Chapter 14

Resource Management in Real Time Distributed System with Security Constraints: A Review

Sarsij Tripathi
Motilal Nehru National Institute of Technology, India

Rama Shankar Yadav
Motilal Nehru National Institute of Technology, India

Ranjivay
Motilal Nehru National Institute of Technology, India

Rajib L. Jana
Motilal Nehru National Institute of Technology, India

ABSTRACT

The world has become a global village. Today applications are developed which require sharing of resources dispersed geographically to fulfill the need of the users. In most cases applications turn out to be time bound thus leading to Real Time Distributed System (RTDS). Online Banking, Online Multimedia Applications, Real Time Databases, and Missile tracking systems are some examples of these types of applications. These applications face many challenges in the present scenario particularly in resource management, load balancing, security, and deadlock. The heterogeneous nature of the system exacerbates the challenges. This paper provides a widespread survey of research work reported in RTDS. This review has covered the work done in the field of resource management, load balancing, deadlock, and security. The challenges involved in tackling these issues is presented and future directions are discussed.

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INTRODUCTION

Today there are applications such as Online trading systems (Ahmed & Vrbsky, 1998), online multimedia applications, power grid distribution systems, etc., which require large amounts of computational resources dispersed geographically and cannot be executed on a single machine. Growing need of large computation intensive and data intensive applications demand sharing of resources particularly processing power geographically dispersed on different machines. Thus giving rise to distributed system where different computing nodes are interconnected with each other to fulfill the need of applications. These distributed systems can be homogeneous (Karatzas & Hilzer, 2003) or heterogeneous (Radulescu & van Gemund, 2000) in nature. These applications which are distributed in nature sometimes require timely completion of task termed as real time distributed system. Online trading systems (Ahmed & Vrbsky, 1998), Online Banking, Online multimedia applications, Real time database system, Medical electronics (Gritzalis, 2004), Aircraft control systems (Abdelzaher et al., 2000), Scientific parallel computing (Connolly & Chien, 2002), Missile Tracking system (Mahafza et al.,1998), Power grid distribution system are examples of such type of applications which are growing very rapidly. These applications are distributed in nature and also require that they should adhere by the timing constraints imposed by application in form of deadline. For example, in an online multimedia applications which is used to view video online, let’s say, of a live Football match, needs to transfer data (video and audio) within stipulated time otherwise the recipients will receive degradation in quality of received data (overlapping of video frames or voice overlapping). These applications are termed as soft real time applications where deadline miss of task degrades the application performance.

A Hard real time system e.g., missile tracking system, the deadline miss can cause catastrophic results which can be fatal sometimes e.g., lateness in tracking enemies’ missiles. Another example could be flight control system (Liden, 1995) of fighter plane. In this system all the flight control tasks—including Guidance, Slow Navigation, Fast Navigation, Controller, and Missile Control—need to be executed in real-time to meet their deadlines. These five tasks are defined as follows: The “Guidance” task sets the reference trajectory of the aircraft in terms of altitude and heading; the “Controller” is responsible for executing the closed-loop control functions that deal with commands; the two “Navigation” tasks read sensor values distinguished by the required update frequency; and, finally, the “Missile Control” task is responsible for reading radar and firing missiles. These separate tasks are mandatory to control the aircraft during flight and they are all cyclic tasks with multiple versions. Deadline miss of any task can be fatal.

RTDS applications utilize the inherent features of distributed system such as resource sharing, openness, concurrency and scalability. To achieve RTDS applications requirements it is needed to organize, move, visualize and analyze massive amounts of data from different geographical locations, as well as employing large-scale computation. There are many challenges while fulfilling the requirements of RTDS. The most prior consideration is meeting deadline. The resources are dispersed and needed to be allocated fairly. The load in the system should be managed fairly and maximum system utilization should be achieved. However, due to openness of distributed system the applications are prone to attack thus application requires protection in terms of security and privacy of data. The different computing environment (heterogeneous) imposes another difficulty due to timing constraints because the mapping of execution time of task, security overhead, communication overhead etc. will differ from one node to another in heterogeneous environment. The solution of above discussed challenges required to
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