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INNOVATIVE CONCEPT IN SERVICE SURRENDER QUEUES

ASHWINI DESHPANDE[1] AND S. P. KANE[2]
[1]Department of Statistics, Ruia College Matunga, Mumbai 400019
[2]Vice Chancellor Rashtrasanta Tukdoji Maharaj Nagpur University, Nagpur

Abstract

Service Surrender Facility is that feature of a normal queueing model where, a service at a particular queueing system can be returned back after use or because it cannot be used due to some reasons. When such a facility is available, there may be takers for this facility, who were initially deprived of the service since it was exhausted. This may give rise to Secondary Queues which comprise of all such service takers. This paper deals with a unique characteristic of Service Surrender Facility i.e. Moving Server. A Moving Server is observed in case of public transport, elevators, etc. The example of an ELEVATOR is described with its detailed working procedure where the moving server caters to multiple queues simultaneously.

Key Words: Queue, Service Surrender Facility, Secondary Queues, Moving Server, Bulk Queues

Area of research: Statistics, Operations Research.

1. INTRODUCTION:

Queues are waiting lines. They are a common feature of our day-to-day life.

The main components of a queueing system are *a customer* who wants to avail a certain service and *a server* who makes that facility available to him. If the waiting time of a customer is reduced, the idle time of the server increases and if the idle time of the server is reduced, the waiting time of the customers' increases. Hence the main aim is to obtain a balance between the two.

1.1: DIFFERENT EXAMPLES OF A QUEUE

- Patients waiting at the doctors clinic
- Customers waiting at booking windows.
- Letters to be typed at a typist's desk.
- Ships to be loaded or unloaded.
- T.V. sets to be repaired at the repairer's shop.
- Phone calls arriving at the operator's board.

From the above examples it can be seen that queues not only comprise of people but also of goods.

1.2: QUEUES THAT CANNOT BE SEEN

There are also queues that we cannot see (unless we use a software/hardware system), such as:

- Streaming a video
- Web services
- Calls on hold at a call centre

1.3: OPERATION OF A QUEUEING SYSTEM

- A customer arrives at the serving facility.
- He joins the queue.
- The server starts with the first customer.
- Upon completing his service takes up the next customer.
- This process is repeated till all the customers are served.
- The time spent between the end time of the service of a customer (i.e. the departure of a served customer) and the start time of the service of a new customer is negligible.

1.4: FEATURES OF A QUEUEING SYSTEM:

The main characteristics of a queuing system can be completely described by:

1. INPUT PATTERN
2. SERVICE MECHNISM
3. QUEUE DISCIPLINE
4. CUSTOMER'S BEHAVIOUR
5. MAXIMUM QUEUE LENGTH
6. SIZE OF THE CALLING SOURCE

2. SERVICE SURRENDER FACILITY:

In examples of public transport bookings for long distance journeys by rail, road or airways, library books, admissions to certain courses, ready-made garments, etc. the services available with the service management are limited in number. Once the services are exhausted the remaining customers waiting to avail the services, if any, are denied service. But there are chances that one or more customers who have availed the facilities may return the services back to the service management due to lack of requirement (as cancellation or change of plans of travelling), dissatisfaction (as in case of misfit of the size of readymade garments; if the garments are exchanged the different size becomes available), or at times the services may be utilized and then returned (as in case of library books, public vehicles, elevators, etc.). Hence, these services do not get exhausted and hencecan be returned (SURRENDERED) by some customers; they can be made available to customers who wish to avail them later. This facility of surrendering the service is known as SERVICE SURRENDER FACILITY.

The customers who do not get service in the primary queue but still wish to avail the service comprise of a secondary queue. There is no compulsion on the customers to join the secondary queue. It may happen that no customers surrender the service (exceptional cases: library books and trains/lifts) which implies that even if a secondary queue is formed, there is no guarantee that the service will be available to them. It may happen that no customers surrender the service which implies that even if a secondary queue is formed, there is no guarantee that the service will be available to them. It may also happen that a service is said to be completed only when it is surrendered (library books and trains/lifts).

The customers who are denied service in the primary queue due to unavailability of services need not physically wait in the queue. They can just register their names with the services management authority and this list of customers forms the secondary queue.

The various examples of queueing systems which can possibly have service surrender facility are rail, road and airways bookings, admissions to various courses, telecom communications with limited number of lines (numbers), vehicles making public transport available, elevators carrying people etc.

The various examples of queueing systems which compulsorily have a service surrender facility are library books, local trains/trams/metro-trains and elevators, etc. The various examples of queueing systems which compulsorily have a service surrender facility are library books, local trains/trams/metro-trains and elevators, etc. that move from point to point carrying people.

3. A MOVING SERVER:

The example of local trains/trams/metro-trains and elevators also depict one more peculiar and important property namely, in these situations the server is moving i.e. the server moves from one point to other carrying the customers who wish to move from one point to another.

The example of an Elevator is the best example to depict the situation. The elevator moving between floors is the server and the passengers who want to move from one floor to another form the customers. When the customers board the elevator their service is said to have begun and when they alight at their desired destination their service is said to end. Also they are said to have surrendered their services since unless the previously boarded passengers alight, the new passengers cannot be accommodated in the elevator. Hence this is a classic example of both, SERVICE SURRENDER FACILITY and MOVING SERVER.

4. SINGLE MOVING SERVER:

Consider a queueing system which consists of one server and more than one parallel queues. The working procedure of this system is that the server moves from one queue to another to serve the customers. The best example of this is an ELEVATOR carrying passengers from one floor to another. The elevator is the server making the facility available and the passengers are the customers who are carried from on floor to another. This is where the service has to be surrendered by the earlier customers so that it can be utilized by the next set of customers. Also this is an example of finite system capacity since the service is limited to the capacity of the elevator. Such type of service has to be surrendered i.e. the elevator has to be vacated, since it implies the completion of service. Also here, since the customers are served in groups, the system is said to serve BULK QUEUES.

The situation can be described as follows:

There are multiple queues at fixed points and there is a moving server who will move from first point to

second, second to third and so on... and also from the last point to second last point in the backward direction till it reaches the first point. This procedure continues as long as the customers are waiting to avail the service. It can be assumed that the time required for the customers to enter the ELEVATOR and exit from the ELEVATOR is negligible.

For a single moving server (ELEVATOR) and queues at two or three points the algebra of bulk services can be directly used to find the expected waiting time of the customer in the queue. But for a single moving server (ELEVATOR) and multiple queues, the system can be explained as follows:
Generally the working of elevators is programmed with respect to a direction i.e. upward and downward. The service in both these directions is of opposite types. When the sever (ELEVATOR) is moving in one direction and it receives calls for that direction from intermediate queues, it will attend all those calls on the way proceeding in the same direction (without changing the direction) serving as many customers as possible (i.e. carrying them in the elevator and dropping them at the desired floor) till it reaches the last serving point (the farthest destination) demanded by the customers. Once the server (ELEVATOR) stops there, it can change the direction or continue further in the same direction (if possible), depending up on the call that it receives. Hence the server gives two different types of services going UP and going DOWN. The calls received by the server are an example of PRIORITIES and BULK SERVICES i.e. the system is NOT RANDOM.

This can be explained as:
The programming of the server (ELEVATOR) is such that at each queue, there are two calling switches, DOWN arrow for going down and UP arrow for going up available for the customers. The customer is supposed to select that arrow in the direction in which he/she wishes to go in. If a customer selects the DOWN arrow, the server (ELEVATOR) will stop on that floor only when it is in the downward direction and if a customer selects the UP arrow, the server (ELEVATOR) will stop on that floor only when it is in the upward direction. The server will give service to the one who calls for service, from any of the queues but since the movement of the server is direction-prone, it will give priority to those who demand for service in the direction in which the server is proceeding on the way. It will not change the direction in any case till it completes the service that it has begun in one direction i.e. the priority is given to the direction. If the server (ELEVATOR) is being called by a customer at J^{th} floor by selecting a DOWN arrow and the server (ELEVATOR) has just crossed the Jth floor in the downward direction, it will first complete the service in the downward direction. It will then attend calls in the upwards direction

providing service to the customers wanting to go up and then go to J^{th} floor on the way back in the downward direction to serve the customer who had called for it. But if there is a call from J^{th} floor for going up, the server (ELEVATOR) will stop there while going upward and can pick the customer wishing to go in the downward direction as well, but will take that customer up first and then take him to desired destination while going down.

CONCLUSION:

Thus PRIORITIES and BULK SERVICES form a unique peculiar feature of this system. It can be easily perceived that these calls for service from both the directions form a QUEUE WITHIN A QUEUEING SYSTEM. It will be a queue of calls generated for service from various queueing points i.e. whoever calls first gets the priority to get the service and a group or bulk are served at a time.

REFERENCES:

[1]. Erlang, A.K.,Probability and telephone calls Nyt. Tidsskr. Mat. Ser B Vol. 20, (1909).

[2]. Feller, W.,An introduction to probability theory and its applications,John Wiley & Sons, Inc. New York (1950).

[3]. Kane N. S.,Analytical Study of Queueing Systems with Service Surrender Facility to the Customer; Ph. D. thesis, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur(2001).

[4]. Lakhani P. B.,A Study of Some Special Types of Secondary Queues, Ph. D. thesis, Sant Gadge Baba Amravati University, Amravati (2007).

[5]. Medhi J.,Stochastic Processes – New Age International Publishers (1982).

[6]. Medhi J.,Stochastic Models in Queueing Theory – Academic Press (2002).