

QLLC Implementation, Connections, and Debugging

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Introduction

Qualified Logical Link Control (QLLC) is an IBM-defined data-link-layer protocol that allows Systems Network Architecture (SNA) data to be transported across X.25 networks.

This document discusses QLLC implementation, connections and debugging.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

This document is not restricted to specific software and hardware versions.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

QLLC Implementation

The implementation of QLLC commands in X.25 packets occurs with the use of the Q-bit. X.25 packets that contain QLLC primitives are typically 5 bytes, or the length of the X.25 packet header, plus 2 bytes of QLLC control information.

Note: X.25 data packets that contain SNA data do not use the Q-bit.

After the QLLC connection is established, the unique virtual circuit of the X.25 connection is used to forward data traffic. LLC (Logical Link Control) is a subset of HDLC (High Level Data Link Control). SDLC (Synchronous Data Link Control) and QLLC are also subsets of HDLC. This table lists the QLLC primitives that Cisco converts to LLC primitives, and vice versa:

QLLC	LLC
QSM	SABME
QXID	XID
QDISC	DISC
QUA	UA
X.25 DATA PACKET	I-FRAME

Normal QLLC Connections

The receipt of an X.25 INCOMING CALL that contains the QLLC CUD (0xc3) initiates a normal QLLC/LLC connection. A reverse QLLC connection is a QLLC/LLC connection that a LAN initiates.

Note: For a QLLC/LLC connection, there is a QLLC connection between the QLLC device and the router, and an LLC connection between the LAN-attached device and the router.

```

LAN Device----- Router -----QLLC device
                    |
                    | < -- X.25 incoming call -----

```

If QLLC is configured, the router answers an X.25 QLLC call with an X.25 CALL CONNECTED message. The router then sends a test frame, or explorer, to the LAN device to initiate the LAN connection. If the LAN partner can be located, the LAN partner sends an explorer response with a RIF on how to locate it.

```

LAN Device----- Router -----QLLC device
                    |
                    | -----X.25 call connected -- >

```

The router then sends a null exchange identification (XID) to the LAN partner, under the assumption that the QLLC device can perform XID negotiation. Most SNA devices can perform XID negotiation. If the QLLC device cannot perform the XID negotiation on its own, the router offers an XID proxy utility.

```

LAN Device----- Router -----QLLC device
                    |
                    | < -- null XID-----

```

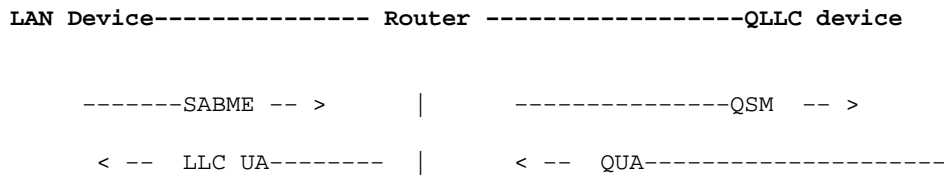
The router must receive an XID response from the LAN partner. The router tries to execute in XID-pass thru mode as much as possible. The router converts the XID Response from the LAN device to a QXID and forwards the QXID to the QLLC side. The negotiation takes place until one side has all the necessary information and wants to be the primary device.

```

LAN Device----- Router -----QLLC device
                    |
                    | -----XID Response -- >

```

A LAN device that decides to be primary sends a Set Asynchronous Balanced Mode Extended (SABME). The SABME is converted into a Qualified Setresponse Mode (QSM). If the QLLC side is content to be secondary, the QLLC device sends a Qualified Unnumbered Acknowledgement (QUA). This QUA is converted into an LLC UA and sent to the LAN partner.



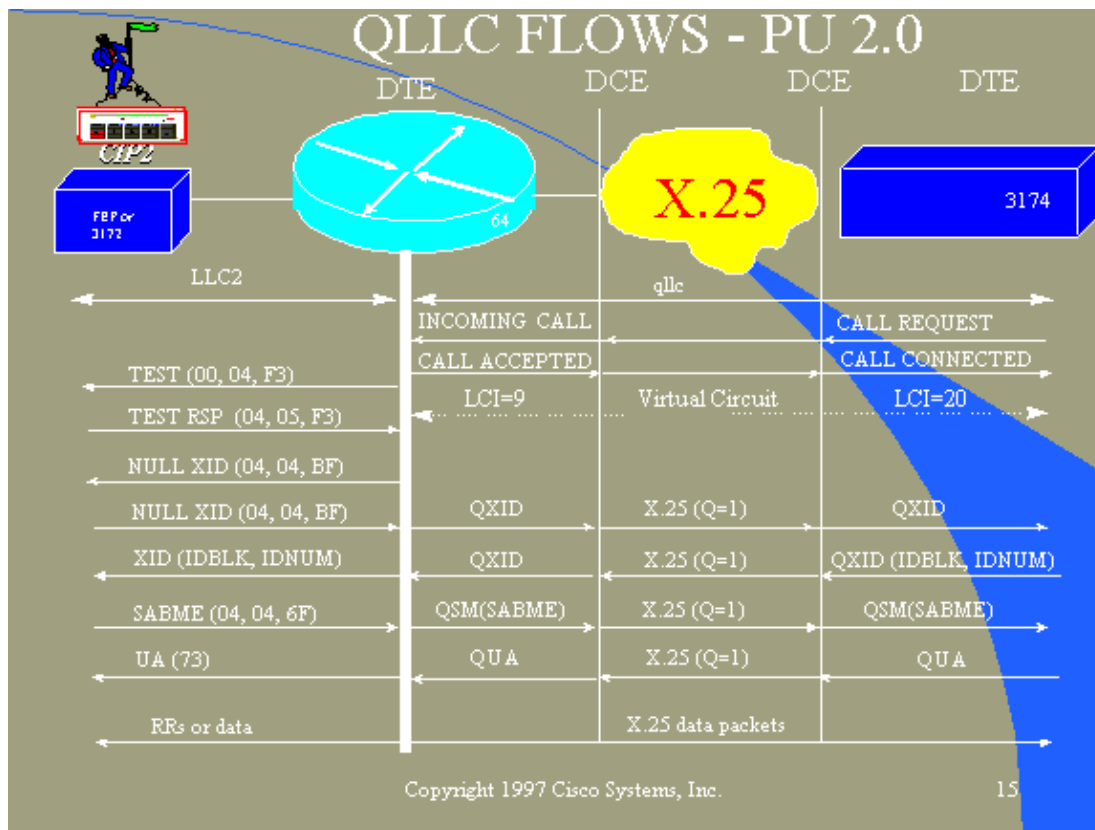
Here is the current connections summary:

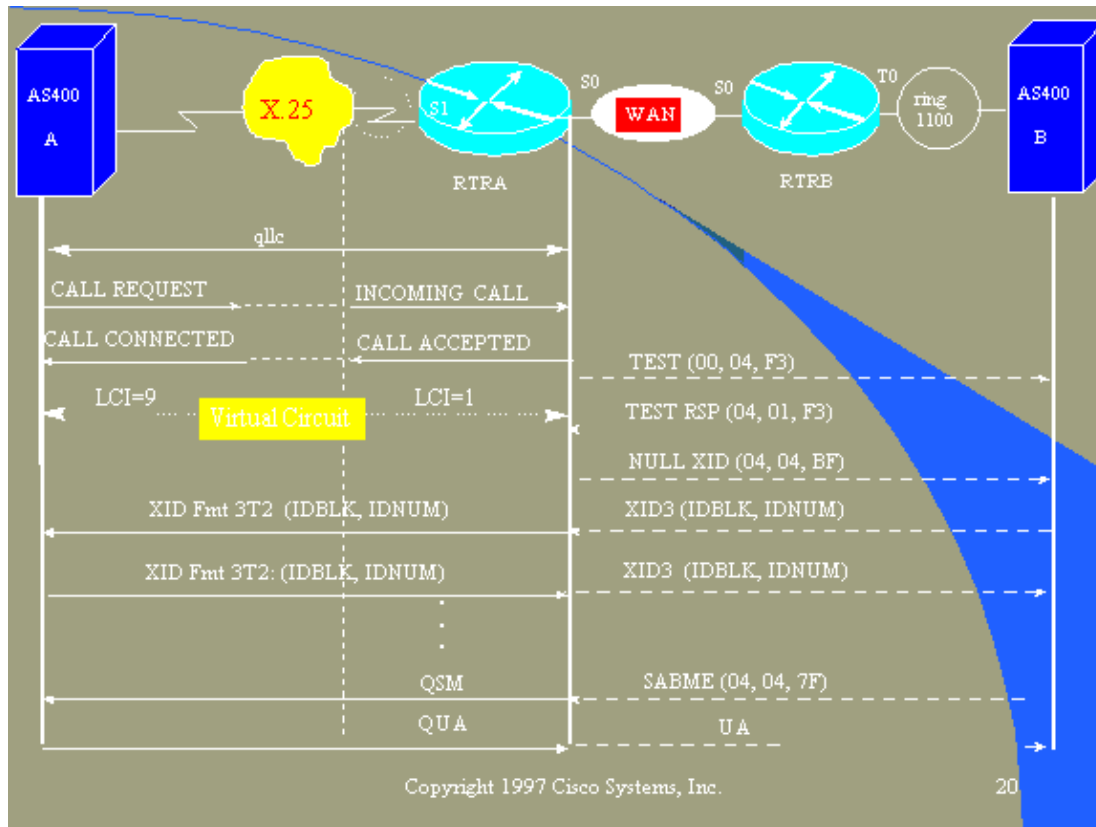
- A QLLC connection between the QLLC device and the router
- An LLC connection between the router and the LAN device
- An active QLLC/LLC connection on the router

The **show qlc** command shows the state of the QLLC/LLC connection. A router trace with **debug qlc packet**, **debug qlc event**, and **debug x25** displays this information.

QLLC Flows with PU 2.0

Here are QLCC flows with Physical Unit 2 (PU 2.0):





QLLC Debug Example

This section provides a short debug example of a QLLC startup. This trace shows a dumb PU 2.0 coax-attached to an IBM 3174. The IBM 3174 has a QLLC connection to a router. The LAN partner is an IBM 3745 and the physical unit (PU) performs IBM 3270 emulation. For a more detailed explanation of X.25 parameters and states, refer to X.25 international standards specifications.

```

Serial0: I X25 P1 CALL REQUEST (11) 8 lci 20

From (8): 06431743 To(2): 64

Facilities (0)

Call User Data (1): 0xC3 (qllc)

Serial 0: X25 O P4 CALL CONNECTED (5) 8 lci 20

From(0): To(0):

Facilities: (0)

QLLC: allocating new qllc lci 20

QLLC: tx POLLING TEST, da 4000.3172.0002,sa 4000.011c.3174

QLLC: rx explorer response, da 4000.011c.3174, sa
c000.3172.0002, rif 08B0.1A91.1901.A040

QLLC: gen NULL XID, da c000.3172.0002, sa 4000.011c.3174,
rif 0830.1A91.1901.A040, dsap 4, ssap 4

QLLC: rx XID response, da 4000.011c.3174, sa c000.3172.0002,
rif 08B0.1A91.1901.A040

```

```

Serial0 QLLC O: ADM XID

Serial0: X25 O P4 DATA (5) Q 8 lci 20 PS 0 PR 0

Serial0: X25 I P4 RR (3) 8 lci 20 PR 1

Serial0: X25 I D1 DATA (25) Q 8 lci 20 PS 0 PR 1

Serial0 QLLC I: QXID-RSPQLLC: addr 01, ctl BF

QLLC: Fmt 1T2: 01731743

QLLC: 4000.011c.3174DISCONNECT net <-SABME (NONE)6F

QLLC: qllc_open : vmac 4000.011c.3174

Serial0 QLLC O: QSM-CMD

Serial0: X25 O D1 DATA (5) Q 8 lci 20 PS 1 PR 1

Serial0: X25 I D1 DATA (5) Q 8 lci 20 PS 1 PR 2

Serial0 QLLC I: QUA-RSPQLLC: addr 01, ctl 73

QLLC: qsetupstate: recvd qua rsp

25kc#

25kc#show qllc

QLLC Connections:

```

In this output:

- **I** is an input packet
- P1** is an X.25 state
- CALL REQUEST** is an X.25 DTE-to-DCE packet that starts the X.25 connection
- (11)** is the length of the packet in bytes
- 8** represents module 8
- lci 20** is the X.25 logical channel number used by this connection
- **(8): 06431743** is the 8-byte calling address
- To(2): 64** is the 2-byte called address.
- **(0)** indicates that no facilities are used.
- **(1): 0xC3** is one byte of X.25 user data that indicates a QLLC connection.

Related Information

- [IBM Technologies Support Page](#)
 - [Technical Support & Documentation – Cisco Systems](#)
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