Mechanics Transport Communications

Academic journal

ISSN 1312-3823

issue 3, 2007

article № 0186

http://www.mtc-aj.com

GPSS AS TOOL FOR DECISION OF CLASSICAL TASK IN OPERATION SYSTEM

George POPOV

popovg@tu-sofia.bg

Technical University - Sofia, Comp. Science dept. Kliment Ohridski str 8, 1000 Sofia

BULGARIA

Abstract: *This paper suggests use of GPSS models as a tool to investigate a classical tasks in area of operation systems. Calculation a dimension of operational queues is very useful when it is need to project new embedded system.*

Key words*: deadlock, operation systems, system programming, mutual exclusion, modeling*

1. Introduction

The problem "Communication between couple producer and consumer thought limited buffer with N elements" is widely known example [1,2,3,4] This problem is included in more books of operation systems and system programming, because they are classical example for synchronization.

In [5,6] is given an example to use GPSS as a tool for investigate parallel processes and critical sections., because it is possible to decide the reason to origin a deadlock.

The code of task "Limited buffer with N elements" is shown on fig.1. Two types semaphores are used in this example:

- Binary, for mutual exclusion;
- Count. for synchronization

Main rules of this task are:

- Only one process can work with buffer at one moment;
- Recording into buffer is possible, if free elements persist. In other case processes will be blocked (on the semaphore P(empty);
- Reading form buffer is possible only filled elements persist. In other case processes will be blocked (on the semaphore P(full);

In this example data is local variable and buffer is global and number of elements is 8.

```
Init (mutual_exclusion, 1);     //A binary semaphore
Init (empty, 8);                //In the beginning all buffers are free
Init (full, 0);                 //Filled buffers are zero.

procedure PRODUCER;
   begin
   repeat
         P(empty);
         P(mutual_exclusion);
         WRITE (buffer, data);
         V(mutual_exclusion );
         V(full);
   until false;
end;

procedure CONSUMER;
   begin
   repeat
         P(full);
         P(mutual_exclusion);
         READ (data,buffer);
         V(mutual_exclusion );
         V(empty);
   until false;
end;
```

Fig. 1 The problem "Limited buffer with N elements"

2. Decision of the Problem "Limited buffer"

In [5,6] is proof that GPSS models are useful tool to investigate a possibility of a deadlock and eventual choice of strategy to fight it. For modeling to a semaphore is suitable to use the GPSS unit, as block SEIZE S respond to P(S) and RELEASE to V(S) semaphore operation. Except this, the multi channel unit defined by STORAGE describes precisely common (count) semaphore.

We are trying to decide the problem with real data. This buffer is very useful for compensation of asynchronous speed between central and channel processors in computer systems. If we know the speed of these units, we can decide the number of buffers. A GPSS model of this task is shown on fig.2. The states of buffer during simulation are shown on Tab.1

.

```
empty   storage     8
full    storage     8

; Process producer
        generate    ,,,1
        advance     100,99  ; make data
lab1    enter       empty
        seize       mutex
        advance     50
        release     mutex
        leave       full
        transfer,   lab1

; Process consumer
        generate    ,,,1
lab2    enter       full
        seize       mutex
        advance     50
        release     mutex
        leave       empty
        advance     100,99  ;use data
        transfer,   lab2
```

Fig.2 *A GPSS model of "Couple producer-consumer"*

Tab. 1 *The states of buffer during simulation.*

OPERATION	VALUE (EMPTY)	VALUE (FULL)	ACTION
Read	8	0	Block on P(full)
Write	7	1	Writing
Write	6	2	Writing
Read	7	1	Reading
Write	6	2	Writing
Write	5	3	Writing
Write	4	4	Writing
Write	3	5	Writing
Write	2	6	Writing
Write	1	7	Writing
Write	0	8	Writing
Write	0	8	Block on P(empty)
Read	7	1	Reading

3. Conclusion

GPSS could be a tool to model classical tasks in area in operation systems and system programming. It is very useful to make educative programs for students in course of "operational system" investigate a classical system tasks. Modeling of software is useful in the area of embedded system, where processes number and resources are constant. Many classic problems, as eating Philosophers, synchronization tasks might be modeled with GPSS.

References:

[1] Nicolov L., *Operation systems*, Ciela soft and publishing, 2005, Sofia

[2] Borovska P., *Computer Systems*, Ciela soft and publishing, 2003, Sofia,

[3] Nakov O., *A Formalization for Distributed Deadlock Detection in Networks*, 12th Int. Conf. for Automation of Engineering and Research, 19-20sept. 1998, Varna

[4] Наков О., Д. Гоцева, Д. Петрова, К. Костадинов, *Програмни среди - .NET*, ръководство за лабораторни упражнения, Част втора, Издателство на ТУ, 2004

[5] Popov G., O.Nakov, M. Hristova, *A Deadlock Possibility Integration Using GPSS*, Proceeding of Third Int. Scientific Conference 'Computer Science', Turkey, Istanbul, 2006

[6] Coffman, E.G.,et al. *System Deadlocks*, Computer Serves 3,*No2*, June 1971, p.67.

ПРИЛОЖЕНИЕ НА GPSS ЗА РЕШАВАНЕ НА КЛАСИЧЕСКИ ЗАДАЧИ В ОПЕРАЦИОННИТЕ СИСТЕМИ

Георги ПОПОВ

Технически Университет – София, ФКСУ, София, бул. Кл. ОхридскиN8, блок1

БЪЛГАРИЯ

Резюме: *Тази статия разглежда моделиращата система GPSS като средство за изследване на класическите задачи в операционните системи. С помощта на GPSS могат да бъдат моделирани успешно примери на взаимно изключване, синхронизация, комуникация, мъртва хватка и др. В резултат от моделирането се получават стойности за верочтността от мъртва хватка, размер на операционните опашки, средно време за очакване и др.*

Ключови думи: *операционни системи, системно програмиране, сихронизация, GPSS.*