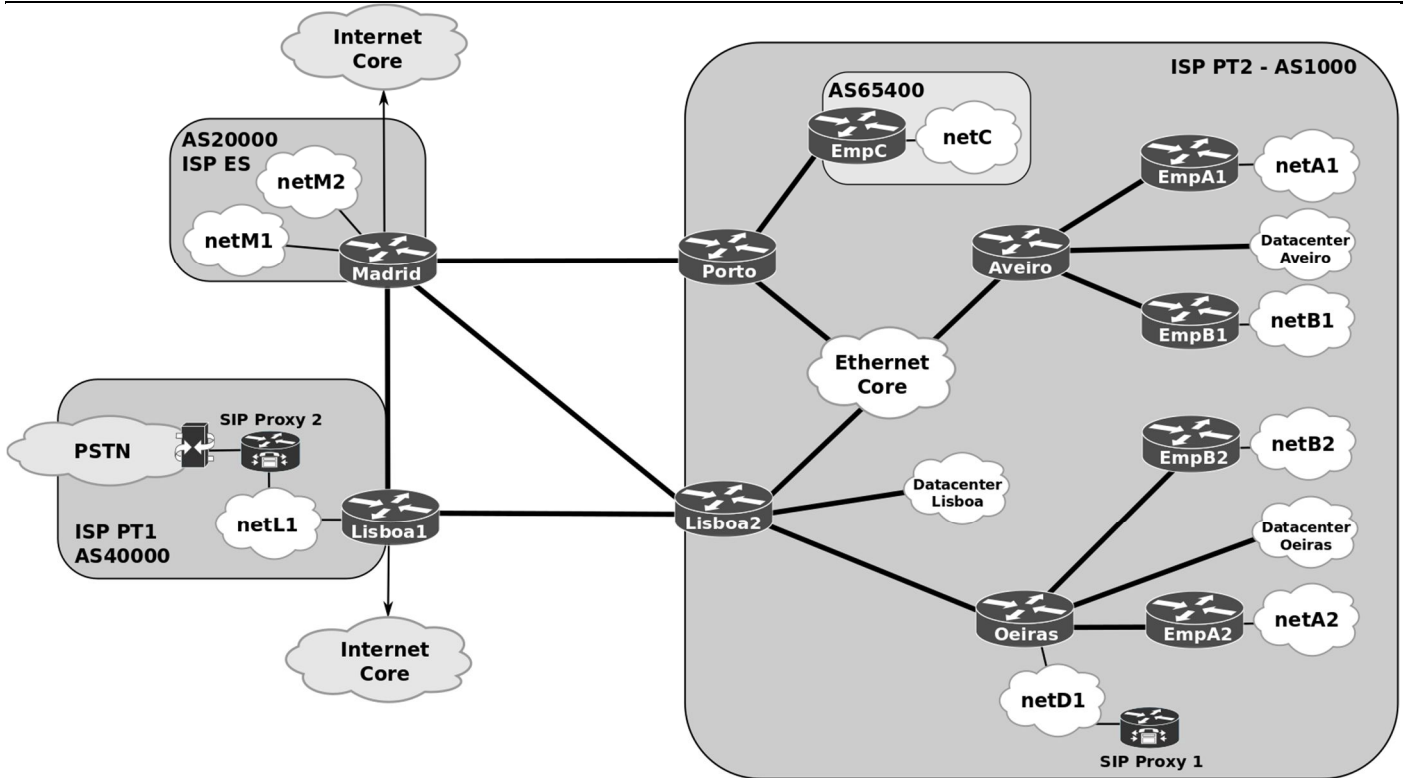# Arquitetura de Redes Avançadas
Project 2017/18

Professors:
  Rui Aguiar (ruilaa@ua.pt); Paulo Salvador (salvador@ua.pt)

⤷ **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 ES (AS20000) via Lisboa2, and one peering relation with ISP PT1 (AS40000) via Lisboa2 and via Porto.
- ISP PT2 has three corporate clients (A, B and C), to which provides IP inter-connectivity and a VoIP service with PSTN inter-connectivity.
- Corporate clients A and B have two branches, one in Aveiro and another in Oeiras.
- Corporate client C, has a single location in Porto, however corporate client C is a private BGP autonomous system (AS 65400).
- ISPs and Corporate clients have the following IPv4 and IPv6 IP networks:

ISP PT2 - core, netD1 and internal point-to-point links	192.100.1.0/24 10.0.0.0/16	2001:100:1::/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	200.100.1.0/24	2201:200:100::/48
ISP ES - netM2	200.200.1.0/24	2201:200:200::/48
ISP PT1 - netL1	65.0.1.0/24	2301:65:0:/48
External BGP peering links	4.4.4.0/26	2001:4:4::/60

- ISP PT2 has three independent datacenters in Lisboa, Aveiro, and Oeiras.
- Both ISP PT1 and ISP ES provide IP interconnection to the Internet Core.
- ISP PT2 should be configured as a non-transit AS assuming possible future BGP peering relations.
- ISP PT1 provides PSTN interconnection through SIP Proxy 2.

Deployment requirements:

Basic mechanisms and BGP (6 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 preferably 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) cannot be routed via Porto using the direct peering link to ISP ES.
    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 (6 points)
- Client B requested two bi-directional channels, between its two branches, with dedicated bandwidth of 20Mbps.
- Deploy a MPLS VPN for Corporate client A (interconnecting Aveiro and Oeiras branches).

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

CDN (4 points)
- Deploy a CDN routing service (Conditional DNS) for corporate clients. The service DNS server is located in the Lisboa Datacenter, and must be able to redirect clients to the closest Datacenter according to their location, i.e., terminals in Aveiro to the Aveiro Datacenter, terminals in Oeiras to the Oeiras Datacenter, and all other internal or external terminals to the Lisboa Datacenter.
- Improve the CDN routing service (Conditional DNS) by including a link/router/server load condition in the decision process.

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 2001:2:2::/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.