

Arquitetura de Redes Avançadas

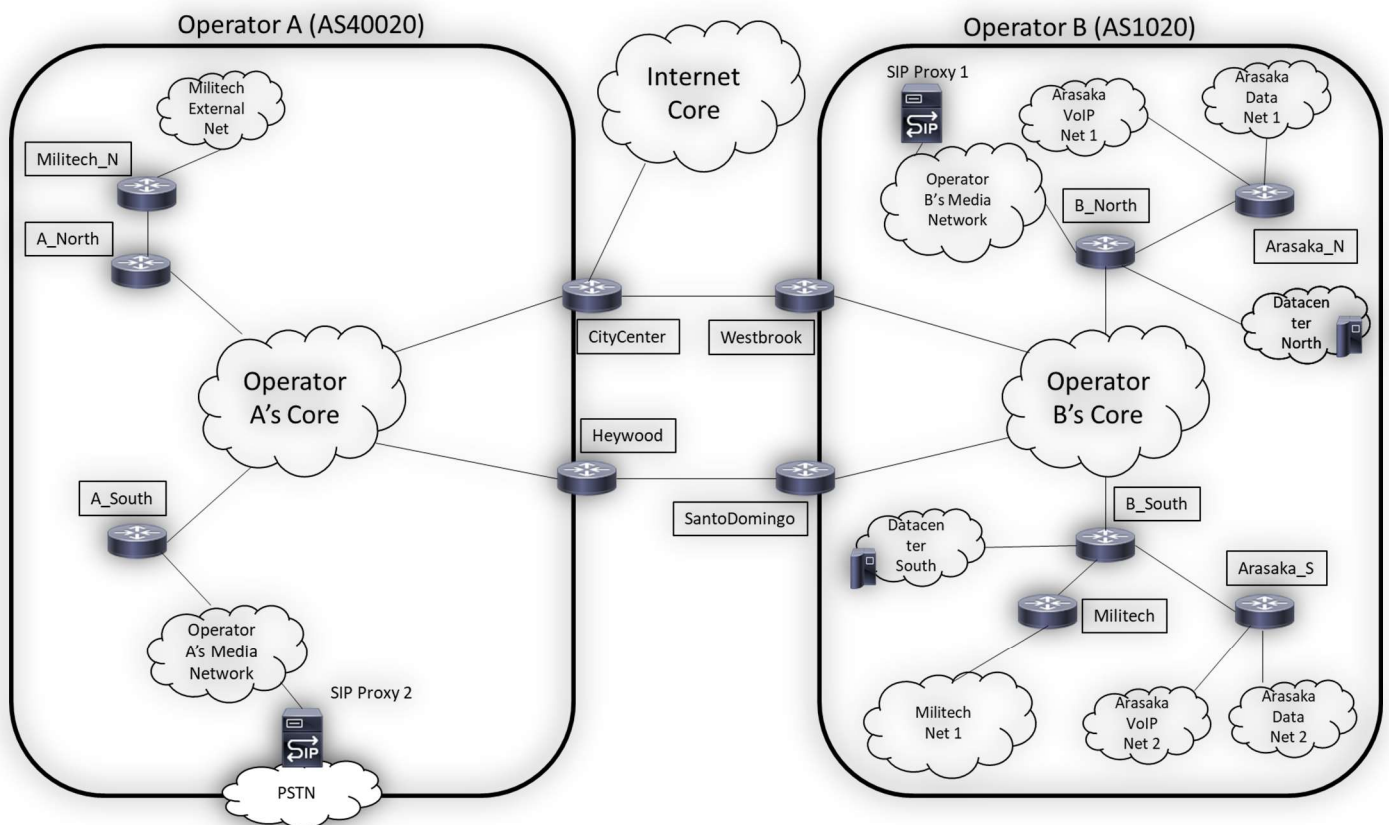
Project 2020/2021 v3-errata

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- **Important:**

- The project must be deployed and tested using GNS3;
- The project is to be done by groups of two students, but grades may be differentiated in function of discussions with the students in the final presentation.
- Be careful on the usage of your host memory in this project, taking care on the size of the images that you will use.
- All engineering choices must have a valid justification. A report providing these justifications is to be delivered at the agreed date in January.

Consider the following reference scenario, with two operators, and two corporate clients, running both voice and data communications:



Scenario Description:

- Assume that you are an engineer belonging to each one of the operator's engineering team;
- Both operators have two peering relations with one another, one between **CityCenter** and **Westbrook** and the other between **Heywood** and **SantoDomingo**;
- **Operator B (AS1020)** has two corporate customers (**Arasaka** and **Militech**), to which it provides IP inter-connectivity and a VoIP service via a dedicated "SIP Proxy 1" (along with potential PSTN inter-connectivity (using **Operator A (AS40020)** SIP Proxy 2);

- **Operator A (AS40020)** has a dedicated stub branch for **Militech** and also features a network for external clients to connect to VoIP services provided by **Operator B (AS1020)**;
- **Arasaka** is a large customer of operator B, with two branches, one in **B_North** and one in **B_South**. **Militech** is a corporation with a wider geographical range, and has a branch in **Operator B B_South** and a branch in **Operator A (AS40020)** in **(Militech_N)**;
- **Operator B (AS1020)** offers also services in two dedicated Datacenters, one at **B_North** and one in **B_South**;
- **Operator A (AS40020)** provides interconnection to the Internet Core.
- The operators and the corporations have the following IPv4 networks (see below):

Core and internal point-to-point links	10.10.0.0/16
Arasaka Corporation	193.136.1.0/22
Militech Corporation	193.136.2-9-200.0/22
Operator A's Media Network	100.200.1.0/24
Operator B's Media Network	10.20.1.0/24
Datacenter North	200.100.2.0/24
Datacenter South	200.100.4.0/24
External BGP peering links	4.4.4.0/26

As an engineer, you are tasked to implement the following **Deployment requirements**:

Basic mechanisms and Inter-Operator border agreements (6 points):

- Provide full connectivity between **Operator B (AS1020)** corporations and the Internet Core, according to scenario constraints (above) and ISP networking good practices.
- Implement the following routing constraints:
 - Inter-operator VoIP traffic belonging to **Arasaka** and **Militech** should always be routed via the **CityCenter** <-> **Westbrook** link;
 - Inter-operator data traffic, and traffic towards the "Internet Core", should always be routed between the **Heywood** <-> **SantoDomingo** link;

Note: You must assume that **Operator A (AS40020)** and **Operator B (AS1020)** receive multiple network prefixes from the Internet Core, and (ii) those prefixes are sent to all its BGP peers.

Provisioning of Corporate Networking Services (6 points):

- **Arasaka** requested its North and South branches inside **Operator B (AS1020)** to be interconnected using the same subnet;
- Both operators provide a service to **Militech**: its traffic in a specific network inside both operators, and it has a single access point to the "Internet Core" which is the **B_South** router;

Provisioning of VoIP services (3 points):

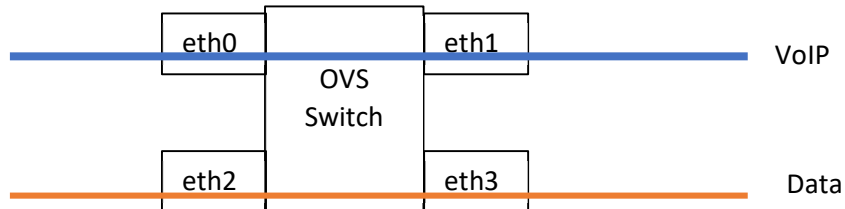
- All corporate customers from **Operator B (AS1020)** benefit from a VoIP - SIP service. The service provides VoIP connectivity through SIP Proxy 1 between internal calls and forwards all other calls (including PSTN numbers) to **Operator A (AS40020)** SIP Proxy 2. The assigned (PSTN compatible) telephone numbers are: for **Arasaka** 234101xxx and 289101xxx and for **Militech** 289102xxx.

Provisioning of Datacenter Services (3 points):

- **Operator B (AS1020)** offers datacenter services under the domain name "**burn-city.org**". **Arasaka** has a privileged connection to these services, where **Operator B (AS1020)** ensures that resolution requests for **Arasaka** will be always sent to the closest Datacenter (geographically defined);
- Conversely, all of **Militech**'s traffic associated with the Datacenter service will always be resolved to the same Datacenter (South).

SDN Services (Open vSwitch) (2 Points):

- **In a separate project**, consider that the interconnection between the two operators is done by a new interconnecting operator, specialized in fast L2 communications.
As such, convert the **CityCenter**, **Westbrook**, **Heywood** and **SantoDomingo** cluster into a single Open vSwitch (OVS), with two links towards “Operator A’s Core” and two links towards “Operator B’s Core”. Implement the necessary management rules to allow VoIP traffic to flow through one pair of ports, and data traffic to flow through the other pair, as per the following figure:



NOTE: you can simplify in the the SDN deployment, the inter-operator aspects.

Added Deployment and Demonstration notes:

- Datacenters (without services deployed) may be simulated using a single L2 switch and VPCS.
- To test SIP deployment just make SIP proxy “answer” all calls forwarded towards it, as a simple client. Real communications will be positively discriminated.
- As a group work, an extra bonus point will be given for the implementation of operator A and operator B in different computers.