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Practica 1

Control de enlace lógico.

Control de enlace lógico LLC ("Logical Link Control") define la forma en que los [datos](https://es.wikipedia.org/wiki/Dato) son transferidos sobre el medio físico, proporcionando servicio a las capas superiores.

Es la más alta de [las dos subcapas de enlace de datos](https://es.wikipedia.org/wiki/Capa_de_enlace_de_datos) definidas por el [IEEE](https://es.wikipedia.org/wiki/IEEE) y la responsable del control de enlace lógico. La subcapa LLC maneja el control de errores, control del flujo, entramado, control de diálogo y direccionamiento de la subcapa [MAC](https://es.wikipedia.org/wiki/Control_de_Acceso_al_Medio). El protocolo LLC más generalizado es [IEEE 802.2](https://es.wikipedia.org/wiki/IEEE_802.2), que incluye variantes no orientado a conexión y orientadas a conexión.

En la subcapa LLC se contemplan dos aspectos bien diferenciados:

Los protocolos

* Los protocolos LLC: Para la comunicación entre entidades de la propia subcapa LLC, definen los procedimientos para el intercambio de tramas de información y de control entre cualquier par de puntos de acceso al servicio del nivel de enlace LSAP.

Las interfaces

* Las interfaces: con la subcapa inferior [MAC](https://es.wikipedia.org/wiki/Control_de_Acceso_al_Medio) y con la capa superior ([de Red](https://es.wikipedia.org/wiki/Nivel_de_red)).
* Interfaz LLC – [MAC](https://es.wikipedia.org/wiki/Control_de_Acceso_al_Medio): Especifica los servicios que la subcapa de LLC requiere de la subcapa [MAC](https://es.wikipedia.org/wiki/Control_de_Acceso_al_Medio), independientemente de la topología de la subred y del tipo de acceso al medio.
* Interfaz LLC – Capa de Red [Modelo OSI](https://es.wikipedia.org/wiki/Modelo_OSI): Especifica los servicios que la Capa de Red [Modelo OSI](https://es.wikipedia.org/wiki/Modelo_OSI) obtiene de la Capa de Enlace [Modelo OSI](https://es.wikipedia.org/wiki/Modelo_OSI), independientemente de su configuración.

#### Servicio en modo conexión (CONS, Connection Oriented Network Service)

Es un servicio que establece una conexión entre las estaciones del [enlace](https://es.wikipedia.org/wiki/Enlace), y que garantiza la entrega de las unidades de datos que fluyen a través de dicha conexión ( [servicio confiable](https://es.wikipedia.org/w/index.php?title=Servicio_confiable&action=edit&redlink=1) ). El servicio de conexión le garantiza al receptor la entrega en secuencia de las unidades de datos y la protección contra pérdidas y duplicados. Con ese fin dispone de los mecanismos necesarios para controlar el [flujo](https://es.wikipedia.org/wiki/Flujo) y corregir los errores.

#### Servicio no orientado a conexión ([CLNS](https://es.wikipedia.org/wiki/CLNS), Connection Less Network Service)

No establece una conexión previa entre las estaciones, por lo que cada trama intercambiada es independiente de todas las demás ( de las enviadas antes y después). Cada trama es individualmente autónoma y autosuficiente ante el receptor. Es un servicio que tiene utilidad cuando el establecimiento de una conexión implica retrasos que son inaceptables para el funcionamiento del sistema ( control distribuido ). El servicio de enlace sin conexión puede ser con o sin confirmación.

En resumen, las funciones de esta subcapa son:

* Agrupar los [bits](https://es.wikipedia.org/wiki/Bit) a transmitir en forma de tramas (enmarcar)
* Se ocupa de los errores de transmisión
* Regula el [flujo](https://es.wikipedia.org/wiki/Flujo) de las tramas (control de flujo)
* Administra la capa de enlaces (gestión)
* Traduce las tramas de las redes heterogéneas

Y los Servicios que ofrece:

* Sin conexión y sin reconocimiento
* Sin conexión y con reconocimiento
* Orientado a la conexión.

Formato de trama LLC (control de Enlace Lógico)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| DSAP  (1byte) | | SSAP  (1 byte) | | Control  (1 – 2 bytes) | Datos  (variable) |
| Dir. Destino  7 bits | I/R | Dir. Origen  7 bits | C/R |

Trama IEEE802.3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| MAC0  6bytes | MAC0  6 bytes | Longitud  2 bytes | LLC  3-4 bytes | Datos  Variable | CRC  9bytes |

Longitud/tipo 0 => 1500 => IEEE802.3 > 1500 => ETHERNET

Control

**Tramas I**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 0 |  |  |  | P/F |  |  |  |

**Trama S**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 |  |  | P/F |  |  |  |

00 = RR (Listo para recibir)

01 = REJ (Rechazo)

10 = RNR (No listo para recibir)

11 = SREJ (Rechazo Selectivo)

Código –

Trama S

**Trama U**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 |  |  | P/F |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | COMANDO | RESPUESTA |
| 00 | 001 | SNRM | - |
| 11 | 011 | SNRME | - |
| 11 | 000 | SARM | DM |
| 11 | 010 | SARME | - |
| 11 | 100 | SABM | - |
| 11 | 110 | SABME | - |
| 00 | 000 | UI | UI |
| 00 | 110 | - | UA |
| 00 | 010 | DISC | RD |
| 11 | 001 | RSET | - |
| 11 | 101 | XID | XID |

Código –

Trama U

SNRM = modo de tespuesta normal

SARM = Modo de respuesta asincrónico

SABM = Modo de respuesta asíncrono balanceado

UI = Informacion sin Numerar

UA = Ack sin numerar

XID = intercambio de ID

RSET = Reinicio

RD = Peticion de desconexión

DM = Modo de Desconexion

1

00 02 b3 9c ae ba 00 02 b3 9c df 1b 00 03 f0 f0 7f 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 43 05 90 6d

2

00 02 b3 9c df 1b 00 02 b3 9c ae ba 00 03 f0 f1 73 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 54 90 6d

3

00 02 b3 9c ae ba 00 02 b3 9c df 1b 00 04 f0 f0 01 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 41 a3 90 6d

4

00 02 b3 9c df 1b 00 02 b3 9c ae ba 00 04 f0 f1 01 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 f2 90 6d

5

00 02 b3 9c ae ba 00 02 b3 9c df 1b 00 12 f0 f0 00 01 0e 00 ff ef 19 8f bc 05 7f 00 23 00 7f 23 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 41 91 6d

6

00 02 b3 9c df 1b 00 02 b3 9c ae ba 00 12 f0 f0 00 03 0e 00 ff ef 17 81 bc 05 23 00 7f 00 23 7f 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 90 91 6d

7

00 02 b3 9c df 1b 00 02 b3 9c ae ba 00 04 f0 f1 01 03 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 df 91 6d

8

00 02 b3 9c ae ba 00 02 b3 9c df 1b 00 04 f0 f1 01 03 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 18 ac 92 6d

9

00 02 b3 9c ae ba 00 02 b3 9c df 1b 00 ac f0 f0 02 02 0e 00 ff ef 16 04 00 00 00 00 28 00 7f 23 ff 53 4d 42 72 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 82 09 00 77 00 02 50 43 20 4e 45 54 57 4f 52 4b 20 50 52 4f 47 52 41 4d 20 31 2e 30 00 02 4d 49 43 52 4f 53 4f 46 54 20 4e 45 54 57 4f 52 4b 53 20 33 2e 30 00 02 44 4f 53 20 4c 4d 31 2e 32 58 30 30 32 00 02 44 4f 53 20 4c 41 4e 4d 41 4e 32 2e 31 00 02 57 69 6e 64 6f 77 73 20 66 6f 72 20 57 6f 72 6b 67 72 6f 75 70 73 20 33 2e 31 61 00 02 4e 54 20 4c 4d 20 30 2e 31 32 00 00 fb 92 6d 86 df

10

00 02 b3 9c df 1b 00 02 b3 9c ae ba 00 04 f0 f1 01 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 7b 93 6d

11

00 02 b3 9c df 1b 00 02 b3 9c ae ba 00 5f f0 f0 02 04 0e 00 ff ef 16 0c 00 00 28 00 28 00 23 7f ff 53 4d 42 72 00 00 00 00 80 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 82 09 11 05 00 02 02 00 01 00 68 0b 00 00 00 00 01 00 7f 07 00 80 03 02 00 00 00 e5 fe 29 25 7c c2 01 2c 01 08 08 00 7f 07 00 80 32 3e b9 3d 00 ca 93

12

00 02 b3 9c ae ba 00 02 b3 9c df 1b 00 04 f0 f1 01 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 7c 94 6d

13

00 02 b3 9c ae ba 00 02 b3 9c df 1b 00 91 f0 f0 04 04 0e 00 ff ef 16 0c 00 00 28 00 28 00 7f 23 ff 53 4d 42 73 00 00 00 00 10 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 82 09 0d 75 00 5d 00 68 0b 02 00 00 00 7f 07 00 80 00 00 00 00 00 00 00 00 01 00 00 00 20 00 00 00 45 53 43 4f 4d 00 57 69 6e 64 6f 77 73 20 34 2e 30 00 57 69 6e 64 6f 77 73 20 34 2e 30 00 04 ff 00 00 00 02 00 02 00 17 00 20 00 5c 5c 50 52 4f 47 59 44 45 53 41 5c 49 50 43 24 00 49 50 43 00 00

14

00 02 b3 9c df 1b 00 02 b3 9c ae ba 00 04 f0 f1 01 06 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 32 95 6d

15

00 02 b3 9c df 1b 00 02 b3 9c ae ba 00 46 f0 f0 04 06 0e 00 ff ef 16 0c 00 00 28 00 28 00 23 7f ff 53 4d 42 73 00 00 00 00 90 00 00 00 00 00 00 00 00 00 00 00 00 00 00 03 c0 00 00 00 00 82 09 03 75 00 29 00 00 00 00 00 02 ff 00 00 00 04 00 49 50 43 00 00 81 95 6d 86 cb 94 6d 86 0d 09 0e

16

00 02 b3 9c ae ba 00 02 b3 9c df 1b 00 04 f0 f1 01 06 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 20 96 6d

17

00 02 b3 9c ae ba 00 02 b3 9c df 1b 00 7e f0 f0 06 06 0e 00 ff ef 16 0c 00 00 28 00 28 00 7f 23 ff 53 4d 42 25 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 03 c0 00 00 00 00 82 0a 0e 20 00 00 00 08 00 00 10 00 00 00 00 88 13 00 00 00 00 20 00 4c 00 00 00 00 00 00 00 2d 00 5c 50 49 50 45 5c 4c 41 4e 4d 41 4e 00 68 00 57 72 4c 65 68 44 7a 00 42 31 36 42 42 44 7a 00 01 00 00 10 ff ff ff ff 45 53 43 4f 4d 00 00 6f 96 6d

18

00 02 b3 9c df 1b 00 02 b3 9c ae ba 00 04 f0 f1 01 08 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 be 96 6d

19

00 02 b3 9c ae ba 00 02 b3 9c df 1b 00 04 f0 f1 01 08 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 5d 97 6d

20

00 02 b3 9c ae ba 00 02 b3 9c df 1b 00 7e f0 f0 08 08 0e 00 ff ef 16 0c 00 00 28 00 28 00 7f 23 ff 53 4d 42 25 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 03 c0 00 00 00 00 02 0b 0e 20 00 00 00 08 00 00 10 00 00 00 00 88 13 00 00 00 00 20 00 4c 00 00 00 00 00 00 00 2d 00 5c 50 49 50 45 5c 4c 41 4e 4d 41 4e 00 68 00 57 72 4c 65 68 44 7a 00 42 31 36 42 42 44 7a 00 01 00 00 10 00 00 00 80 45 53 43 4f 4d 00 00 ac 97 6d

21

00 02 b3 9c df 1b 00 02 b3 9c ae ba 00 04 f0 f1 01 0a 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 fb 97 6d

22

00 02 b3 9c ae ba 00 02 b3 9c df 1b 00 04 f0 f1 01 0a 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 4a 98 6d

23

00 02 b3 9c ae ba 00 02 b3 9c df 1b 00 12 f0 f0 0a 0b 0e 00 ff ef 14 00 00 00 28 00 00 00 7f 23 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 99 98 6d

24

00 02 b3 9c df 1b 00 02 b3 9c ae ba 00 04 f0 f1 01 0d 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 45 99 6d

25

03 00 00 00 00 01 00 04 ac 44 4d 02 00 8b f0 f0 03 2c 00 ff ef 08 00 00 00 00 00 00 00 42 34 20 20 20 20 20 20 20 20 20 20 20 20 20 1b 49 42 4d 53 45 52 56 45 52 20 20 20 20 20 20 00 ff 53 4d 42 25 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 11 00 00 06 00 00 00 00 00 00 00 00 00 e8 03 00 00 00 00 00 00 00 00 06 00 56 00 03 00 01 00 01 00 02 00 17 00 5c 4d 41 49 4c 53 4c 4f 54 5c 42 52 4f 57 53 45 00 09 04 33 17 00 00 00 9b 99 6d 86 99 98