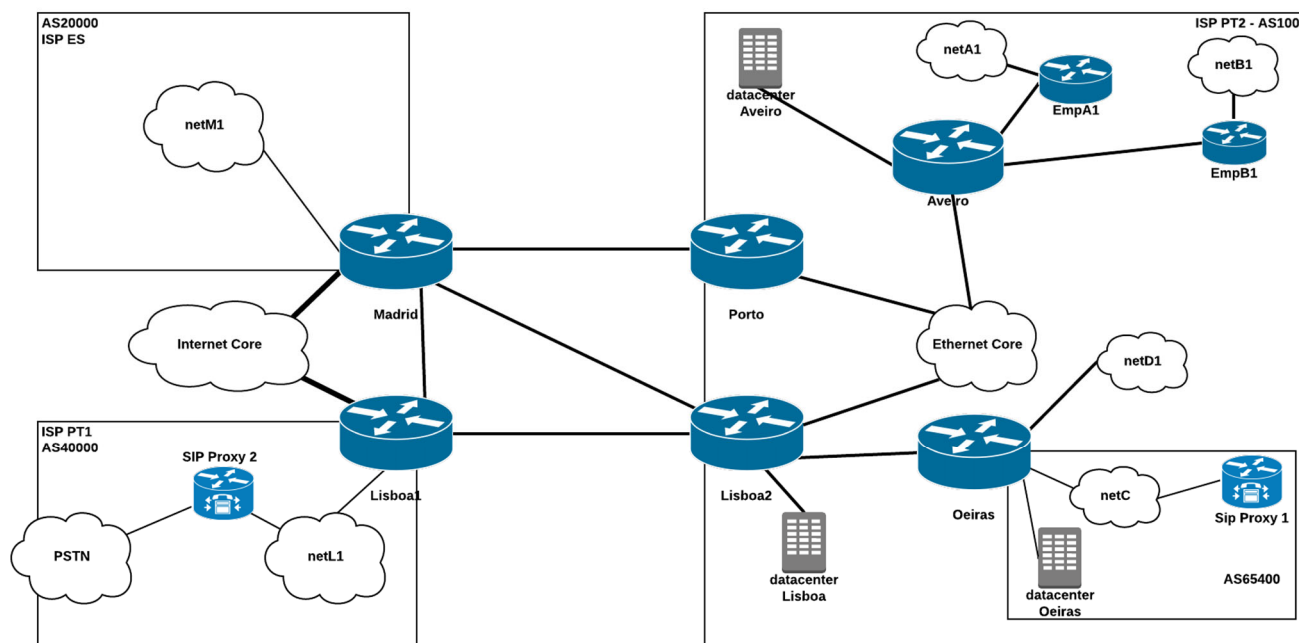# Arquitetura de Redes Avançadas
Project Extra Season 2018/19

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⚑ **The project must be deployed and tested using GNS3.**

⚑ **All engineering choices must have a valid justification. A report providing these justifications is required to be delivered at the work presentation time (and not after!).**

Scenario description:

- Assume that you are the engineer responsible for ISP PT2 (AS1000) depicted above. All other ISPs are configured with default/minimal BGP configurations.
- AS1000 has two peering relations with ISP PT1 (AS40000) via Lisboa2 and one peering relation via Porto with ISP ES (AS20000)
- ISP PT2 has two corporate clients (A, B), to which provides IP inter-connectivity and a VoIP service with PSTN inter-connectivity (using partner C SIP Proxy).
- Corporate clients A and B have two branches, one in Aveiro and another in Oeiras via netD1.
- Corporate partner C, has a single location in Oeiras, however is a private BGP autonomous system (AS 65400)
- ISPs and Corporate clients have the following IPv4 (and IPv6 IP networks, see below):

ISP PT2 - core, netD1 and internal point-to-point links	192.168.1.0/24 10.0.0.0/16	4001:100:1::/48
Corporate client A	110.1.1.0/24	3001:110::/48
Corporate client B	111.1.1.0/24	3001:111::/48
Corporate client C	112.1.1.0/24	3001:112::/48
ISP PT2 Datacenters	10.2.0.0/16	3001:10:2::/48
ISP ES - netM1	190.100.1.0/24	4201:200:100::/48
ISP ES - netM2	190.200.1.0/24	4201:200:200::/48
ISP PT1 - netL1	65.0.1.0/24	4301:65:0:/48
External BGP peering links	5.4.4.0/26	5001:4:4::/60

- ISP PT2 has three independent datacenters in Lisboa, Oeiras and Aveiro.
- Both ISP PT1 and ISP ES provide IP interconnection to the Internet Core.

- ISP PT2 is transit AS.
- ISP PT1 provides PSTN interconnection through SIP Proxy 2.

Deployment requirements:

Basic mechanisms and BGP (4 points)

- Provide full IPv4 and IPv6 between ISP PT2 clients and Internet Core, according to scenario constrains (above) and ISP networking good practices.
- Implement the following MP-BGP routing constrains (within ISP PT2):
    - IP traffic towards Internet should be always routed via ISP PT1.
    - IP traffic towards all AS20000 networks, should be preferably routed via Porto from Aveiro, and via Lisboa from Oeiras.
    - IP traffic for remote SIP proxy 2 (to network netL1) must be routed via Porto using the direct peering link to ISP ES.
    - Packets from AS65000 should be routed to the Internet as generic, but should be routed via Lisbon2 to reach netM1
    Note: You must assume that (i) ISPs PT1 and ES receive multiple network prefixes from the Internet Core, and (ii) those prefixes are sent to all its BGP peers.

MPLS (5 points)

- External AS transit traffic should be routed (between Lisboa2 and Porto) over a MPLS tunnel, with reserved bandwidth of 30Mbps.
- Deploy a MPLS VPN for Corporate client A (interconnecting Aveiro and Oeiras branches),and test this with proper packtet tracing.

CDN (3 points)

- Deploy a CDN routing service (Conditional DNS) for corporate clients. The service DNS server is located in the Aveiro Datacenter, and must be able to redirect clients to the closest Datacenter according to their location, i.e., terminals in Lisboa to the Lisboa Datacenter, and terminals in Oeiras to the Oeiras datacenter.
- Improve the CDN routing service (Conditional DNS) by including a rotating decision for requests associated to Corporate B, in function of the specific network of the request.

VoIP - SIP (4 points)

- Deploy a VoIP - SIP service for all ISP PT2 corporate clients. The service provides VoIP connectivity (through ISP SIP Proxy 1) between internal clients and forwards all other calls (including PSTN numbers) to ISP PT1 SIP Proxy 2. The assign (PSTN compatible) telephone numbers are: for Corporate client A 23410xxxx and 21910xxxx and for Corporate client B 23411xxxx and 21911xxxx.
- Extend this VoIP-SIP service for corporate Client A by using alternatively both SIP Proxies

IPv6 deployment (4 points)

- Deploy the same networks (as above) in an IPv6 ONLY network environment (with the exception of the MPLS component).

Extra (2 points):

- Conversion of the Ethernet Core to an ATM core with three ATM switches in a triangle configuration. Students are advised that they may need to use a different router image for this work.
- Alternative: students may propose additional services/mechanisms to incorporate into the project (subject to professors' approval). Professors may also suggest other additions upon completion of the mandatory requirements.

Deployment and Demonstration notes:

- To test BGP announcements of Internet prefixes, configure (i) IP networks 2.2.2.0/24 and 4001:2:2::/64 in the Internet core connections, and (ii) respective BGP configurations
- During demonstration, if necessary due to lack of computational resources, some routers may be turned off (where/when irrelevant to mechanisms being shown).
- To test SIP deployment just make SIP proxy 2 "answer" all calls forwarded towards him as a simple client.
- All engineering choices and assumptions should be properly reported in a document.