

S-38.3192
ITGuru Exercise (4: Defining applications and user profiles, creating background load)

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Original version: Johanna Nieminen and Timo Viipuri (2005)
Modified: Johanna Nieminen (2006)

Task Description

In this part of the exercise you will create user profiles and applications to be used by the employees in the access networks as well as background load for the core network links. The idea is that only a small fraction of the total offered traffic load will be created by the applications while the rest will be pure background traffic. This is because the applications create a huge amount of packet level events that increase the simulation time considerably. On the other hand, background load and traffic demands are modeled in ITGuru with an analytic fluid-flow model where the traffic is simulated as flows, not as a stream of packets.

Combining packet and flow level simulation in ITGuru is referred to as Hybrid Simulation. In the '`p\opnet\11.5.A\models\std\example_networks`' directory you can find example scenarios of hybrid simulation where you can easily see how much longer it takes to execute the simulation as the fraction of traffic created directly by the applications increases. Figure 1 shows the network topology used in the example. Background traffic demands are represented by the blue, dashed arrows. If 80% of the total load is modeled as background traffic and 20% with applications, a simulation of 25 minutes takes 3 hours and 35 minutes in real time. For comparison, if only 20% of the load is background traffic and 80% is created by the applications, the same simulation takes 7 hours and 58 minutes.

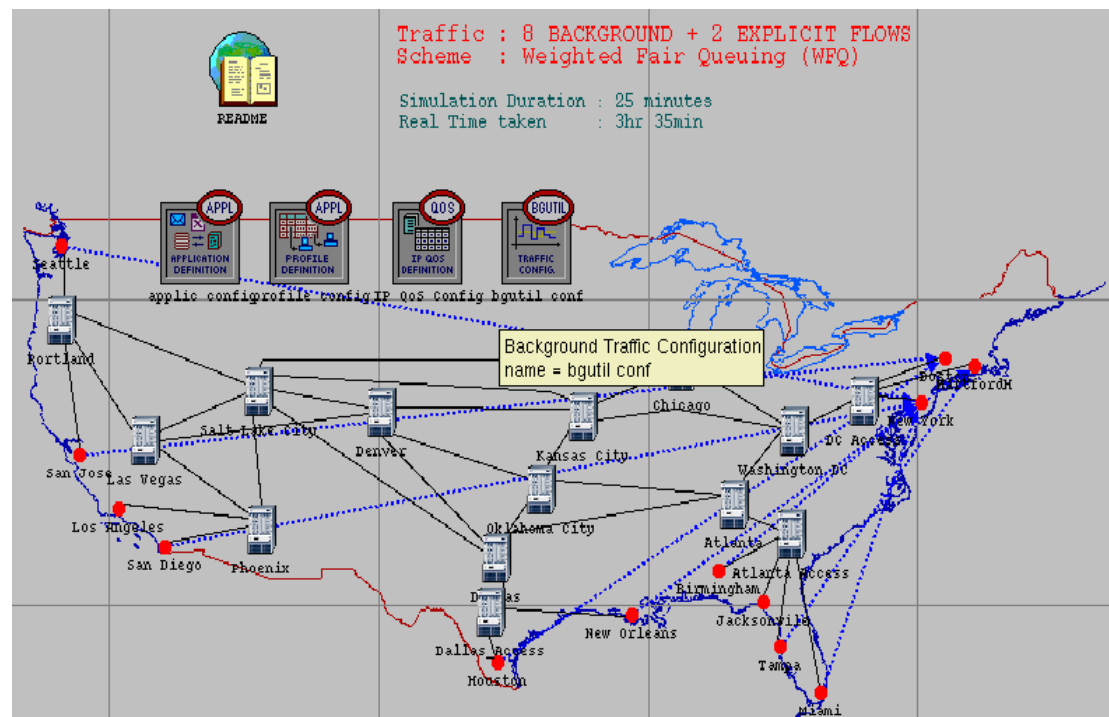


Figure 1 Hybrid Simulation

Creating the Applications

Add an **Application Config** and **Profile Config** object to the map. You can find these objects from the Utilities Object Palette. The Utilities palette contains a number of objects that define some general properties and parameters that can be utilized throughout the simulation.

It is possible to define totally new user profiles and applications in the Application and Profile Config objects. However, in this exercise only profiles and applications already existing in ITGuru are used. In the Application Config object, select **'Application Definitions->Default'**. This will enable 16 different application models, such as Web Browsing, E-mail, Database Access and Video Conferencing. Some of the default application parameters are far from realistic, so you have to do the following changes in the attributes of the default applications:

- in File Transfer (Heavy) set file size to 1000000 bytes
- in Web Browsing (Heavy) set mean object size to 3300 bytes and mean number of objects to 5.

In the Profile Config object, select **'Profile Configuration->Sample Profiles'**. This will enable ready-made profiles such as Engineer, Researcher and Salesman. For each profile in the Profile Configuration, set **Repeatability to Once at Start Time** (since a profile will last till the end of the simulation, there is no need to repeat the profile). For the applications within each profile, set the common attribute **Operation Mode to Simultaneous**. This ensures that different applications within a profile can be used at the same time. For example, an engineer may download a file with FTP and surf in the web while waiting the download to complete. For each individual application within each profile, set **Repetition Pattern to Serial**. This indicates that new sessions will not be started by an application until the previous session has been completed. Furthermore, change the applications in the sample profiles so that heavy versions are used instead of the light versions. This guarantees that enough application traffic is generated in the simulation.

Now that the profiles and applications have been enabled you can use them for example in the LAN objects. Before using the applications, double the number of users in each LAN (this is just to generate more user traffic). Select **'Applications->Application: Supported Profiles'** and add as many rows as there will be traffic profiles. For example, if you have 100 employees in the LAN, 50 of them may be Researchers and other 50 may be Engineers. You will also have to configure the supported profiles and services in the servers of each subnet. Select the profiles from **'Applications->Application: Supported Profiles'** and select **All** for **'Applications->Application: Supported Services'**.

The idea is that the same amount of application traffic will be sent from each subnet to every other subnet. This is not a very realistic case but it considerably reduces the amount of configuration work required. You can direct the traffic to the servers by setting the **Destination Preferences** attribute to **None**. Now the destination server will be selected randomly from the servers in the network that are able to support the requested service.

Creating the Background Traffic

Background traffic can be created in ITGuru either by using Traffic Demands or by defining a certain amount of background load for each link in the link attributes. In this exercise the background traffic is modeled by creating demands between the PE-routers of subnets. In those subnets where MPLS VPN is not used and thus PEs do not exist, create the demands between the edge LSRs. Notice that the traffic demands are

bidirectional. Thus, altogether 10 bidirectional connections are required in the network to create a full mesh of traffic demands.

Amounts of Application and Background Traffic

For the application part your task is to create the profiles and applications for each subnet as instructed in the exercise overview description. You do not have to explicitly measure the amount of traffic created since it will be very small compared to the total amount of traffic in the network. The applications are only used to measure the performance from the users' point of view when the network has a certain load level. However, if you wish to inspect how much traffic the different profiles generate, the easiest way is to measure this directly from the first access link.

For determining appropriate bit rates for the background traffic, take the E1 link as a reference (the data rate of the E1 link is 2.048 Mbps). Define the 10 traffic demands so that the first demand will create a load level of 0.3 times the capacity of the E1 link while the last demand's load level is 25 times the capacity of the E1 link. The load levels of the remaining eight demands should be selected uniformly from within this interval, providing a range of different loads. It is obvious that E1 links are not able to support the resulting, extremely high load levels in some links. In the next part of the exercise the idea is that you will dimension the core network links so that the offered traffic can be carried.

Exercise Sessions

The exercise session for this task will be arranged on **Thursday, 23rd** February at 14 o'clock in computer class Maari-A.

Handout Requirements

The exercise should be returned before the beginning of the next exercise session (2nd March, 14 o'clock). Send the exercise package as an e-mail attachment to Johanna Nieminen (jmanti3@netlab.tkk.fi) provided that the size of the attachment is reasonable. You have to pack the files with the command:

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"tar -cf - -C ~ op_models | gzip > 4_appl_def.tar.gz"
```

Remember to include only the relevant files (we do not want all the backups). Try to unpack the files and then run the project on some other computer (or with another group member's account) to make sure that the packaging is done properly.