UDC 621.39

SCOPES TO SOLVE PROBLEMS OF TELECOMMUNICATION RESOURCES DISTRIBUTION TO PROVIDE THE REQUIRED QOS

Martynova K.G.
Institute of Telecommunication Systems,
Igor Sikorsky Kyiv Polytechnic Institute, Ukraine
E-mail: scorpio.for.teen@gmail.com

Можливості вирішення задачі розподілу телекомунікаційних ресурсів для забезпечення потрібного QoS

У статті розглядається задача розподілу телекомунікаційних ресурсів в межах уніфікованої системи масового обслуговування (СМО), що включає довільне число обслуговуючих приладів, місця для черги, а також різноманіття пріоритетів.

Multiservice systems are able to meet users' needs in storage and data processing that requires significant quantity of telecommunication resources: frequency, channels, time. General tendency shows that users choose the way of rising QoS requirements up. However, telecommunication resources are limited [1] and obviously the "fight" starts for the right to use these resources.

Thus, there is a problem of resources access that raises the number of tasks to solve for a telecommunication systems engineer. During the process of solving these tasks a specialist in telecommunications has to decide what should be "sacrificed" for all the users' sake.

Obviously, there is a huge variety of queuing systems (QS) intended for different kinds of tasks. In each case a telecommunication systems engineer encounters the analysis of quantitative and qualitative characteristics of QS aimed at choosing the most effective model.

The object of research is QS that consists of arbitrary number of streams and devices and various service disciplines.

Regardless of the QS type (see Figure 1), its structure is appropriate to be represented with following levels:

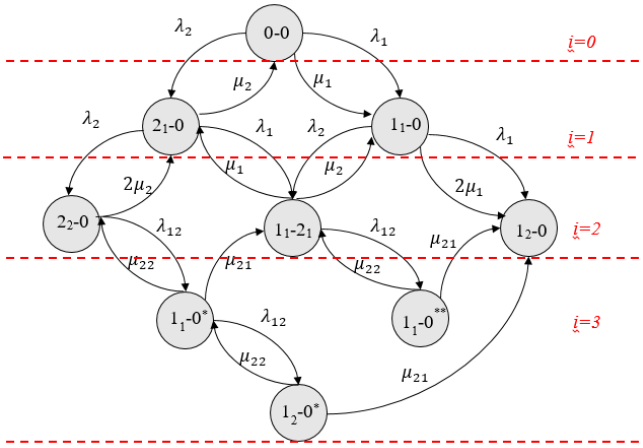

Figure. 1. The unified QS with two streams and to devices and queue [2].

- *i=0*: the system if free of requirements;
- *i=1*: the first device is occupied;
- *i=2*: the second device is occupied;
- *i=3*: requirements occupy the queue; the priority level (requirements "fight" for the place in queue).

To understand which role each level takes in dynamics of QS characteristics, let us formulate following questions.

1. How does the number of devices influence QoS characteristics?

Obviously, the easiest way to improve QoS characteristics is increasing the number of service devices.

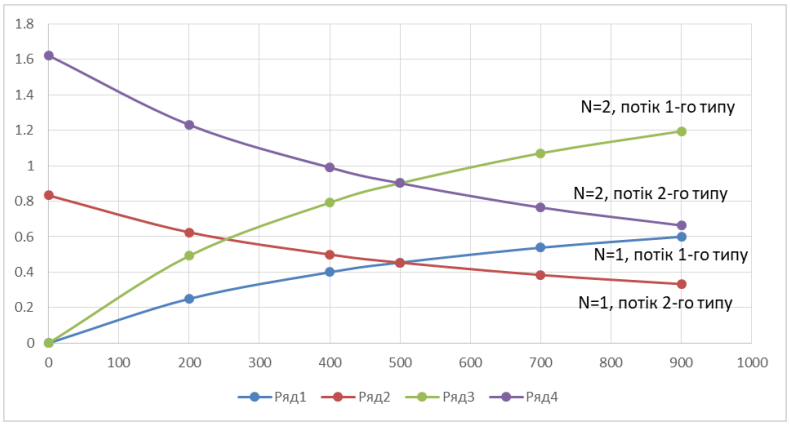

Figure 2. The dynamics of productivity characteristics with N=1 and N=2 depending on increasing of input load of the 1st type of requirements.

In Figure 2, there is a significant advantage in the characteristics of QS with two devices comparing to QS with one device. Undoubtedly, QS with two devices is capable to serve more requirements than QS with the only device. However, when it comes to dozens, hundreds of subscriber devices, the telecommunication service provider should think about the downtime probability of the system.

2. How does queue influence QoS characteristics?

In Figure 3, because of queues availability, there is a significant increase in productivity for the 1st type of requirements (20%), slightly less for the 2nd type of requirements - 12%. Increasing the number of servicing devices is a relatively more effective method of improving performance than queuing, but all of Little's criteria must be taken into account.

Along with the improvements made as the result of adding queue, there is an important problem for the user: a sharp increase of the average waiting time for service of the requirement. In QS models without queue, the requirements were either serviced or lost. The queue is a tool for reducing the number of lost requirements, but the improvement has to be "paid" in the time that the user spends on waiting.

3. How does the discipline of service influence QoS characteristics?

The discipline of service formally describes the service procedure (device occupation, waiting, service interruption) [1]. At the moment of the queue overflow, a choice of the appropriate for the current state of the QS, the discipline

of service becomes a panacea that provides the service of priority requirements and, if it is possible, applications of lower priority. The previous studies show [3], the use of priorities significantly improves QoS characteristics, relative priority in particular.

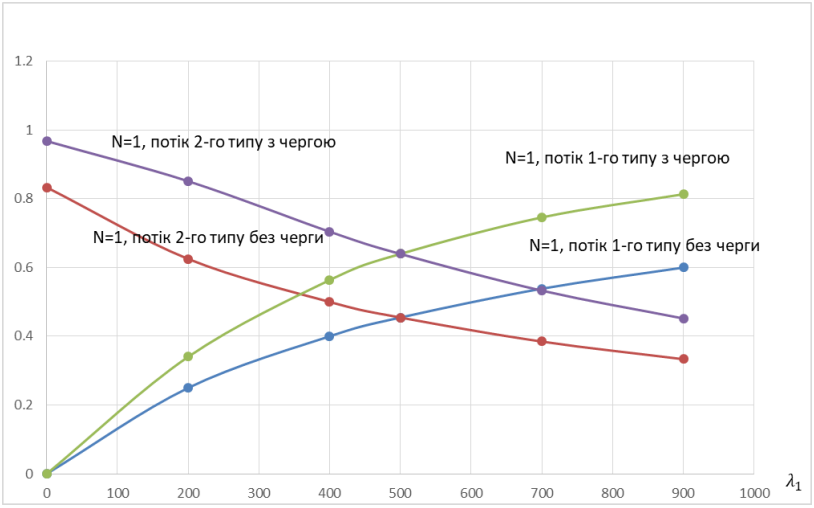

Figure 3. The dynamics of productivity characteristics with N=1, available queue and queue less depending on increasing of input load of the 1st type of requirements.

However, if the intensity of the input load is sharply increased, it is necessary to choose a discipline, depending on which of the available disciplines is the most optimal in the current state of QS. To do this, a telecommunication systems engineer must know the techniques of situational management.

Thus, having analyzed the observed problem and the number of questions that are able to highlight the problem, we conclude that increasing the number of servicing devices is suitable in case of QS with huge input loads. Adding queue is acceptable for QS with arbitrary input loads, but in this case, it is necessarily to take the average waiting time of requirements into account. Using the priority service is the most flexible tool for improvement QoS characteristics. At the same time, it is necessary to master the points of priority choice management in favor of this or another indicator of QoS characteristic [2].

References

1. Урывский Л.А. Обобщение процесса «размножение и гибели» на системы с «конфликтом доступа» // Наукові записки Українського науково-дослідного інституту зв'язку: науково-виробничий збірник. – 2009. – № 1. – с. 97-104.
2. Уривський Л.О., Гахова Г.С. Узагальнення системи масового обслуговування з пріоритетами //Тези доповіді/ IX Міжнародна НТК «Проблеми телекомунікацій», /Збірник матеріалів. — К.: ІТС НТУУ «КПІ», 2015, с. 77…79.
3. Уривський Л.О. Мартинова К.Г. Аналіз дисциплін обслуговування в мультисервісних телекомунікаційних системах// Тези доповіді/ XIII Міжнародна НТК «Перспективи телекомунікацій 2019», /Збірник матеріалів. — К.: ІТС НТУУ «КПІ», 2019, с. 1.