

The diagram is a circular state transition diagram for the LAPB protocol. At the center is a circle labeled "Information transfer". Surrounding this central circle are ten other circles, each representing a state. Transitions between these states are indicated by arrows, many of which are labeled with specific events or conditions. To the right of the diagram, a vertical double-headed arrow indicates the flow of "Link management" (upward) and "Data transfer" (downward).

**States and Transitions:**

- Disconnected** (top):
  - Transition to **SABM send** (top right) labeled "L\_CONNECT req. SABM".
  - Transition to **DISC UA** (top left) labeled "UA".
- SABM send** (top right):
  - Transition to **Information transfer** (center) labeled "SABM, UA".
  - Transition to **Waiting ACK** (right) labeled "UA".
- Waiting ACK** (right):
  - Transition to **RR (R/P = 1)** (bottom right) labeled "Timer expires, R/P = 1".
- RR (R/P = 1)** (bottom right):
  - Transition to **RR** (bottom) labeled "RNR, RR".
- RR** (bottom):
  - Transition to **RR** (bottom left) labeled "RR".
  - Transition to **RR** (top left) labeled "RR".
- RR** (bottom left):
  - Transition to **RR** (top left) labeled "RR".
- RR** (top left):
  - Transition to **DISC UA** (top left) labeled "RR".
- DISC UA** (top left):
  - Transition to **DISC send** (left) labeled "L\_DISCONNECT req. DISC".
- DISC send** (left):
  - Transition to **Information transfer** (center) labeled "RR".
- Information transfer** (center):
  - Transition to **RR** (bottom) labeled "RR".
  - Transition to **RR** (top) labeled "RR".
  - Transition to **RR** (left) labeled "RR".
  - Transition to **RR** (right) labeled "RR".

## Protocol structure

<b>Flag</b> 0111 1110 (8 bits)	<b>Address</b> (8 bits)	<b>Control</b> (8 bits)	<b>Data</b> (Variable)	<b>Checksum</b> (16 bits)	<b>Flag</b> 0111 1110 (8 bits)
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**Address field** – In LAPB, this field has no meaning since the protocol works in a point to point mode and the DTE network address is represented in the layer 3 packets. This byte is therefore put to a different use; it separates the link commands from the responses and can have only two values: 0x01 and 0x03. 01 identifies frames containing commands from DTE to DCE and responses to these commands from DCE to

DTE. 03 is used for frames containing commands from DCE to DTE and for responses from DTE to DCE. Therefore, one side must be configured as a Layer 2 DTE and the other as a Layer 2 DCE (you must not confuse this with the more familiar Layer 1 DCE and DTE designations).

**Control field** – it serves to identify the type of the frame. In addition, it includes sequence numbers, control features and error tracking according to the frame type.

**Modes of operation** – LAPB works in the Asynchronous Balanced Mode (ABM). This mode is balanced (i.e., no master/slave relationship) and is signified by the SABM(E)/SM frame. Each station may initialize, supervise, recover from errors, and send frames at any time. The DTE and DCE are treated as equals.

**FCS** – The Frame Check Sequence enables a high level of physical error control by allowing the integrity of the transmitted frame data to be checked.

**Window size** – LAPB supports an extended window size (modulo 128 and modulo 32768) where the maximum number of outstanding frames for acknowledgment is raised from 7 (modulo 8) to 127 (modulo 128) and 32767 (modulo 32768).<sup>[1]</sup>

## Protocol operation

LAPB has no master/slave node relationships. The sender uses the Poll bit in command frames to insist on an immediate response. In the response frame this same bit becomes the receiver's Final bit. The receiver always turns on the Final bit in its response to a command from the sender with the Poll bit set. The P/F bit is generally used when either end becomes unsure about proper frame sequencing because of a possible missing acknowledgment, and it is necessary to re-establish a point of reference. It is also used to trigger an acknowledgment of outstanding I-frames.

## Node addressing

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The following table shows which addresses are placed into the LAPB frame when issuing commands and responses from DTE to DCE and DCE to DTE using single link operation or multilink operation.<sup>[2]</sup>

Direction	Single link operation		Multilink operation	
	Command	Response	Command	Response
DTE-DCE	01 Hex (B)	03 Hex (A)	07 Hex (D)	0F Hex (C)
DCE-DTE	03 Hex (A)	01 Hex (B)	0F Hex (C)	07 Hex (D)

## Protocol commands and responses

Type	Commands	Response	Info
Supervisory	RR	RR	acknowledges the reception of a frame and indicates that the device is ready to receive the next one in the sequence
	RNR	RNR	acknowledges a received frame but it indicates that it cannot receive any more I-frames because it is still busy
	REJ	REJ	requests the retransmission of I-frames, the packet contains the error frame so that the DTE will retransmit all packets since the error frame
		SREJ	requests the retransmission of selected I-frames, the packet contains the specific frames that the DTE will retransmit (not used for modulo 8, optional for modulo 128, mandatory for modulo 32768)
Unnumbered	SABM	UA	establish the DTE to DCE link in Normal (Basic) mode (modulo 8)
	SABME	UA	establish the DTE to DCE link in Extended mode (modulo 128)
	SM	UA	establish the DTE to DCE link in Super mode (modulo 32768)
	DISC	DM	terminates the link
		FRMR	Frame Reject, which reports an error condition
Information	I		

Command frame sent with P = 1	Response frame returned with F = 1	Info
SABM, SABME, SM	UA, DM	
I-frame	RR, RNR, REJ, SREJ	
I-frame	FRMR	
RR, RNR, REJ	RR, RNR, REJ, SREJ	
FRMR	FRMR	
DISC	UA, DM	

## See also

- [ISDN](#)
- [Frame Relay](#)
- [Synchronous Data Link Control](#)

## References

1. [ITU-T Recommendation X.25 \(10/96\) \(http://www.itu.int/rec/T-REC-X.25-199610-I/en/\)](http://www.itu.int/rec/T-REC-X.25-199610-I/en/), p. 35.

2. ITU-T Recommendation X.25 (10/96) (<http://www.itu.int/rec/T-REC-X.25-199610-I/en/>), p. 23.

## External links

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- "X.25" ([https://web.archive.org/web/19991009073548/http://cisco.com/univercd/cc/td/doc/cisintwk/ito\\_doc/x25.htm](https://web.archive.org/web/19991009073548/http://cisco.com/univercd/cc/td/doc/cisintwk/ito_doc/x25.htm)). *cisco.com*. Archived from the original ([http://cisco.com/univercd/cc/td/doc/cisintwk/ito\\_doc/x25.htm](http://cisco.com/univercd/cc/td/doc/cisintwk/ito_doc/x25.htm)) on 9 October 1999.
  - "HDLC - High Level Data Link Control" (<https://web.archive.org/web/20060408153932/http://www2.rad.com/networks/1994/hdlc/hdlc.htm>). Archived from the original (<https://www2.rad.com/networks/1994/hdlc/hdlc.htm>) on 8 April 2006.
  - ITU-T Recommendation X.25 (<http://www.itu.int/rec/T-REC-X.25/en/>)
  - ITU-T Recommendation X.222 (<http://www.itu.int/rec/T-REC-X.222/en/>)
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