

S-38.3192
ITGuru Excercise (Overview)

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Introduction

This exercise will teach you how to construct and simulate large networks with ITGuru simulation tool. You have already got an idea of what can be done with the tool by going through the ITGuru's tutorials. Now it is time to apply in practice the skills you have learned.

In the exercise you will have to build a network that connects four sites of a company located in Paris, Rome, Athens and Lissabon, to the headquarters of the company located in Berlin through the global Internet by using VPNs. In Figure 1 the locations of these companies are shown in a map.

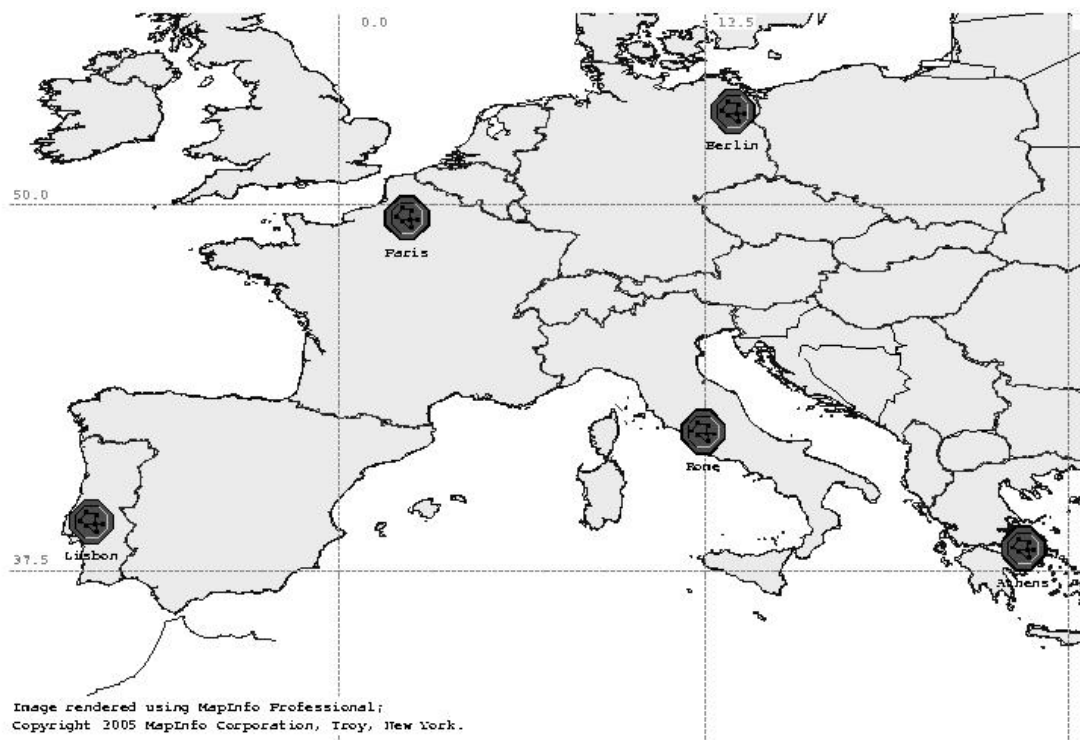


Figure 1 Locations of the companies

The company's sites consist of the following users:

- **Site1 (Berlin):** 60 Engineers and 40 Researchers using Ethernet as an access technology
- **Site2 (Athens):** 40 Researchers using ADSL as an access technology
- **Site3 (Lisbon):** 40 Engineers using Ethernet as an access technology
- **Site4 (Rome):** 10 E-commerce users and 10 SalesMen using Ethernet as an access technology
- **Site5 (Paris):** 20 SalesMen using ADSL as an access technology

The idea is that Site 2, 3, 4 and 5 are connected to Site 1 through VPNs that utilize the underlying Internet infrastructure.

The exercise will be performed step-by-step. Altogether it will consist of the following eight parts:

1. Building the access networks
2. Building the MPLS-capable core network, performing addressing and configuring IP routing (OSPF, BGP)
3. Building MPLS VPNs between Ethernet LANs and IP VPNs between LANs using ADSL
4. Defining the applications and user profiles, creating background load
5. Dimensioning the network
6. Simulating the network, analyzing the results and writing a WebReport

There will be a separate exercise session for each part. Detailed instructions will be given before each exercise session. Below the tasks are described at a general level to give an overview of the exercise.

Building the access networks

You will first have to add five subnet symbols to the map as depicted in Figure 1. Create the access networks within the subnets, containing the number of users specified in the introduction.

Building the core network

The idea of the core network is to emulate the Internet. However, since we do not want the simulations to become overly time-consuming, the network size has to be kept reasonable. Therefore, you will have to connect the access routers of the subnets so that there will be a certain minimum number of hops between each access router pair. The equipment and links in the core network have to be MPLS capable. Note that you will also have to add an MPLS-capable access router to each access subnet.

The requirement in the final version is that the utilization in each link should be in a certain, predefined interval. In other words, the network must be neither underutilized nor overutilized. Keep this in mind when selecting the link technologies.

Configuring IP routing and performing addressing

When you have built the core network, the next step is to assign IP-addresses and net masks to each network interface, including routers and hosts. Next, you have to configure OSPF routing in the backbone network and in the access part. In addition, BGP has to be configured in the boundaries of the MPLS VPNs and Virtual Routing Functions have to be configured in the MPLS devices.

Building VPNs

Configure MPLS VPNs between Ethernet LANs and IP VPNs between LANs using ADSL. The MPLS VPNs can be created by modifying the parameters of the MPLS devices while a separate firewall element is required for the IP VPNs.

Defining the applications and creating background load

The applications are defined by the ready-made user profiles in ITGuru. These profiles are: Researcher, Engineer, SalesMan, MultimediaUser and E-commerce Customer. For example, the Engineer user profile contains web, mail and ftp applications. Since the traffic generated by the applications is simulated in a packet-by-packet manner, the simulations will become very time consuming and memory intensive if all the traffic is created in this manner. Therefore, the background traffic in the core network will be created with traffic demands, which is much less time consuming.

Dimensioning the network

As you have built the network, you will have to run the initial simulation to see whether there are severe congestion points in the network or links that are heavily under utilized. With ITGuru's flow analysis tool you may inspect each link in the network and determine its utilization. If the utilizations of some links are not within the utilization range defined in the requirements, you have to update the capacity of the links.

Simulating the network, analyzing the results and writing a WebReport

Simulate the final version of the network and collect both user-level and network-level performance statistics. Investigate also how the performance statistics and routing statistics change for example in a case of a link failure. Write a report containing result tables, figures and analysis by using the WebReport tool available in ITGuru. You can find instructions on how to create a WebReport from the tutorials.

Getting help

A separate exercise session will be arranged for each part of the exercise. In addition, you can get help by reading the ITGuru manual, by doing the tutorials and by studying the example projects where the functions and network elements of each technology are described. You may also run various example scenarios and examine how the devices have been configured. The example projects can be found from the */p/opnet/11.5A/models/std/example_networks* directory. You can also read the descriptions of each network element in the object palette by right clicking the element and selecting "View Node/Link Description".

Grading

Each part of the exercise has to be returned and passed separately. If some part of the exercise has been returned late or has not been passed, the exercise (and the course) can not be completed. Only the final version of the exercise will be graded as a whole. The grade depends on how well your solution meets the goals set for link utilizations, application performance and other specified metrics. However, in order to get a good grade, you also have to justify your technological choices and discuss what other alternatives you might have had. You will also have to make deep analysis about the results; just showing some figures and result tables is not enough.