# SCHEDULING IN REAL TIME SYSTEMS : A REVIEW

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**Abstract -** Multiprocessor task scheduling is main and computationally troublesome issue. Many algorithms are put together to represent various trade-off between the nature of arrangement and the computational complexity and versatility of the issue. Scheduling is worried ofassigning the finiteassets to assignments to obtain definitetarget functions. Real time operating systems are most widely used software architecture for executing application demanding strict deadlines and managing multiple tasks together. The real time operating is used at various places such as embedded system, industrial robots, scientific research equipment, air traffic control, toll traffic control, vehicle subsystem control and nuclear power plant control.

**Keywords: -** Real time operating system, Scheduling, Multiprocessor Task Scheduling, Real time Scheduling.

**1.INTRODUCTION**: "Operating system is system software that manages computer hardware and software resources and provides services for computer programs"[14].

Examples of operating systems are: Linux, Unix, macOS.

Some commonly used operating system are :-

1. Batch Operating System
2. Time Sharing Operating System
3. Distributed Operating System
4. Network Operating System
5. Real Time Operating System(RTOS)

### 1.1 The Real Time Operating System (RTOS):

The real time has beencharacterized by its data processing framework in which time interim is required to effectively process and react to their sources .The time taken by reaction to input and display the updated required data is defined as the reaction time. The reaction time obtained is very less when studied in context of web based handling.

The real time system framework is executed when there are crucial time necessities for task of the processor. The real time operating system are used in applications such as Scientific experiments, Industrial control system, Robots, Air traffic control system, Traffic control system. These applications follow the deadline constraints if they do not follow they may fail. There are mainly 2 types of Real Time Operating System:-

**Hard Real Time Systems**: In these types of operating systems the time limitations are extremely hard and even the minor delay is not tolerable. If the deadline is not met than its causes fatal error to the system. In hard real time systems the virtual memory is almost never found and data is stored in ROM.

**Soft Real Time Systems**: In this type of RTOS a time constraints is less strict. The strict real time tasks get the priority over these tasks and have the priority till the task is completed. The work is still completed if the deadline is gone. Examples of soft real time systems are multimedia, virtual reality and some others also.

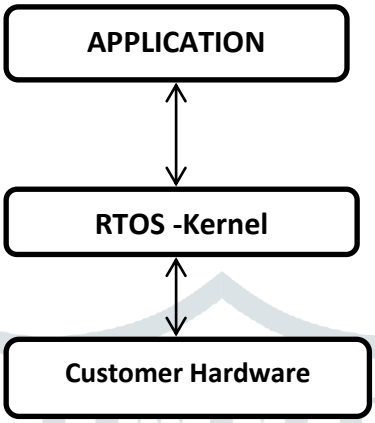


**Figure 1 : Block diagram of Real Time operating system**

Real time applications are basically found on top of the Real time functionality operating systems[13]. Scheduling algorithm are being made specific. Static cyclic graph is being calculated in off line mode when it is possible. In on line techniques flexibility is being increased.

## 2. SCHEDULING

Scheduling is one of the most important activity that executes in real time systems. It is arrangement of conventional or unconventional assignments for parallel execution on the arrangements of processor and the parallel programs are disintegrated into a lot of little assignments that usually have conditions as in form of dependencies. The main point of scheduling is to allot assignments to accessible processor and to minimize the makespan for all the task execution.The states involved in a scheduling task are as: -

1) Running(CPU Execution)

2) ready(in a state to be executed)

3) Blocked(waits for input or output)

A directed acyclicgraph represents the scheduling of a task on a multiprocessor framework which is used for limiting the distinctive execution estimates which is an issue in parallel processing. To achieve the optimal objective tasks are executed on more than one processor parallely and it is NP-Hard problem. The multiprocessor task scheduling is used in various application such as liquid stream, climate demonstrating, database frameworks, image processing, information processing.

### 2.1 Real Time Scheduling

The essential goal of real time scheduling is to expand throughput and minimize normal reaction time rather than over crossing the deadline. The tasks of real time systems are designed non-pre-emptively with the aim to boost the aggregate utility in. There are two types of time utility functions (TUF) involved in real time systems and these functions are: -

1) A Benefit time utility function

2) A Punishment time utility function

These two functions of real time systems are connected to each task.

**3. Prior Work**

Various advancement has been achieved in real time operating system. The main focus of scheduling is on: to upgrade execution.The nature of the administration is being increased by keeping the employees productivity and the cost of execution is being decreased. Real time systems are used widely these days and this technology is increasing day by day to in various fields. The main aim of real time systems is completion of the task within the given deadline which helps to increase the efficiency and decrease the makespan of the schedule. Various approaches have been developed for real time systems and multiprocessor task scheduling and some of them are as follow:-

**Shiyuan Jin, et al [1]** proposed a comparison with realistic assumption of two linear algebra problems i.e. decomposition and gauss Jordan elimination [1]. These calculations are normally parallelizable and they have highinformationreliances. The paper includes the comparison of nine scheduling algorithm for multi processor task scheduling with communication delay. The smallplanning time and shortestmakespan of the schedule is given by Duplication Scheduling algorithm but it includes expenses occurring by duplication of task on multiple processor. Insertion scheduling Heristic Algorithm gives the adquequation performance and fast scheduling time which are given by one short heruristic algorithm without task duplication. The next group of scheduling algorithm requires a magnitude longer computational time but gives the finerresults with smaller makespanover one short heuristic algorithm. These calculations are based on iterative search and best result is obtained by search and genetic algorithm. These are justified when scheduling is done off line.

**Sunita Dhingra, et al [2]** considered a bicriteria multiprocessor task scheduling problem for parameter optimization of genetics algorithm by central composite design approach of response surface methodology. Considered parameters were crossover, mutation, selection function, crossover probability and population size. They concluded that except selection and crossover function rest three parameters have significant effect on quality of solution.

**Andrew J. Page and Thomas J. Naughton[3]** have given a scheduling algorithm to schedule heterogeneous tasks onto heterogeneous processor in a distributed computing system and these gives the efficient schedules and changes according to the different resources availability. Hence algorithm proposed uses processor more efficiently than genetics algorithm and is better suited for real world uses. It is more suited because of the use of the properties like changing communication cost and accessing different processors of the distributed system which other processors do not consider for task scheduling algorithm.

**Clifford W. Mercer [4]** compared the real time systems with non- real tme systems. In this paper various types of application-level real-time requirements and several scheduling algorithm are proposed to schedule real time activities and these used different implications for design and development ,system operations and maintaince.

**Will C. Meilander, et al [5]** considered scheduling and performance predictability in command and control world and used the dynamic scheduling algorithm. In this paper Air Traffic Control system is analysed which shows that scheduling is traceable which means that it has polynomial time solution.

**Sunita Dhingra, et al [6]** Considered a comparative analysis of heuristics for multiprocessor task scheduling with homogeneous processors. The heuristics considered for comparison are based on makespan and total completion time of the schedule. The performance measure i.e. makespan&total completion time shows proper load balancing and effective system utilisation. For the best solution according to there performance measure there should be trade off between the heuristics. The comparative analysis has been

done by performance index(PI) with the communication cost of the processors. The comparative results show that Insertion Scheduling Heuristic and Earliest Time First provide best result as compared to other algorithm. Earliest Time First uses the minimum number of processors and gives the best trade off result for maximum number of the task scheduling problems.

**A.Burns [7]** reviewed the results in the application of scheduling theory to hard real time systems. The paper includes a discussion of reviews, protocols and issues. They discussed that the complexity is NP-Hard. The complexities considerations indicates the feasibility of scheduling and are the following aspects of realistic hard real time: ensuring that both periodic and non-periodic real time processes on same processor, non-critical processors makes the use of spare time, static allocation of processes should be analysed and in response to changing environment condition and local overload there should be migration of processes.

**C. L. LIU and James W. Layland[8]**discussed the problems related with multiprogramming in hard real time environment by process control and monitoring. The scheduling algorithm which was optimum among the class of all fixed priority scheduling algorithm was assigned priorities to tasks in a monotonic relation to their request rates and the least upper bound to processor utilisation factor was on the order of 70% for larger task set. The globally optimum and capable of achieving full processor utilisation was shown by dynamic deadline driven scheduling algorithm.

**Walter Cedeno and Phillip Laplante [9]**proposed the applications developed for common platforms with the real time requirement. This paper provide background information to help in getting the real time operating system technical featuresand other nontechnical criteria.

**Mohammad Shokouhifar and Ali Jalali [10]** proposed a new scheduling algorithm artificial bee colony(ABC) for scheduling of soft real time assignments. It is used to reduce the total tardiness, overall active processor and the execution time concurrently. To improve the conjunction of ABC a hybrid neighbourhood search appliance is initiated. This proposed algorithm utilises the fewer processors and results are better than other algorithms(Monnier-GA,Oh-GA,Yoo-GA). The rate of change of processor by this introduced algorithm is more favourable and usefulover other algorithm. New algorithm are being designed using simulated annealing and variable neighbourhood search.

**Wan Yeon Lee [11]** considered a scalability of real time task on multiprocessor system of on line scheduling. They proposed a task scheduling algorithm that make proper use of the features of adaptable task for online and real time planning. This calculation is used for determining the amount of processor to be given for every assignment to keep the system efficient so as to assure the deadline of maximum number ofassignment possible. The processor allocated are small and still satisfies the deadline. When we apply proposed algorithm to the real time assignments that have huge parallelism or small parallel execution, they get low miss ratio. The application based on maximum workload derivatives shows better performances. The supremeoptionfor scalablility of real time tasks of on line scheduling is the Fast MWF-FA algorithm when compared with other algorithm based on EDF.

**Alan Burns and Laurent George[12]** reviewed the previous papers and extended the papers which focuses on different problems. The paper reflects the current research trends in real time computing. These issues includes the scheduling for graphical processing unit, for real time systems the formal verification approaches are desingned, for unrelated processors polynomial time approximations schemes are proposed and for multi phase multi thread parallel scheduling is designed .

**S.Ghosh, R. Melhem and D. Mosse [15]** considered a fault tolerant schedulingon a hard real multiprocessor system. Fault tolerance is used to plannumerous duplicates to different processor and to handle the transient fault a primary approach algorithm is proposed. This algorithm also concludes that completion time of primary is greater than backup. This paper concludes that if sufficient amount of time is being separated than calculation can accept more than one fault. It also concludes that more backup are needed to be scheduled to tolerate 2 simultaneous task.

**Conclusion :-**

Scheduling is process in which each task is being assigned some time interval and work is done in cyclic way. Real time systems are being characterised in two different ways that are hard real time systems where there is strict time constraint and no delay is being accepted. The second real time system is soft real time system in which some delay is being accepted. Priority base work is done. Various algorithm are being designed and implemented for various experiments. Air Traffic control system is controlled using scheduling algorithm which shows that scheduling is traceable. It is tedious and expensive task to evaluate the algorithm in various real time systems. Some more examples will be analysed using real time systems like traffic control system or toll tax traffic control system or in industrial control.

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