by the **debug x25 vc** command, traffic on any virtual circuit that has the specified number is reported.

Virtual circuit zero (**vc 0**) cannot be specified. It is used for X.25 service messages, such as RESTART packets, not virtual circuit traffic. Service messages can be monitored only when no virtual circuit filter is used.

The **debug x25 xot** output allows you to restrict the debug output reporting to XOT traffic for one or both hosts or host/port combinations. Because each XOT virtual circuit uses a unique TCP connection, an XOT debug request that specifies both host addresses and ports will report traffic only for that virtual circuit. Also, you can restrict reporting to sessions initiated by the local or remote router by specifying 1998 for the remote or local port. (XOT connections are received on port 1998.)

Use the **debug x25 aodi** command to display interface PPP events running over an X.25 session and to debug X.25 connections between a client and server configured for AO/DI.

## Examples

The following is sample output from the **debug x25** command, displaying output concerning the functions X.25 restart, call setup, data exchange, and clear:

```
Router# debug x25

Serial0: X.25 I R/Inactive Restart (5) 8 lci 0
Cause 7, Diag 0 (Network operational/No additional information)
Serial0: X.25 O R3 Restart Confirm (3) 8 lci 0
Serial0: X.25 I P1 Call (15) 8 lci 1
From(6): 170091 To(6): 170090
Facilities: (0)
Call User Data (4): 0xCC000000 (ip)
Serial0: X.25 O P3 Call Confirm (3) 8 lci 1
Serial0: X.25 I D1 Data (103) 8 lci 1 PS 0 PR 0
Serial0: X.25 O D1 Data (103) 8 lci 1 PS 0 PR 1
Serial0: X.25 I P4 Clear (5) 8 lci 1
Cause 9, Diag 122 (Out of order/Maintenance action)
Serial0: X.25 O P7 Clear Confirm (3) 8 lci 1
```

Table 2 describes the fields shown in the display.

**Table 2** debug x25 Field Descriptions

Field	Description
Serial0	Interface on which the X.25 event occurred.
X.25	Type of event this message describes.
I	Letter indicating whether the X.25 packet was input (I) or output (O) through the interface.

**Table 2            debug x25 Field Descriptions (continued)**

Field	Description
R3	<p>State of the service or virtual circuit (VC). Possible values follow:</p> <p>R/Inactive—Packet layer awaiting link layer service</p> <p>R1—Packet layer ready</p> <p>R2—Data terminal equipment (DTE) restart request</p> <p>R3—Data circuit-terminating equipment (DCE) restart indication</p> <p>P/Inactive—VC awaiting packet layer service</p> <p>P1—Idle</p> <p>P2—DTE waiting for DCE to connect CALL</p> <p>P3—DCE waiting for DTE to accept CALL</p> <p>P4—Data transfer</p> <p>P5—CALL collision</p> <p>P6—DTE clear request</p> <p>P7—DCE clear indication</p> <p>D/Inactive—VC awaiting setup</p> <p>D1—Flow control ready</p> <p>D2—DTE reset request</p> <p>D3—DCE reset indication</p> <p>See Annex B of the <i>ITU-T Recommendation X.25</i> for more information on these states.</p>
Restart	<p>The type of X.25 packet. Possible values follow:</p> <ul style="list-style-type: none"> <li>• R Events <ul style="list-style-type: none"> <li>— Restart</li> <li>— Restart Confirm</li> <li>— Diagnostic</li> </ul> </li> <li>• P Events <ul style="list-style-type: none"> <li>— Call</li> <li>— Call Confirm</li> <li>— Clear</li> <li>— Clear Confirm</li> </ul> </li> <li>• D Events <ul style="list-style-type: none"> <li>— Reset</li> <li>— Reset Confirm</li> </ul> </li> <li>• D1 Events <ul style="list-style-type: none"> <li>— Data</li> <li>— RNR (Receiver Not Ready)</li> <li>— RR (Receiver Ready)</li> <li>— Interrupt</li> <li>— Interrupt Confirm</li> </ul> </li> <li>• XOT Overhead <ul style="list-style-type: none"> <li>— PVC Setup</li> </ul> </li> </ul>

**Table 2** debug x25 Field Descriptions (continued)

Field	Description
(5)	Number of bytes in the packet.
8	Modulo of the virtual circuit. Possible values are 8 or 128.
lci 0	VC number. See Annex A of the <i>ITU-T Recommendation X.25</i> for information on VC assignment.
Cause 7	Code indicating the event that triggered the packet. The Cause field can only appear in entries for Clear, Reset, and Restart packets. Possible values for the Cause field can vary, depending on the type of packet. Refer to the “X.25 Cause and Diagnostic Codes” appendix in the Cisco IOS Release 12.0 <i>Debug Command Reference</i> publication for an explanation of these codes.
Diag 0	Code providing an additional hint as to what, if anything, went wrong. The Diag field can only appear in entries for Clear, Diagnostic (as “error 0”), Reset, and Restart packets. Refer to the “X.25 Cause and Diagnostic Codes” appendix in the Cisco IOS Release 12.0 <i>Debug Command Reference</i> publication for an explanation of these codes.
(Network operational/ No additional information)	The standard explanations of the Cause and Diagnostic codes ( <i>cause/diag</i> ).

The following example shows a sequence of increasingly restrictive **debug x25** commands:

```

Router# debug x25
X.25 packet debugging is on

Router# debug x25 events
X.25 special event debugging is on

Router# debug x25 interface serial 0
X.25 packet debugging is on
X.25 debug output restricted to interface Serial0

Router# debug x25 vc 1024
X.25 packet debugging is on
X.25 debug output restricted to VC number 1024

Router# debug x25 interface serial 0 vc 1024
X.25 packet debugging is on
X.25 debug output restricted to interface Serial0
X.25 debug output restricted to VC number 1024

Router# debug x25 interface serial 0 vc 1024 events
X.25 special event debugging is on
X.25 debug output restricted to interface serial 0
X.25 debug output restricted to VC number 1024

```

The following examples show the normal sequence of events for both the AO/DI client and server sides:

### Client Side

```
Router# debug x25 aodi
PPP-X25: Virtual-Access1: Initiating AODI call request
PPP-X25: Bringing UP X.25 AODI VC
PPP-X25: AODI Client Call Confirm Event Received
PPP-X25: Cloning interface for AODI is Di1
PPP-X25: Queuing AODI Client Map Event
PPP-X25: Event:AODI Client Map
PPP-X25: Created interface Vi2 for AODI service
PPP-X25: Attaching primary link Vi2 to Di1
PPP-X25: Cloning Vi2 for AODI service using Di1
PPP-X25: Vi2: Setting the PPP call direction as OUT
PPP-X25: Vi2: Setting vectors for RFC1598 operation on BRI3/0:0 VC 0
PPP-X25: Vi2: Setting the interface default bandwidth to 10 Kbps
PPP-X25: Virtual-Access2: Initiating AODI call request
PPP-X25: Bringing UP X.25 AODI VC
PPP-X25: AODI Client Call Confirm Event Received
```

### Server Side

```
Router# debug x25 aodi
PPP-X25: AODI Call Request Event Received
PPP-X25: Event:AODI Incoming Call Request
PPP-X25: Created interface Vi1 for AODI service
PPP-X25: Attaching primary link Vi1 to Di1
PPP-X25: Cloning Vi1 for AODI service using Di1
PPP-X25: Vi1: Setting vectors for RFC1598 operation on BRI3/0:0 VC 1
PPP-X25: Vi1: Setting the interface default bandwidth to 10 Kbps
PPP-X25: Binding X.25 VC 1 on BRI3/0:0 to Vi1
```

### debug x25 events for X.25 CUGs

The following example of the **debug x25 events** command shows output related to the X.25 CUGs feature. It shows messages concerning a DCE rejecting a call because the selected network CUG had not been subscribed to by the caller.

```
Router# debug x25 events
00:48:33:Serial1:X.25 I R1 Call (14) 8 lci 1024
00:48:33: From (3):111 To (3):444
00:48:33: Facilities:(2)
00:48:33: Closed User Group (basic):40
00:48:33: Call User Data (4):0x01000000 (pad)
00:48:33:X.25 Incoming Call packet, Closed User Group (CUG) protection, selected
network CUG not subscribed
00:48:33:Serial1:X.25 O R1 Clear (5) 8 lci 1024
00:48:33: Cause 11, Diag 65 (Access barred/Facility code not allowed)
```

### debug x25 events for DNS-Based X.25 Routing

The following example of the **debug x25 events** command shows output related to the DNS-Based X.25 Routing feature. It shows messages concerning access of the DNS server. In the following example, nine alternate addresses for one XOT path are entered in the DNS server database. All nine addresses are returned to the host cache of the router by the DNS server. However, only six addresses will be used during the XOT switch attempt, because this is the limit that XOT allows.

```

Router# debug x25 events
00:18:25:Serial1:X.25 I R1 Call (11) 8 lci 1024
00:18:25: From (0): To (4):444
00:18:25: Facilities:(0)
00:18:25: Call User Data (4):0x01000000 (pad)
00:18:25:X.25 host name sent for DNS lookup is "444"
00:18:26:%3-TRUNCATE_ALT_XOT_DNS_DEST:Truncating excess XOT addresses (3)
returned by DNS
00:18:26:DNS got X.25 host mapping for "444" via network
00:18:32:[10.1.1.8 (pending)]:XOT open failed (Connection timed out; remote host not
responding)
00:18:38:[10.1.1.7 (pending)]:XOT open failed (Connection timed out; remote host not
responding)
00:18:44:[10.1.1.6 (pending)]:XOT open failed (Connection timed out; remote host not
responding)
00:18:50:[10.1.1.5 (pending)]:XOT open failed (Connection timed out; remote host not
responding)
00:18:56:[10.1.1.4 (pending)]:XOT open failed (Connection timed out; remote host not
responding)
00:20:04:[10.1.1.3,1998/10.1.1.3,11007]:XOT O P2 Call (17) 8 lci 1
00:20:04: From (0): To (4):444
00:20:04: Facilities:(6)
00:20:04: Packet sizes:128 128
00:20:04: Window sizes:2 2
00:20:04: Call User Data (4):0x01000000 (pad)
00:20:04:[10.1.1.3,1998/10.1.1.3,11007]:XOT I P2 Call Confirm (11) 8 lci 1
00:20:04: From (0): To (0):
00:20:04: Facilities:(6)
00:20:04: Packet sizes:128 128
00:20:04: Window sizes:2 2
00:20:04:Serial1:X.25 O R1 Call Confirm (5) 8 lci 1024
00:20:04: From (0): To (0):
00:20:04: Facilities:(0)

```

## Related Commands

Command	Description
<b>debug ppp bap</b>	Displays general BACP transactions.
<b>debug ppp bap negotiation</b>	Displays general BACP transactions, as well as successive steps in negotiations between peers.
<b>debug ppp multilink</b>	Displays information about important multilink events.

## Glossary

**call request**—An X.25 packet sent from a DTE (subscriber) to its DCE (network attachment) that initiates a connection to a destination DTE.

**CUG**—closed user group. An X.25 network service whereby the various subscribers (DTE devices) can be segregated into private subnetworks that limit incoming or outgoing access. A DTE may subscribe to zero, one, or more CUGs. A DTE that does not subscribe to a CUG is considered in the open part of the network. This means that a DTE must contract with its network service provider to obtain membership in each restricted subnetwork (that is, a set of CUGs).

**DCE**—data circuit-terminating equipment. Devices and connections of a communications network that comprise the network end of the user-to-network interface (for example, modem). The DCE provides a physical connection to the network, forwards traffic, and provides a clocking signal used to synchronize data transmission between DCE and DTE devices.

**DTE**—data terminal equipment. A device (for example, computer, protocol translator, or multiplexer) at the user end of a user-network interface that serves as a data source, destination, or both. The DTE connects to a data network through a DCE device (for example, modem) and typically uses clocking signals generated by the DCE. A network identifies each attached subscriber (DTE) by assigning an X.121 address.

**incoming call**—An X.25 packet sent from a DCE (network attachment) to its DTE (subscriber) that presents a connection requested by the source DTE.

**PAD**—packet assembler/disassembler. A device used to connect simple devices (like character-mode terminals) that do not support the full functionality of a particular protocol to a network. PADs buffer data and assemble and disassemble packets sent to such end devices.

**PDN**—public data network. A network operated either by a government (as in Europe) or by a private concern to provide computer communications to the public, usually for a fee. PDNs enable small organizations to create a WAN without all the equipment costs of long-distance circuits.

**POP**—point of presence. A physical location where an interexchange carrier installed equipment to interconnect with a local exchange carrier (LEC).

**QLLC**—Qualified Logical Link Control. Data link layer protocol defined by IBM that allows SNA data to be transported across X.25 networks.

**SVC**—switched virtual circuit. Virtual circuit that is dynamically established on demand and is torn down when transmission is complete. SVCs are used in situations where data transmission is sporadic. Called a switched virtual connection in ATM terminology.

**X.121**—A 14-digit address that directs calls to a unique X.25 element/device.

**XOT**—X.25 over TCP.