Data Structure

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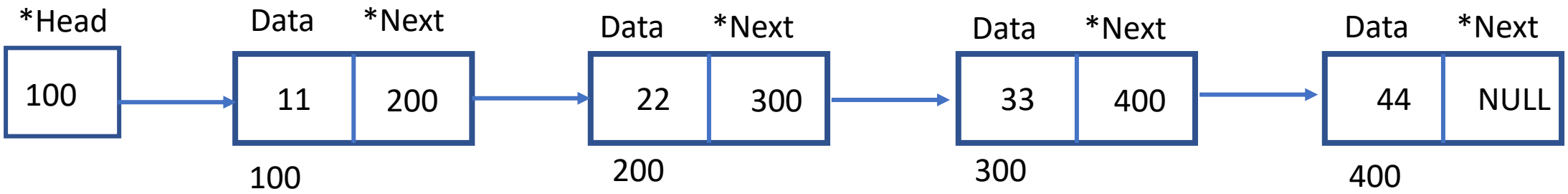
Linked List - Introduction :

- Like Arrays , Linked List is a LINEAR DATA STRUCTURE.
- But unlike arrays, Linked Lists are NOT stored in contiguous memory locations.
- The items in the linked lists are connected to one another using pointers.
- These items are called as NODES.
- Each node contains 2 parts :
  - Data part : it contains actual data (primitive or non-primitive data).
  - Next part : it is a pointer which contains the address of the next node.
- Address of the first node is stored in the Head pointer.



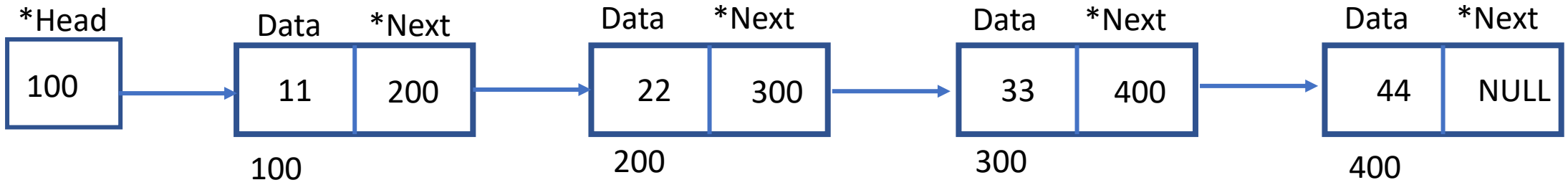
Linked Lists :

- Why Linked List ?
  - Linked Lists are dynamically allocated as and when required and released after it serves its purpose. so unlike arrays they can grow or shrink in size at runtime.
  - Adding or deleting an item in a linked list is much efficient and easier compared to arrays.

- Types of Linked Lists :
  1. Singly Linear Linked List
  2. Singly Circular Linked List
  3. Doubly Linear Linked List
  4. Doubly Circular Linked List

Singly Linear Linked List :

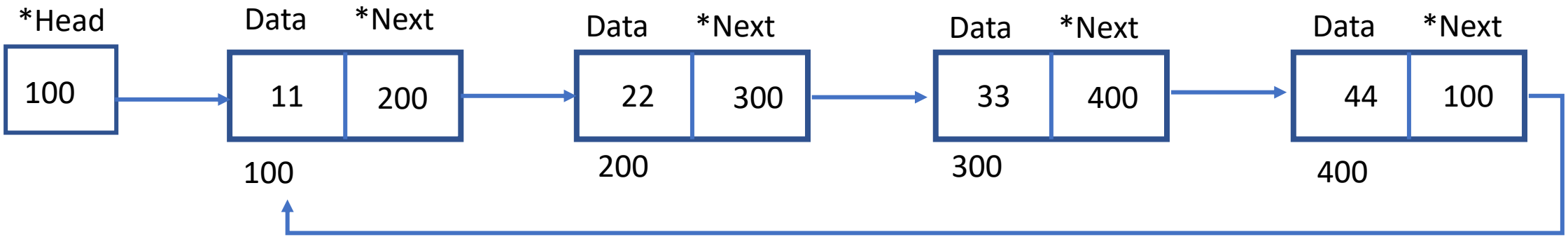
- This linked list is also called as simple linked list.
- It is a type of linked list in which the list can be traversed only in one direction.
- In this, the pointer of each node points to other nodes whereas the pointer of last node contains NULL.
- Address of first node is stored in the Head pointer.



- Operations performed on linked list :
  - Add node at first position
  - Add node at last position
  - Add node at specific position
  - Delete node at first position
  - Delete node at last position
  - Delete node at specific position
  - Traverse the list

Singly Circular Linked List :

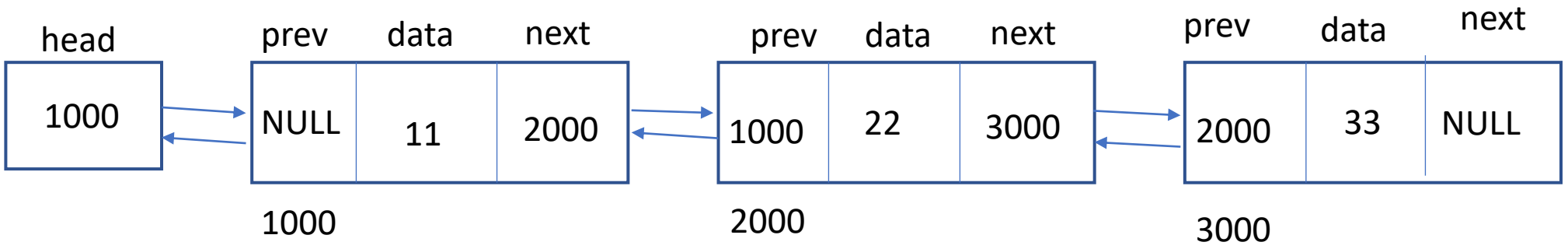
- In this list the last node is linked to the first node. The address of first node is stored in the pointer of the last node.



- Limitations :
  - It is considered as the most inefficient linked list as the add and delete operations on first position also require the traversal till last node to update the pointer.
  - We can traverse only in forward direction.
  - All the operations on this list require O(n) time.

Doubly Linear Linked List :

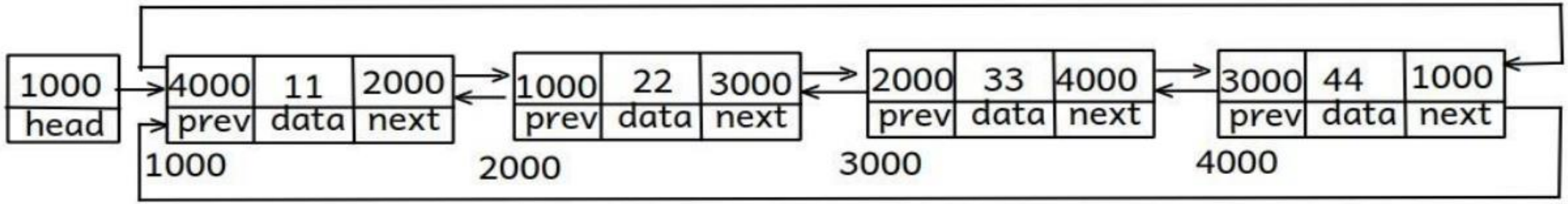
- It is a linked list in which head always contains an address of first element, if list is not empty.
- Each node has three parts:
  - data part: contains data of any primitive/non-primitive type.
  - pointer part(next): contains an address of its next element/node.
  - pointer part(prev): contains an address of its previous element/node.
- next part of last node & prev part of first node point to NULL.



- Limitations :
  - Add last and delete last operations are not efficient as it takes O(n) time.
  - We can starts traversal only from first node, and hence to overcome these limitations Doubly Circular Linked List has been designed.

Doubly Circular Linked List :

- It is a linked list in which head always contains an address of first node, if list is not empty.
- each node has three parts:
  - data part: contains data of any primitive/non-primitive type.
  - pointer part(next): contains an address of its next element/node.
  - pointer part(prev): contains an address of its previous element/node.
- next part of last node contains an address of first node & prev part of first node contains an address of last node.



Linked List :

Advantages of Doubly Circular Linked List:

- DCLL can be traverse in forward as well as in a backward direction.

-Add last, add first, delete last & delete first operations are efficient as it takes O(1) time and are convenient as well.

- Traversal can be start either from first node or from last node.

- Any node can be revisited.

- Previous node of any node can be accessed from it

Array v/s Linked List:

- Array is **static** data structure whereas linked list is dynamic data structure.

-Array elements can be accessed by using **random access** method which is efficient than linked list elements which can be accessed by **sequential access** method.

- Addition & Deletion operations are efficient on linked list than on an array.

- Array elements gets stored into the **stack section**, whereas linked list elements gets stored into **heap section.**

-In a linked list extra space is required to maintain link between elements, whereas in an array to maintain link between elements is the job of **compiler**.

Thank You !!