CHAPTER 1  INTRODUCTION

1.1 Overview

A distributed computing architecture is an enthusiastic area of research. It has been projected by a researcher and scientist form diverse areas of computer science and technology. The distributed shared memory architecture represents an efficient contribution of two parallel modules are geographically separated system and shared memory multiple processors (1). They represent virtual shared memory abstraction in distributed environment with distributed physical location and resulting association, which is a result of both implementations. The technique of distributed shared memory (DSM) is accepted as one of the most advanced investigation area for building high performance, complete multicomputer systems. Below in Fig. 1.1 shows an abstract outlook of distributed shared memory architecture.

**Figure 1.1 Abstract view of Distributed Shared Memory (1)**

To build such kind of multiple computer shared memory structure, its underlying hardware and/or software must move shared data contents between different sites in a way that provides an illusion of one global virtual address space. A DSM system can be created using hardware and software techniques for multiple processors framework based on the data unit reside in the shared memory module and other constraints described subsequently. It is better to build distributed shared memory mechanism in software because the sharing of
shared region contents becomes a problem which has to be smoothly managed in the program, but, not in hardware mechanism as in multiple computer system (2). A programming of software based DSM can be classified to several constraints, but mode to select based on a specific area of research is, it should overcome shortcoming of traditional systems and provide new way. A several research has been done at district point of view to project system more effective, but require to don more effort to prepare system widely useful. Several developments are done with an object oriented language based on GUI specific platforms. Many distributed shared memory architecture has projected in literature based on different constraints are acceptable at some level of its advantages. Since, message communication structure are simple to program and scale is more complex to implement. To this point, message passing paradigm and the shared memory framework are at par. One of the probable resolutions to parallel computer transfer is distributed shared memory which can be aimed after clear understanding of the requirement and its environmental need.

1.2 Challenges of DSM

There are many challenges to distributed shared memory design. A few of probable challenges for distributed shared memory design are primarily (1-2).

To preserve track of the location of data: As the distributed shared memory creates an illusion of logical address space. So, data are stored, distributed locally and remotely. It is very important to keep track location of all data stored in virtual shared memory.

Distributed algorithm: A DSM algorithm extends local virtual address spaces (local memory of the node) to extent multiple sites coupled with a local area network. It is also responsible for managing database transactions between the multiple process or site.

Memory access method: Memory access can be done by MMU, operating system or language run time library. It is required to take care while selecting the proper method that will affect performance measures of the system.

Implementation level: The extent to which DSM approach is applied is most significant resolutions in the construction of a shared memory system because
it touches individual software design and whole design production and expense.

**Data consistency:** There may be more than one copy of specific data in the system. It should require to make all copy consistent after every read or write otherwise the database may fall in inconsistent state which gives incorrect results.

**Data format:** The scope of, a data element consists in the global shared memory (DSM) is essential to organize virtual shared space. This is an essential resolution, which fundamentally administrates the implementation of a memory.

**Environment support:** There may be homogeneous or heterogeneous environment support. For heterogeneous architecture is more complicated to manage because different site may have different schemas and architecture. The heterogeneous site may autonomous and may provide only limited facilities for cooperation between multiple computers unlike homogeneous environment.

A distributed shared memory machines can be implemented with different techniques were shared distributed memory play main role in a distributed environment. In this thesis, the focus is about a novel method of programming with software constraints of the shared memory design. So, shared memory implementing requires the careful evolution of numerous design issues such as collaboration with shared data by site, data organization, consistency model and algorithm, protocols, scheduling etc.

![Diagram of Virtual DSM layer over Local Memories](image)

**Figure 1.2 Diagram of Virtual DSM layer over Local Memories**
It involves complex phases in core construction and near relationship amongst virtual address management and mechanism that make distributed shared memory probable. Fig. 1.2 shows an internal architectural configuration inside software layer of the distributed memory controller. Latency plays a significant character when shopping the shared memory protocol. This research utilizes a sequent consistency model which is robust methodology that acquirable when there is delay in transmission over the network. The inspiration for this programming was to develop with granularity as shared variable and data structure, its algorithm, memory controller concept and definite disputes, kernel programming, protocol and interprocess conversation involved. The objective has been achieved to make design improvement, performance and reliability for moderate scaled structure.

1.3 Motivation

In spite of current new processor design, user still requires more performance. Ultimately, one CPU role gives new direction to multiple processors running in parallel. It is a very good ideal to run 10 inexpensive computers to run in parallel instead to buy new 10 time faster machine. This variation is appreciated and practicable at some extent in the subsystems like bus mastering drive controllers. However, the necessity for surplus computing power needed thus far depend on advances in CPU expertise. In the multiple processor environment, there are basically two categories of communication models: message passing and shared memory. From a computer scientist’s perception, shared address machines simpler to program and complicated to implement which are not scalable beyond a limited number of computers.

So, message passing system easy to develop and extend, but difficult to program. At some extent message passing and shared memory method are equal. But, better resolutions to parallel system statement is distributed shared memory (DSM) where the system component that allows machines with no physical shared memory to share a single virtual address space. The DSM gives the impression as single shared memory to its user, but rest on message passing underlying autonomous CPUs to perform execution within the logical address space. There are several benefits like easier to design and implement parallel algorithms, easier to share data by reference, amortizes access to
remote data by exploiting locality of reference, cheaper than shared physical memory multiprocessor systems, huge physical memory available to all nodes, the data bus is not a bottleneck, a program written for shared memory multiprocessors can run on DSM. So, there various advantages to program distributed shared memory system where smaller or moderate no of computers. This can be very useful in various distributed to incorporate with various distributed applications.

1.4 Objectives

The complete objective is to investigate and develop an effective methodology for distributed shared memory (DSM) mechanism incorporating software based approach. The sub aims are described as below.

a. To learn and perform analysis of conventional techniques for distributed shared memory, data handling behavior and its influence on distributed architectures.
b. To develop a novel logical memory structure with acceptable constraints which will eliminate shortcomings of existing systems.
c. To study and investigate suitable data format of shared region and latency of DSM protocol. An Implementation of properties and behavior of DSM algorithm.
d. Evaluate and comparison of constraints used by existing and proposed distributed shared memory strategy.

1.5 Applications of Distributed Shared Memory

There are many areas where we can find the applications of the distributed shared memory for shared data management. In the recent era, the distributed shared memory system handles many challenging issues due to these, there are many opportunities to use the distributed shared memory in many domains.

Smart applications: The rapid growth in technology and wide use of internet has increased smart applications such as intelligent transportation control system and internet of things which heavily rely on an efficient and reliable distributed database network. It benefits various smart applications that use distributed shared memory network for data analytics and services.
**Information system:** Distributed information systems represent an increasingly important trend to computer users. Distributed processing is often accompanied by the materialization of a distributed database over distributed shared memory network. A distributed database exists when the data elements stored at multiple locations are interrelated or if a process executed at one location requires access to data stored at another location. Very useful for medical, agriculture and industries etc.

**Hypermedia:** By a hypertext or hypermedia application, it is meant a precise network of interconnected distributed computers. Usually system is used to mean an instrument which can be used to create applications. Distributed shared memory system used for data analysis of users.

**Distributed games:** The DSM systems are useful for networked games evolving from small 4-8 person, one time play games to large scale games involving thousands of participants and persistent game worlds.

**Distributed applications:** One of the most used DSM application is within distributed applications (distributed apps) are applications or software that runs on multiple computers within a network at the same time and can be stored on servers or with cloud computing. Some examples are like distributed university system, airline ticket booking systems, industrial control systems and scientific computing etc.

**Weather forecasting:** The distributed shared memory is also used in weather forecasting which predict the conditions of the atmosphere for a given location and time. There are a variety of end uses to weather forecasts. Weather warnings are important forecasts because they are used to protect life and property. Forecasts based on temperature and precipitation are important to agriculture and therefore to traders within commodity markets.

**1.6 Organization of the Thesis**

The contents of the thesis are organized as follows. Chapter one presents introduction of a distributed shared memory system, design challenges, motivation, objectives of research and its applications. Chapter two presents a review of the literature on distributed networks, methods for handling distributed database and review on distributed shared memory design issues. Chapter
three presents a DSM implementation methodology of recent era based on system requirement and its comparative study. In chapter four few standard a distributed shared memory systems like IVY, Mirage, Clouds, Munin, Mermaid, Midway, TreadMarks Orca, Linda, JIAJIA and my own system used for experimental purpose and comparison with proposed architecture is presented. Chapter five is on new investigated architecture for distributed shared memory design have been presented for overcoming the shortcomings of traditional approaches. The system architecture, memory controller, distributed algorithms, data granularity is discussed for shared memory architecture. Also, global naming is presented for unique global naming for different data items and consistency model has been presented. Chapter six focused on the implementation results. This chapter presents how distributed shared memory design parameter selection make an impact on DSM design for distributed environments. The various comparisons of existing and proposed techniques have been presented. Finally, in chapter seven, the contributions made in the thesis are summarized and the scope of further enhancements is outlined.