Introduction to process management: process migration

Main goal of process management in DS is to make best possible use of existing resources by providing mechanism and policies for sharing them among processors

This achieve by providing :

Process allocation : decide which process should assign to which node in any instance of time for better utilization of resources .

Process migration : move process to new node for better utilization of resources

Thread facilities : provide mechanism for parallelism for better utilization of processor capabilities

Process Migration

Relocation of a process from its current location to another node

Process may be migrated

- Either before it start executing on its source code: non-preemptive process migration
- During the course of its execution: preemptive process migration

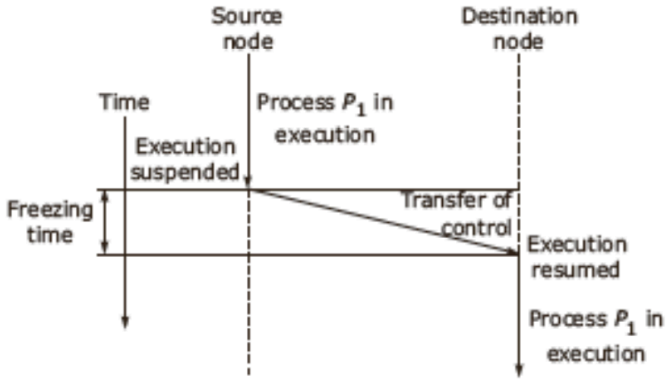
Desirable features of a good process migration

- Efficiency:
  - Issues
    - Time required to migrate process
    - Cost of locating the object
    - Cost of supporting remote execution once the process is migrated
- Robustness :
  - Failure of any other node should not affect the accessibility or execution of the process
- Ability to communicate between co processes of the job:
  - Communication directly possible irrespective of location

Flow of execution of migration of process

Process migration is the relocation of a process from its source node to another destination node.

The way a process migrates from one node to another is shown in the figure below.



Process migration mechanism

A process can either be migrated before it starts execution on its source node which is called a non-preemptive process or during the course of its execution that is known as preemptive process migration.

Preemptive process migration is more costly compared to non-preemptive because the process environment must accompany the process to its new node.

Steps involved in process migration:

i. Process is selected for migration.

ii. Select the destination node for the process to be migrated.

iii. Transfer of selected process to the destination node.

Migration policy is responsible for the first two steps while the third step is handled by the migration mechanism.

Migration of a process is complex that involves handling various activities to meet the

requirements for a good process migration.

The sub activities involved are:

i. Freezing the process on its source node and restarting it on destination node

ii. Transferring the processes address space from restarting from its source to destination node.

iii. Forwarding messages meant for the migrant process.

iv. Handling communication between processes that have been placed at different nodes.

A preemptive process migration facility allows the transfer of an executing process from one node to another. On the other hand, in a system supporting only non-preemptive migration facilities, a process can only be transferred prior to beginning its execution.

Preemptive process migration is costlier than non-preemptive process migration since the process state, which must accompany the process to its new node, becomes much more complex after execution begins.

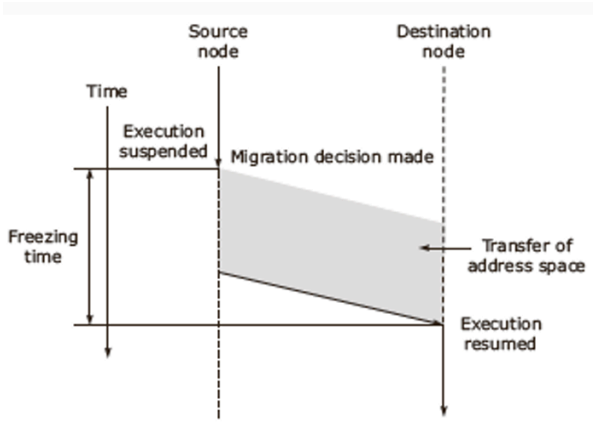
Mechanisms for Address Space Transfer

1. Total Freezing
2. Pre-Transferring
3. Transfer on reference

Total Freezing

Process's execution is stopped while transferring the address space

Disadvantage that process may be suspended for a long time



Total freezing mechanism

Pre-Transferring

Address space transferred while the process is running on the source node.

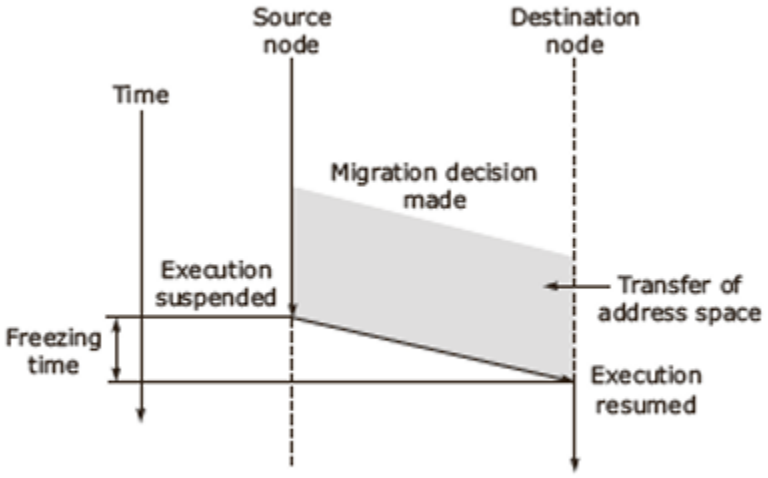
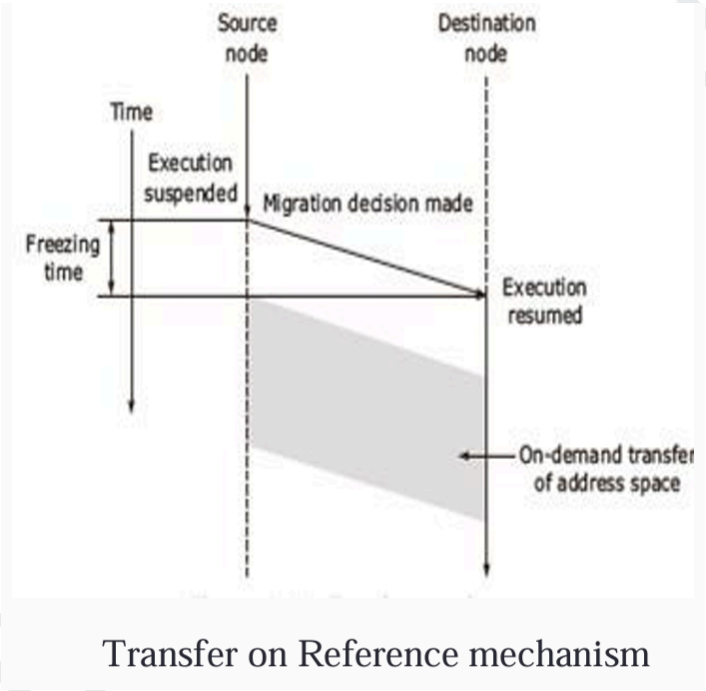


Figure 6-18 Pretransfer

Address space transferred while the process is running on the source node. After a decision for migration is made the process continues to execute on the source node until address space has

been transferred. Initially the entire address space is transferred followed by repeated transfers of pages modified during previous transfer so on until no reduction in number of pages is achieved. The remaining pages are transferred after the process is frozen for transferring its state info. Freezing time is reduced. Migration time may increase due to the possibility of redundant transfer of the same pages as they become dirty while pretransfer is being done.

Transfer or Reference



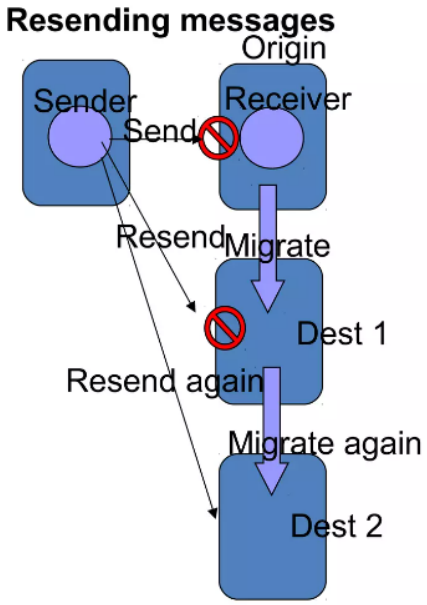
Transfer on Reference mechanism

- Process executes on destination
- Address space is left behind in source node
- Desired blocks are copied from remote locations as and when required
- Failure of source node results in failure of process

Messages Forwarding Mechanism

1. Resending Messages
2. Ask Origin Site
3. Link Traversal
4. Link Update

Resending Messages

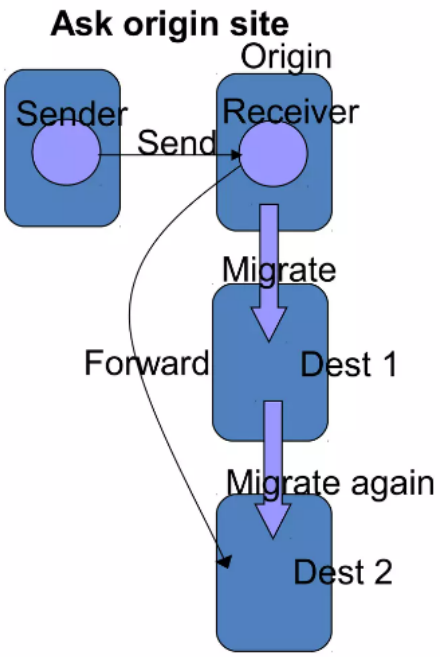


Messages are returned to the sender as not deliverable or are simply dropped, with the assurance that the sender of the message is storing a copy of the data and is prepared to retransmit it.

Disadvantage:

The message forwarding mechanism of process migration operation is non transparent to the processes interacting with the migrant process.

Ask Origin Site

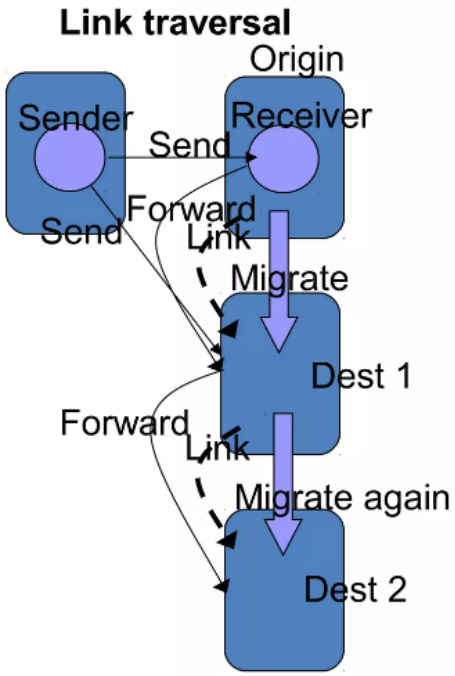


Each site is responsible for keeping information about the current locations of all the processes created on it. Messages for a particular process are always first sent to its origin site. The origin site then forwards the message to the process's current location.

Disadvantage:

Failure of the origin site will disrupt the message forwarding mechanism.

Link Traversal

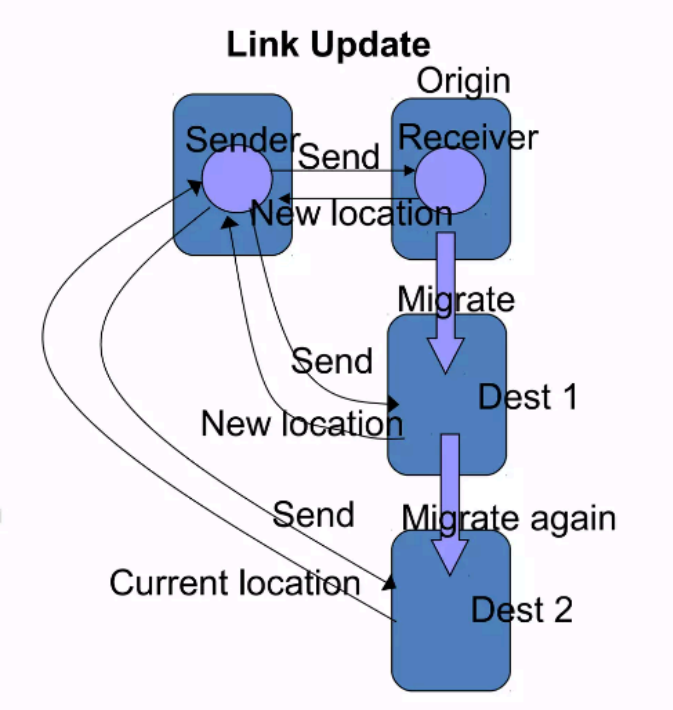


To redirect messages, a message queue for the migrant process is created on its source node. A forwarding address known as link is left at the source node pointing to the destination of the migrant process. Components of link, one is a unique process identifier and second is last known location.

Disadvantage:

Several links may have to be traversed to locate a process from a node and if any node in the chain of link fails, the process cannot be located.

Link Update



Tells the new address of each link held by the migrant process. Acknowledged for synchronization purposes.