8va Clase 12/5/2022

75.43 Introducción a los Sistemas Distribuidos
73.33 Redes y Teleprocesamientos I
95.60 Redes y Aplicaciones Distribuidas

Tema: Capa de Red (IV)

Capítulo 5: desde el apartado *5.4 Routing Among the ISPs: BGP* hasta el final del mismo, del libro *Computer Networking : A Top-Down Approach with Access . James Kurose and Keith Ross. Publisher: Pearson Edition: 7th, 2016.*

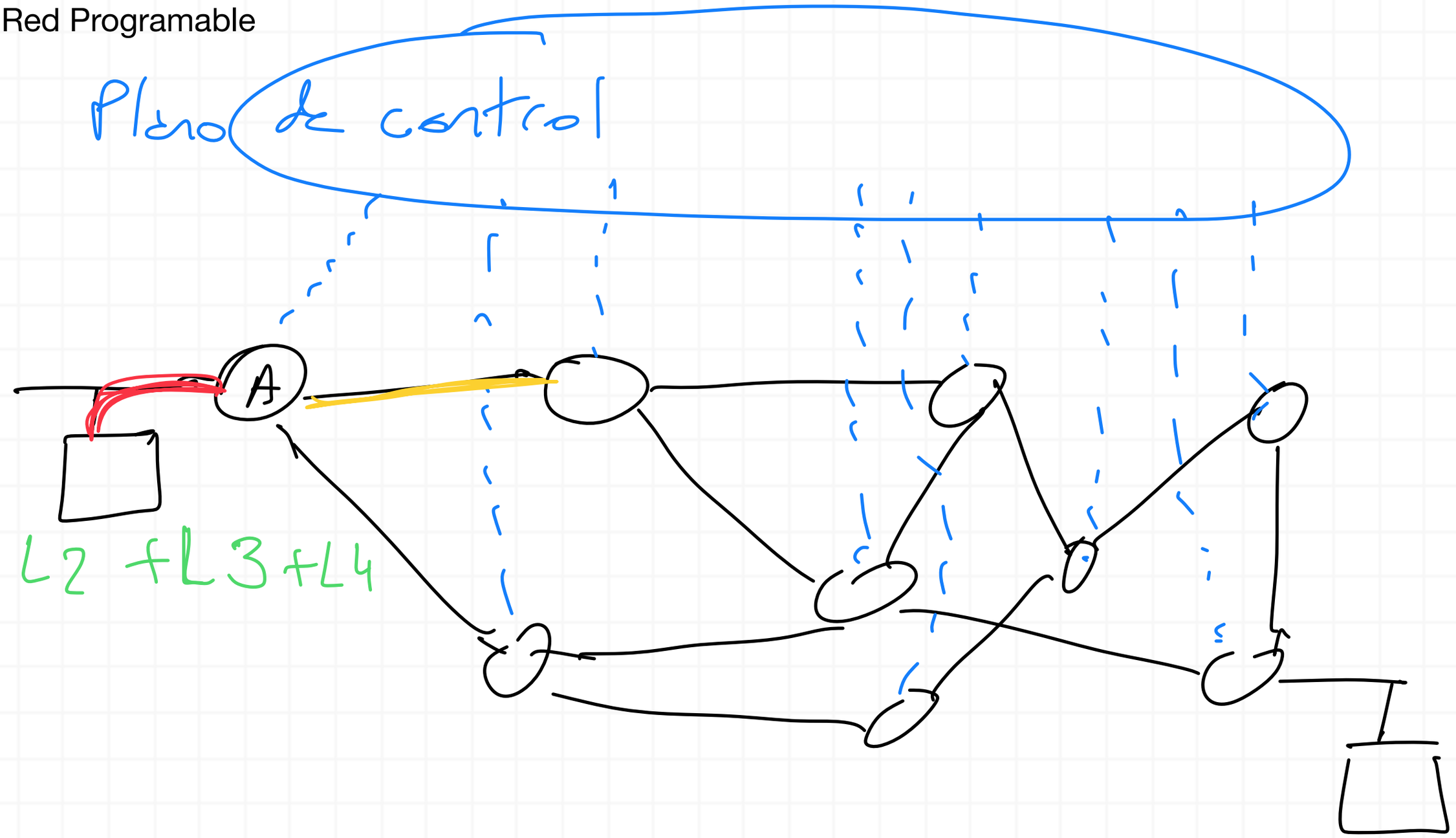
Dr. Ing. J. Ignacio Alvarez-Hamelin

Clase de hoy

- *SDN Control Plane*
- BGP (*Border Gateway Protocol*)
- ICMP (*Internet Control Message Protocol*)

SDN (*Software Defined Networks*), Plano de Control

- Reenvío basado en flujos
- Separación del plano de datos y de control
- Control de Red: externo a los conmutadores
- Red Programable



NAT Routing Access Control Firewall

Norte

App. SDN

SDN Controlador

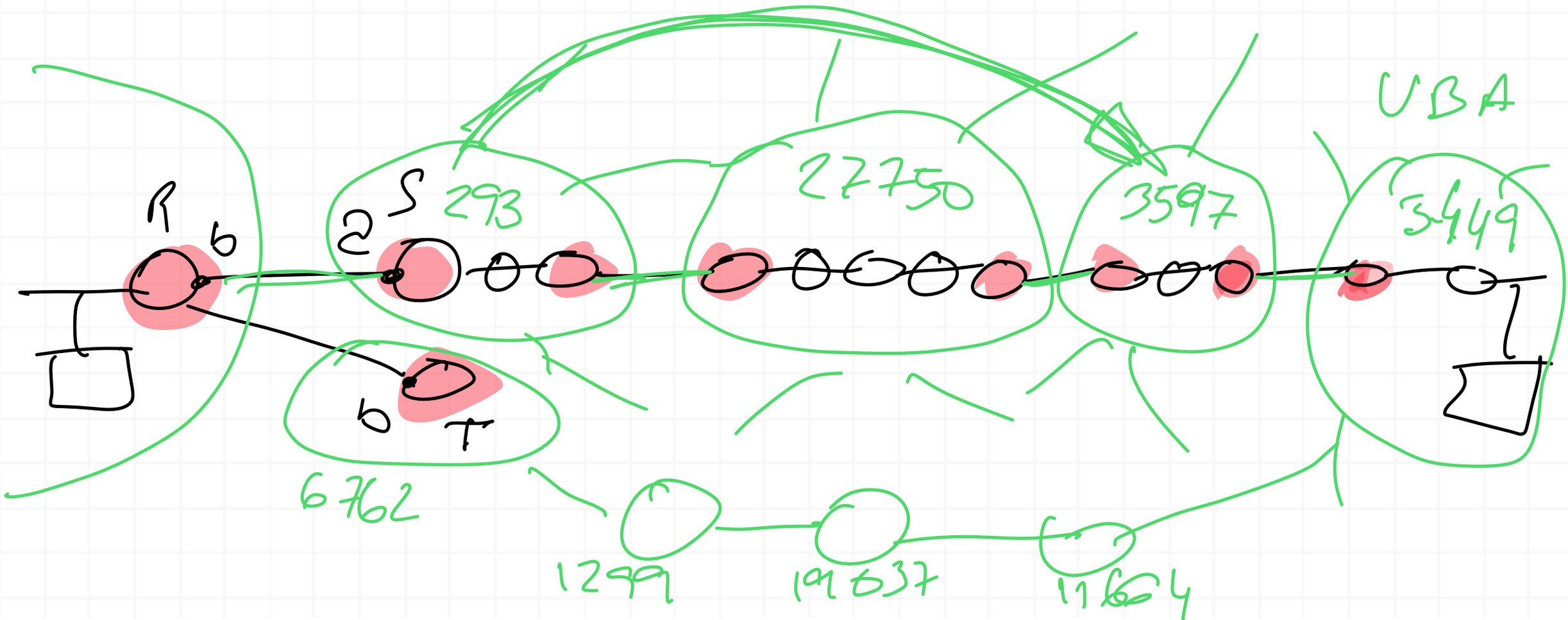
Comunicación

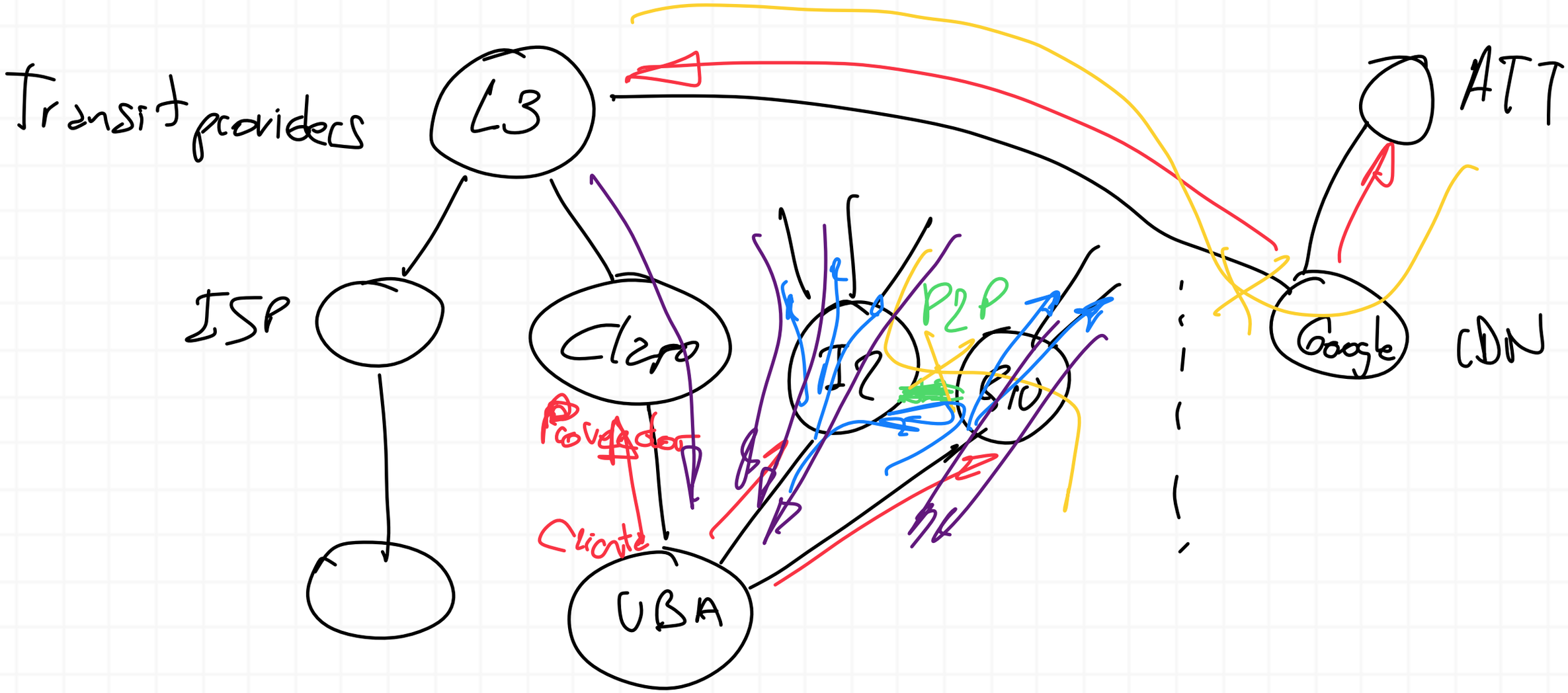
Sur

BGP (Border Gateway Protocol)

- **Uso y aplicación**
- **Funcionamiento**
- **Implementación de Políticas**

Red Destino	Next hop	AS-path	L.P
* 157.92.0.0/16	S.2	293, 27750, 3597, 3449	
157.92.0.0/16	T.b	6762, 1299, 19037, 11664, 3449	

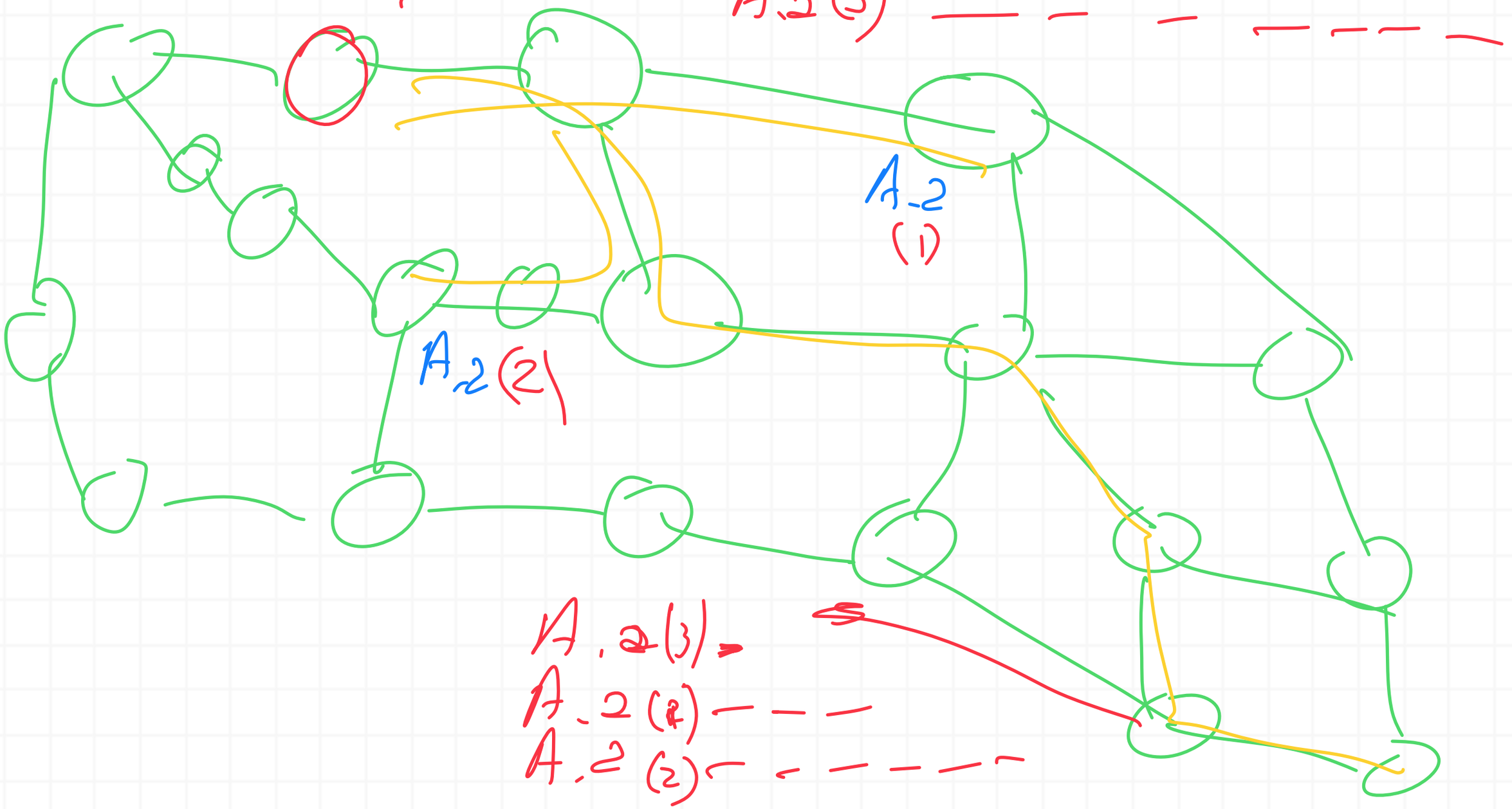



Transit providers
L3
ATT
ISP
Claro
I2
P2P
Google
CDN
Proveedor
Cliente
UBA

Anicast

As_path

A.2(1) — —
A.2(2) — — —
A.2(3) — — — — — — —



Mutually Agreed Norms for Routing Security

https://www.manrs.org/isps/guide/

1. Filtering – Preventing propagation of incorrect routing information.
    - Network operator defines a clear routing policy and implements a system that ensures correctness of their own announcements and announcements from their customers to adjacent networks with prefix and AS-path granularity.
    - Network operator is able to communicate to their adjacent networks which announcements are correct.
    - Network operator applies due diligence when checking the correctness of their customer's announcements, specifically that the customer legitimately holds the ASN and the address space it announces.
2. Anti-Spoofing – Preventing traffic with spoofed source IP addresses.
    - Network operator implements a system that enables source address validation for at least single-homed stub customer networks, their own end-users and infrastructure. Network operator implements anti-spoofing filtering to prevent packets with an incorrect source IP address from entering and leaving the network.
3. Coordination – Facilitating global operational communication and coordination between network operators.
    - Network operator maintains globally accessible up-to-date contact information.
4. Global Validation – Facilitating validation of routing information on a global scale.
    - Network operator has publicly documented routing policy, ASNs and prefixes that are intended to be advertised to external parties.

ICMP

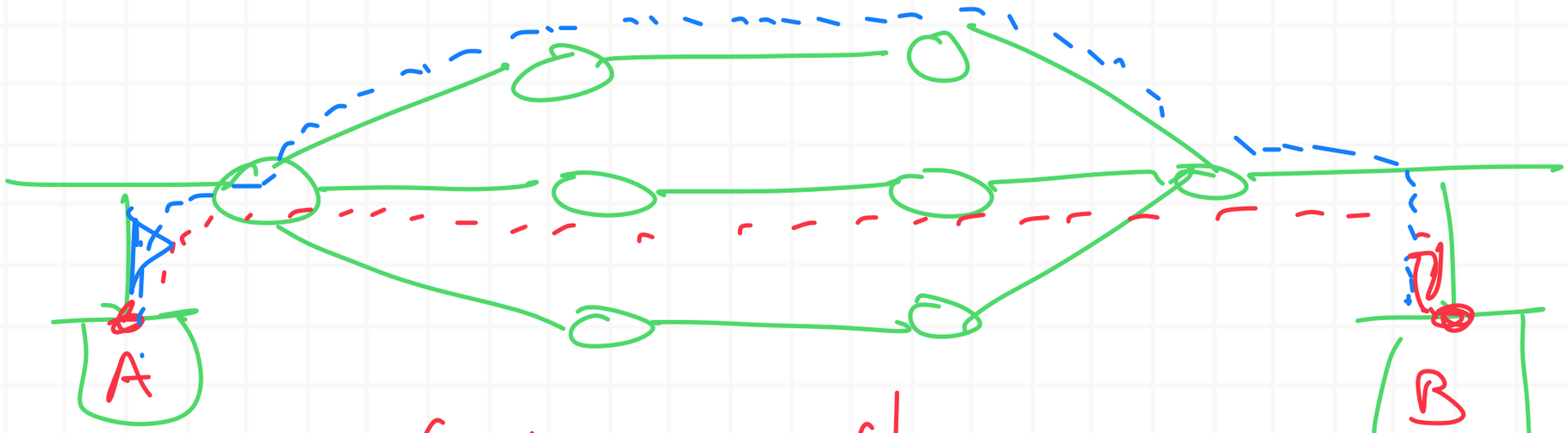
- Utilidad
- IPv4: **RFC 792**
- IPv6: **RFC 4443**

Información

- Echo
  - Request
  - Reply
- Network information
- Source quench
- Redirect

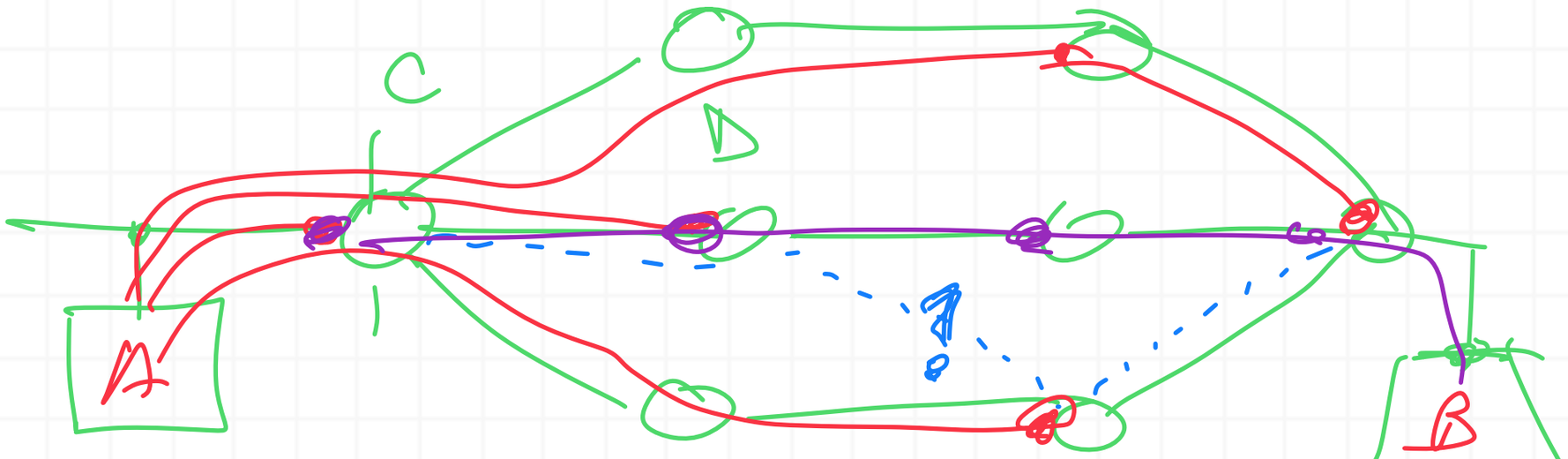
Errores

- Destination Unreachable
  - IPv6 Packet too Big
  - IPv4 Fragment needed but DF=1
- Packet corruption
- Time exceeded
  - transit
  - Reasembling
- Parameter problem



$ ping B (echo request)

(echo reply)



$ traceroute B

Peris_traceroute

Análisis de ICMP y *traceroute* en Wireshark

Tarea no obligatoria:

Realizar un captura con el Wireshark de traceroute (si pueden en IPv6) con las opciones TCP y luego con UDP e ICMP, y realizar un informe en PDF.

Lectura para la próxima clase:
Del inicio del **Capítulo 6, hasta *6.3 Multiple Access Links and Protocols* inclusive.**