


A background network diagram featuring a complex web of nodes and connections. Nodes are represented by circles of varying sizes and colors, including light gray, dark gray, and blue. Some nodes are highlighted with a blue outline. The connections are thin gray lines, some solid and some dashed, forming a dense, interconnected mesh.

Network Layer

Routing among AS - EGP

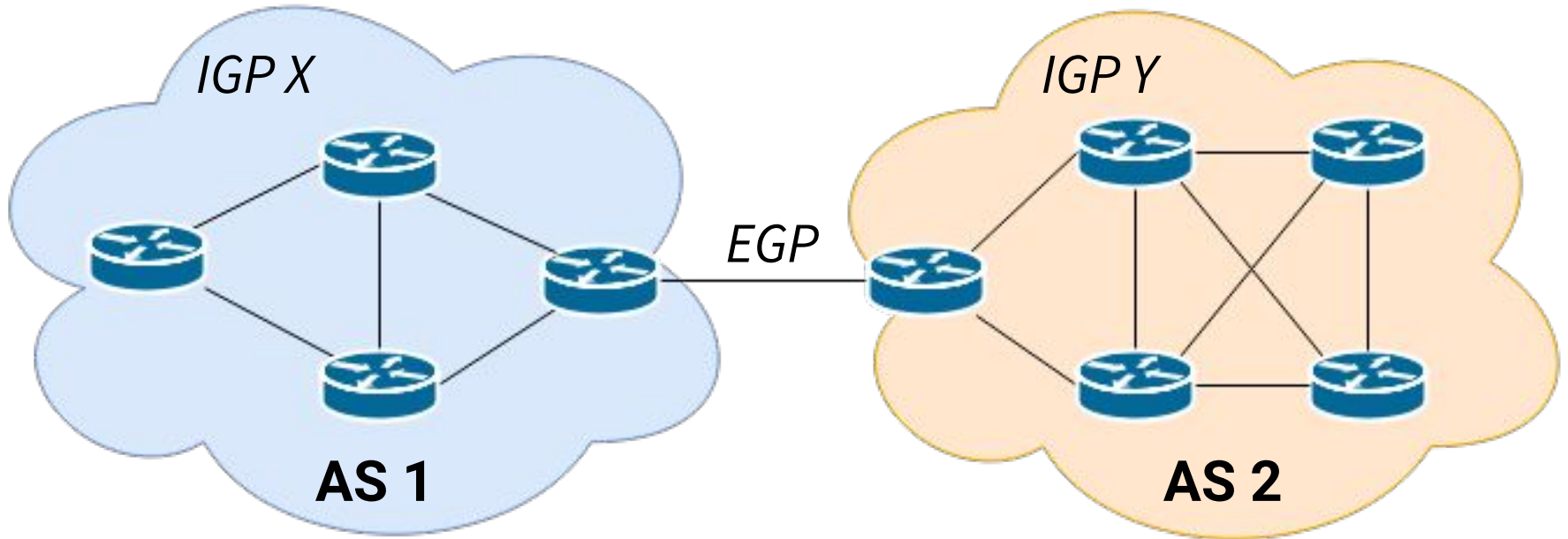
A decorative network diagram in the top-left corner, featuring a complex web of interconnected nodes and lines. The nodes are represented by circles of varying sizes, some with concentric rings, and the lines are thin and grey. The diagram is partially cut off by the left edge of the slide.

Contents !

- How AS are connected ?
 - External routing. BGP
 - Lab! BGP with Docker and Quagga
- 
- A decorative network diagram in the bottom-right corner, similar to the one in the top-left. It shows a complex web of interconnected nodes and lines, with nodes represented by circles of varying sizes and lines as thin grey connections. The diagram is partially cut off by the bottom and right edges of the slide.

What is an Autonomous System(AS) ?

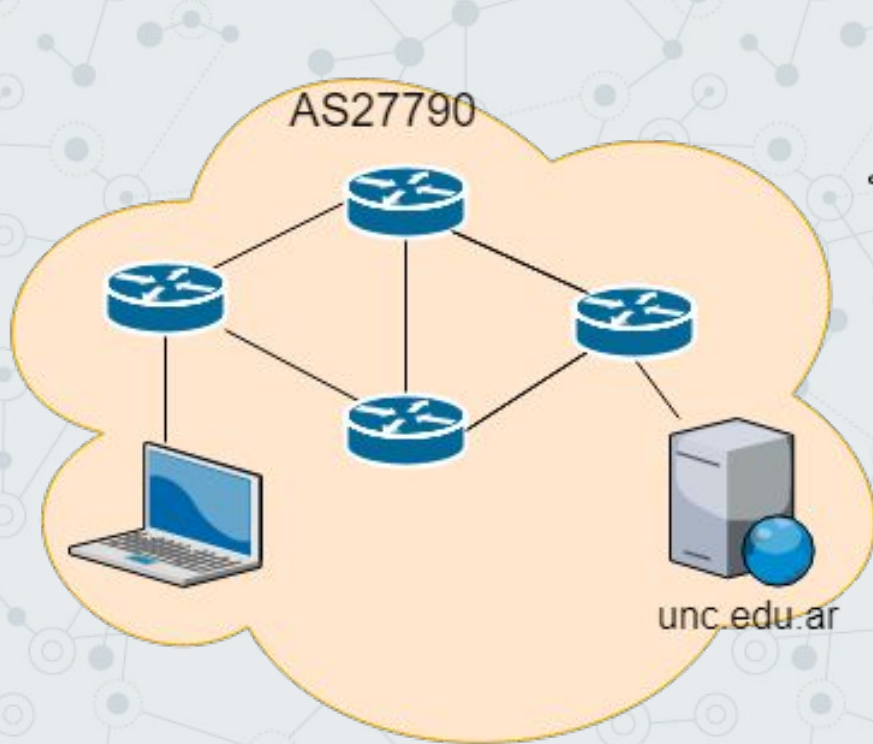
One or more IP networks controlled by one or more operators with a **clear policy that governs how routing decisions are made.**



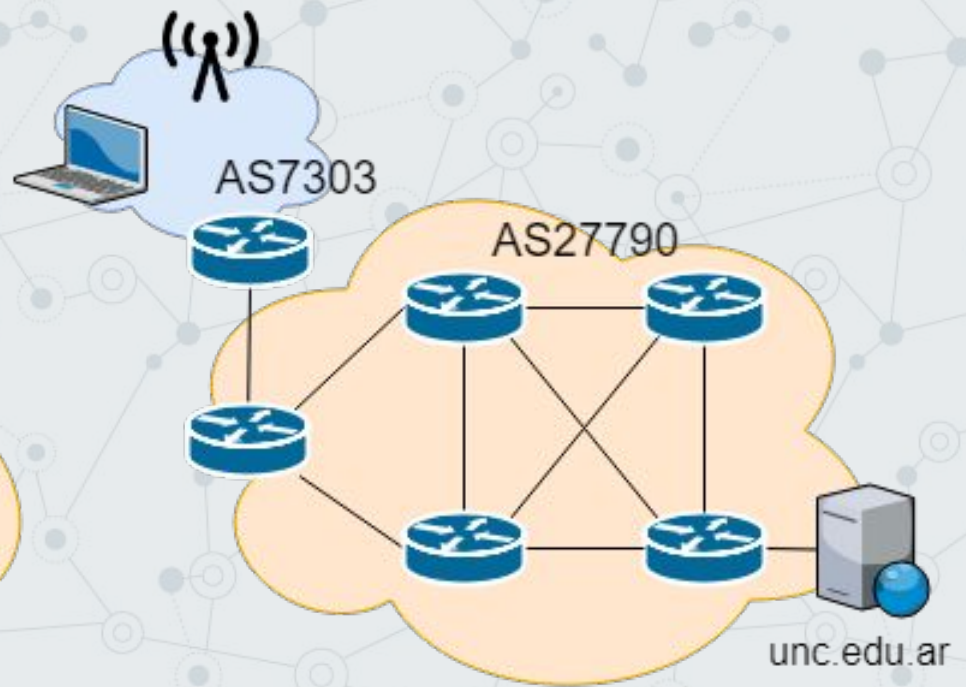
IGP: Interior gateway protocol

EGP: Exterior gateway protocol

EGP in action

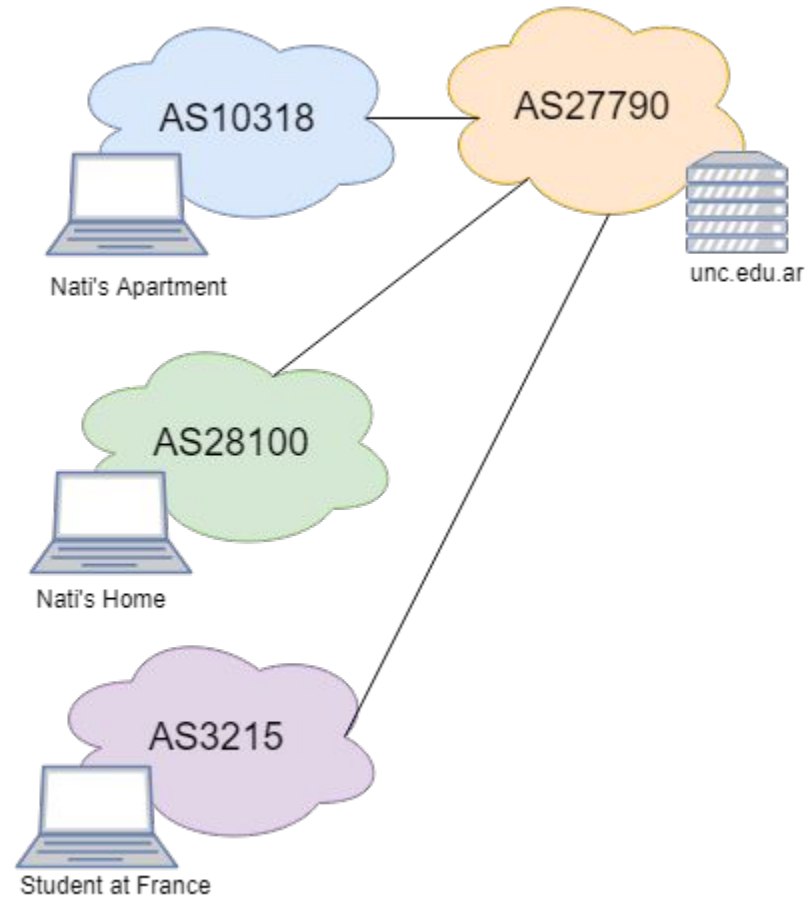


```
traceroute unc.edu.ar
```



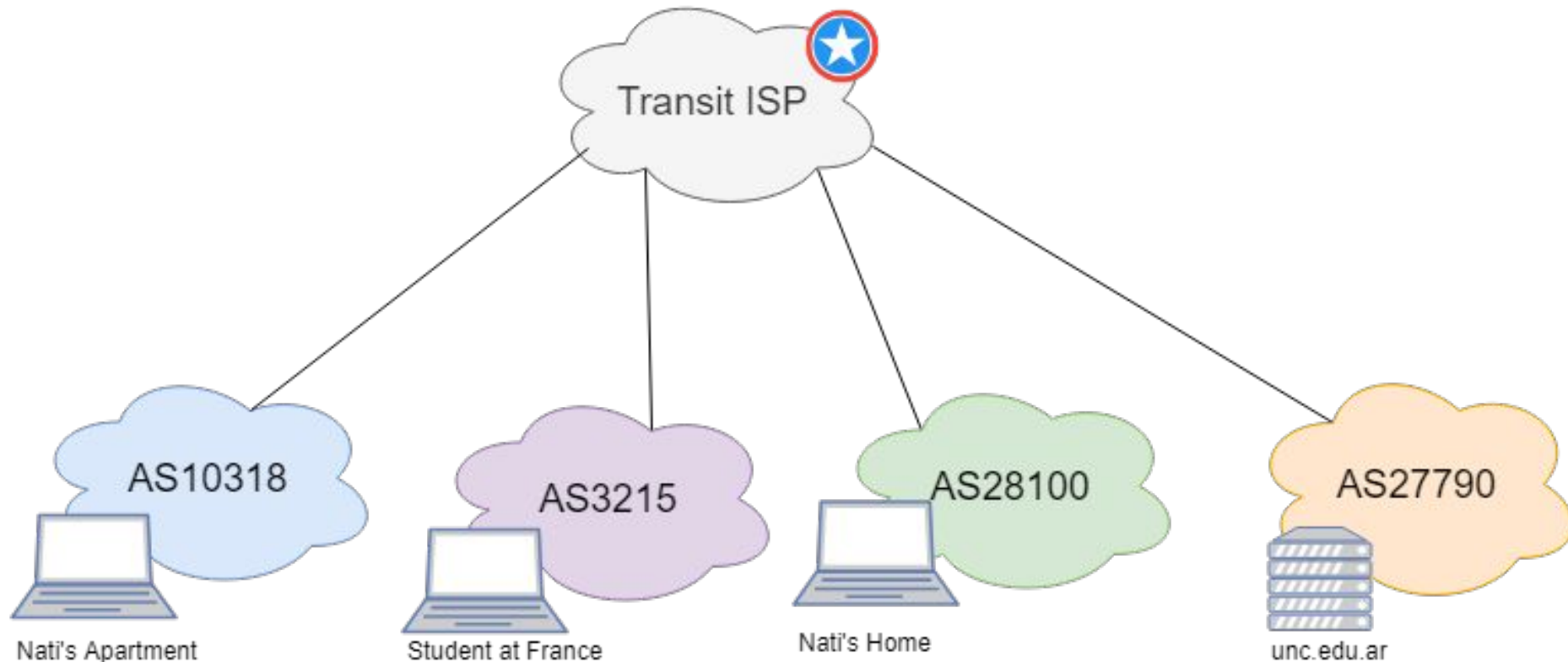
```
traceroute unc.edu.ar
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How AS are connected ?



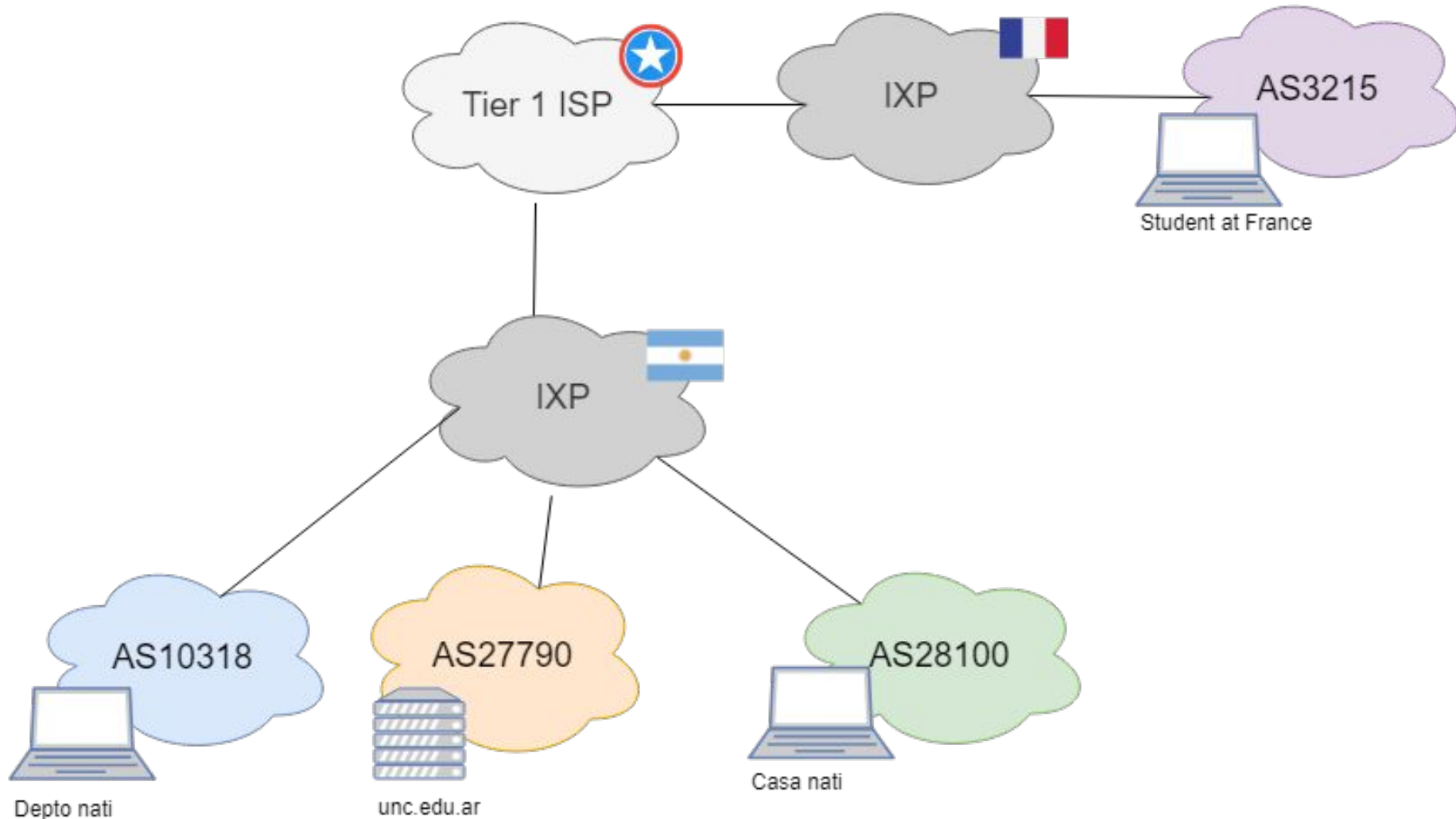
UNC AS would need to peer every network in the world.

How AS are connected ?



- **Transit ISP** would need to have a huge infrastructure and a lot of network resources.
- A message from **Nati's home** to **unc.edu.ar** would travel to USA and back to Argentina !

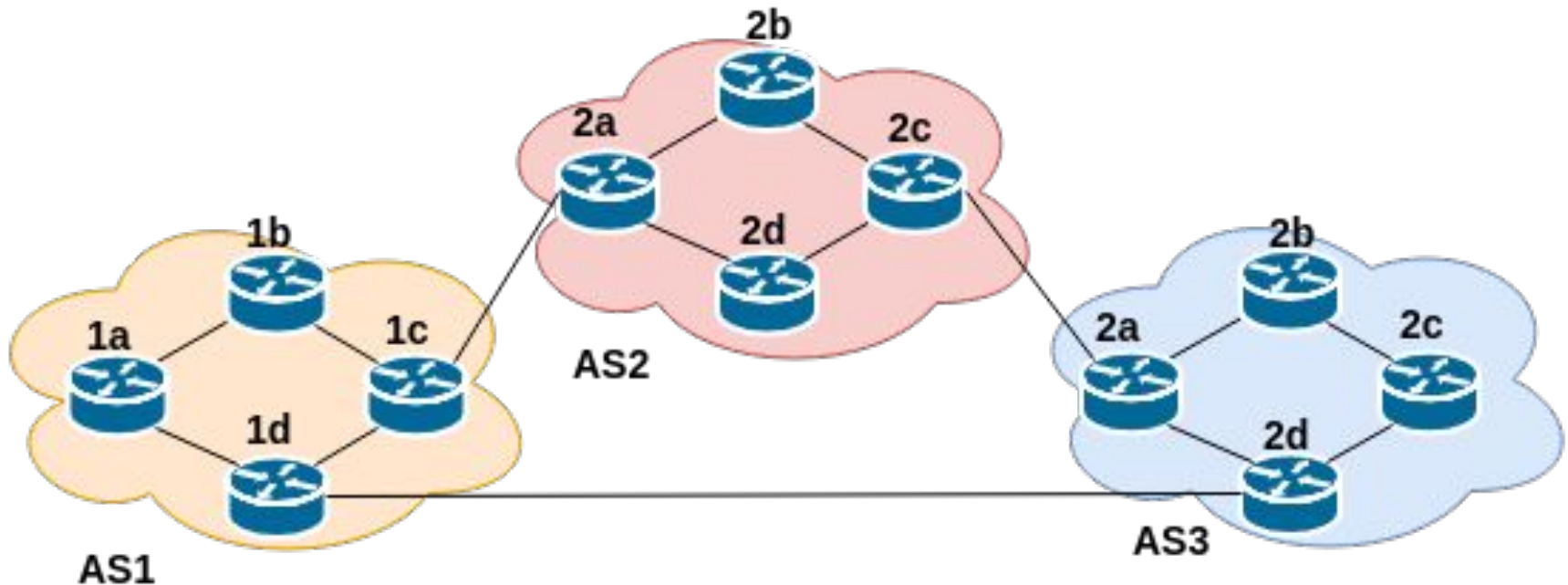
How AS are connected ?



<https://www.cabase.org.ar/wp-content/uploads/2018/07/Poster-Cabase-2018-FINAL-web.gif>

BGP - Border Gateway Protocol

- Establish TCP connection between peers
- Each peer sends positive or negative reachability information
- Ongoing peer verification



AS PATH: contains the list of ASs through which the route advertisement has passed.

NEXT HOP: the IP address of the router interface that begins the AS-PATH

BGP - Border Gateway Protocol

Route Selection Algorithm

- 1.** Highest local preference value
- 2.** The shortest AS PATH
- 3.** The closest NEXT HOP router (*hot potato algorithm*)
- 4.** Use BGP route identifiers



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Lab!

1. Environment Setup - IPv4 and IPv6
 2. Editing the infrastructure
- 
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BGP Environment Setup



Goals:

- Identify the topology in docker-compose file.
- Read quagga bgp configuration files
- Read IPv6 routing tables

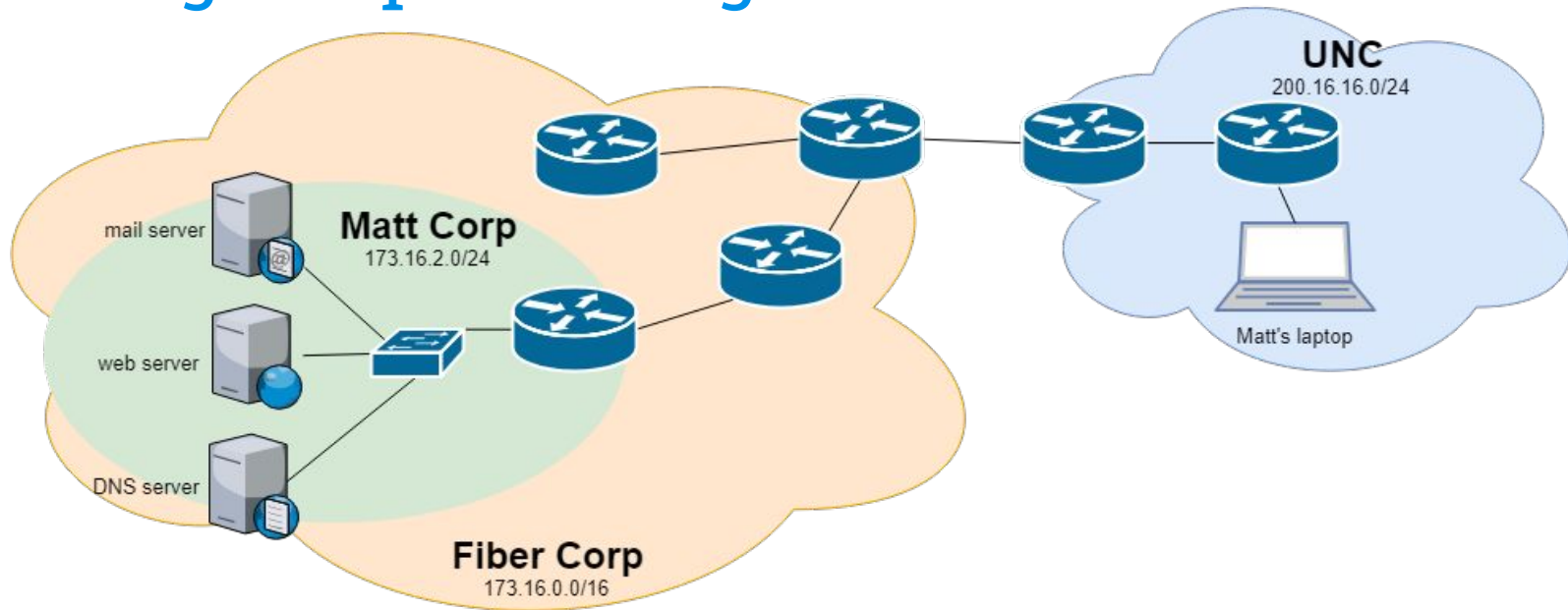
Steps:

- Clone the repository. (https://github.com/maticue/docker_quagga.git)
- Go to **bgp** folder. Run **docker-compose up**
- Verify docker port mapping in order to access the daemons via telnet

Useful commands:

- telnet localhost <daemon_port>
- docker exec -ti <container_name> ash

Putting the pieces together



Goals:

- Add a web server and a client to the previous lab's topo.
- Test connectivity between client and server.

Steps:

- Add a web server to router r1.
- Add a client to router r2.
- Generate a http request from the client to the server.

Resources

- https://www.juniper.net/documentation/en_US/junos/topics/concept/ospf-routing-designated-router-overview.html
- <https://learningnetwork.cisco.com/blogs/vip-perspectives/2017/11/08/ospf-graphs-lsas-and-the-lsdb>
- <https://docs.cumulusnetworks.com/display/CL332/Configuring+Quagga>
- Configuring FRRouting (Similar to quagga):
<http://docs.frrouting.org/en/latest/index.html>