SINGLY LINKED LISTS

Singly Linked List

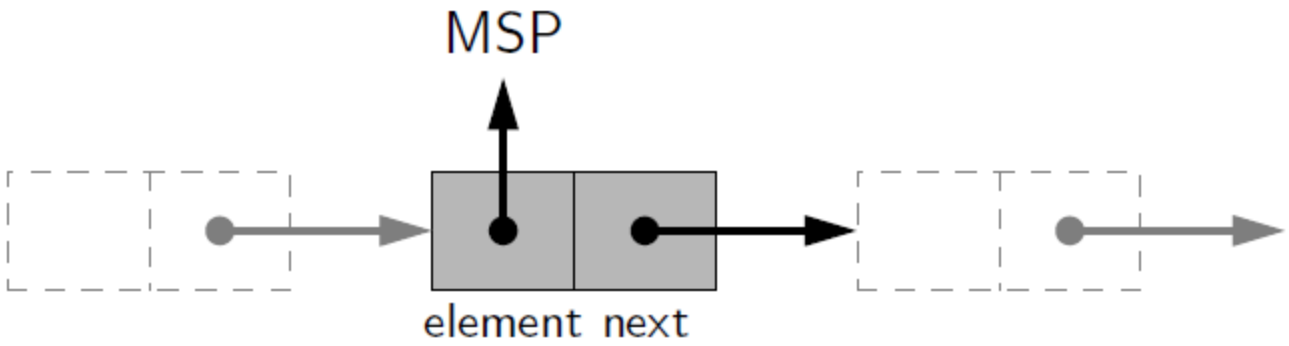
- Singly Linked List Overview
- Adding Elements to List
- Removing Elements from List

Singly Linked Lists

- A ***singly linked list***, in its simplest form, is a collection of ***nodes*** that collectively form a linear sequence.
- Each node stores a reference to an object that is an element of the sequence, as well as a reference to the next node of the list.

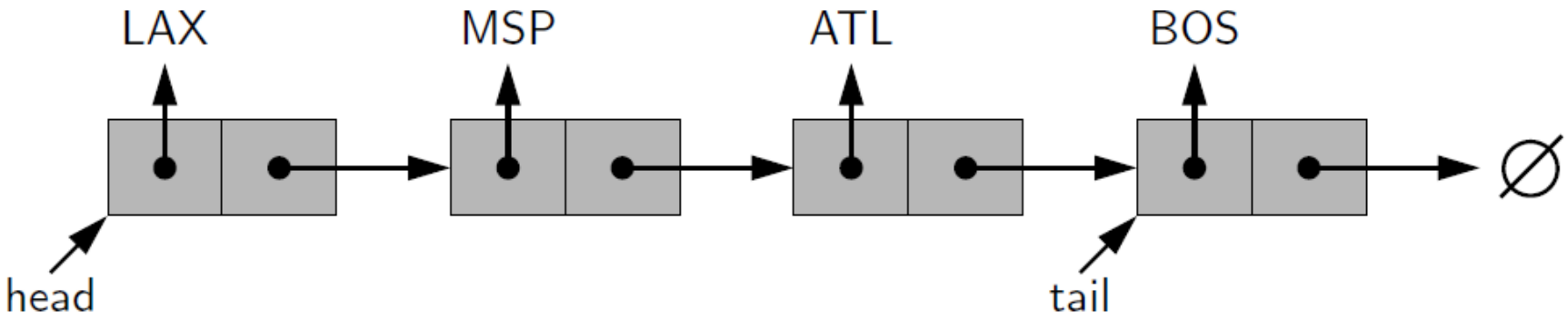
Singly Linked Lists

- Airport codes in example figures.



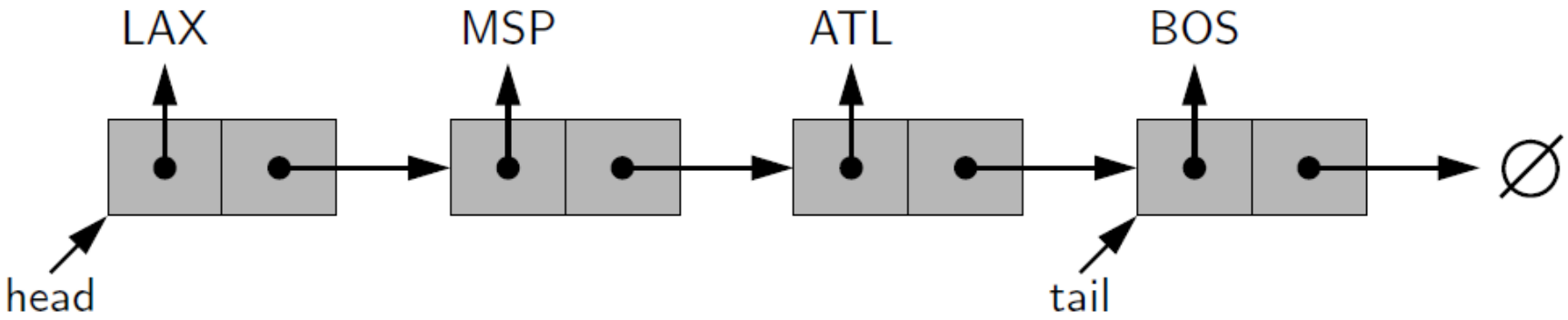
Singly Linked Lists

- The list instance maintains a member named head that identifies the first node of the list.
- In some applications another member named tail that identifies the last node of the list.



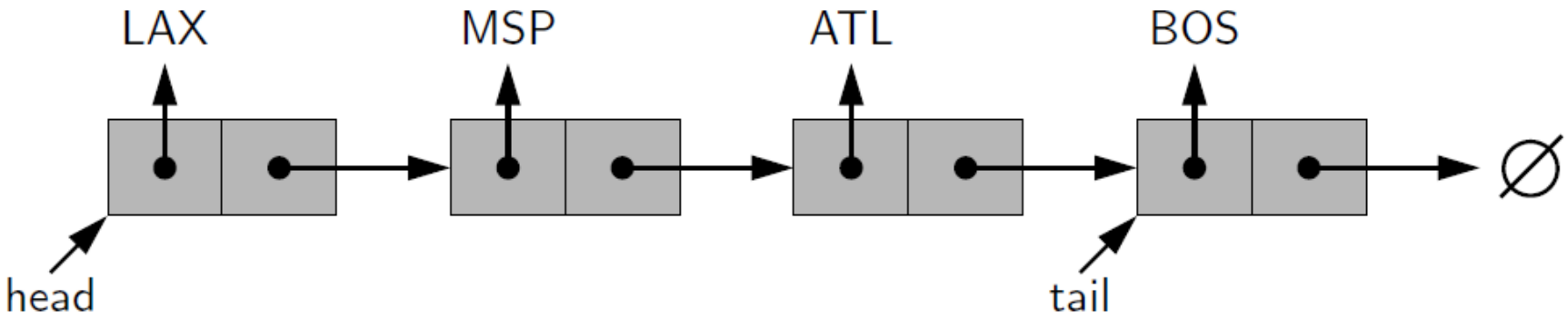
Singly Linked Lists

- The first and last node of a linked list are known as the ***head*** and ***tail*** of the list



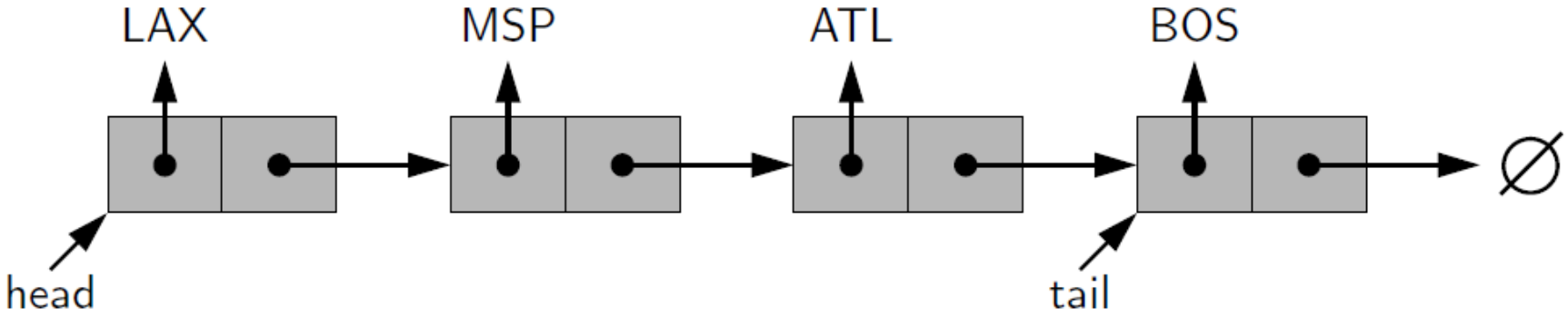
Singly Linked Lists

- We can identify the tail as the node having None as its next reference.
- This process is commonly known as ***traversing*** the linked list.



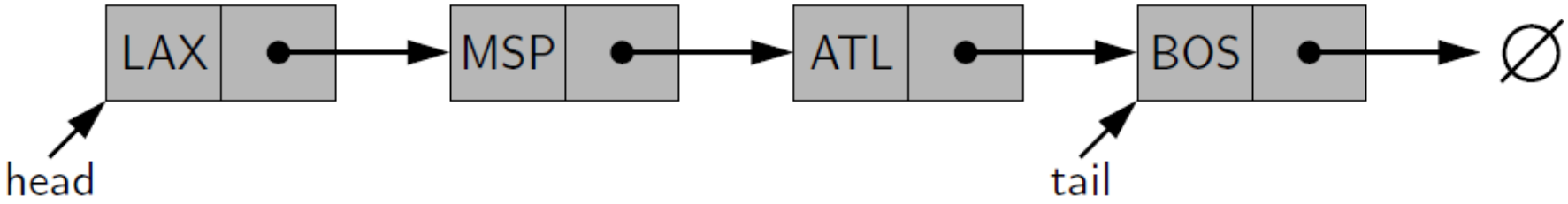
Singly Linked Lists

- Because the next reference of a node can be viewed as a ***link*** or ***pointer*** to another node, the process of traversing a list is also known as ***link hopping*** or ***pointer hopping***.



Singly Linked Lists

- Each node is represented as a unique object, with that instance storing a reference to its element and a reference to the next node (or None)
- Note the change of the diagram for simplicity.

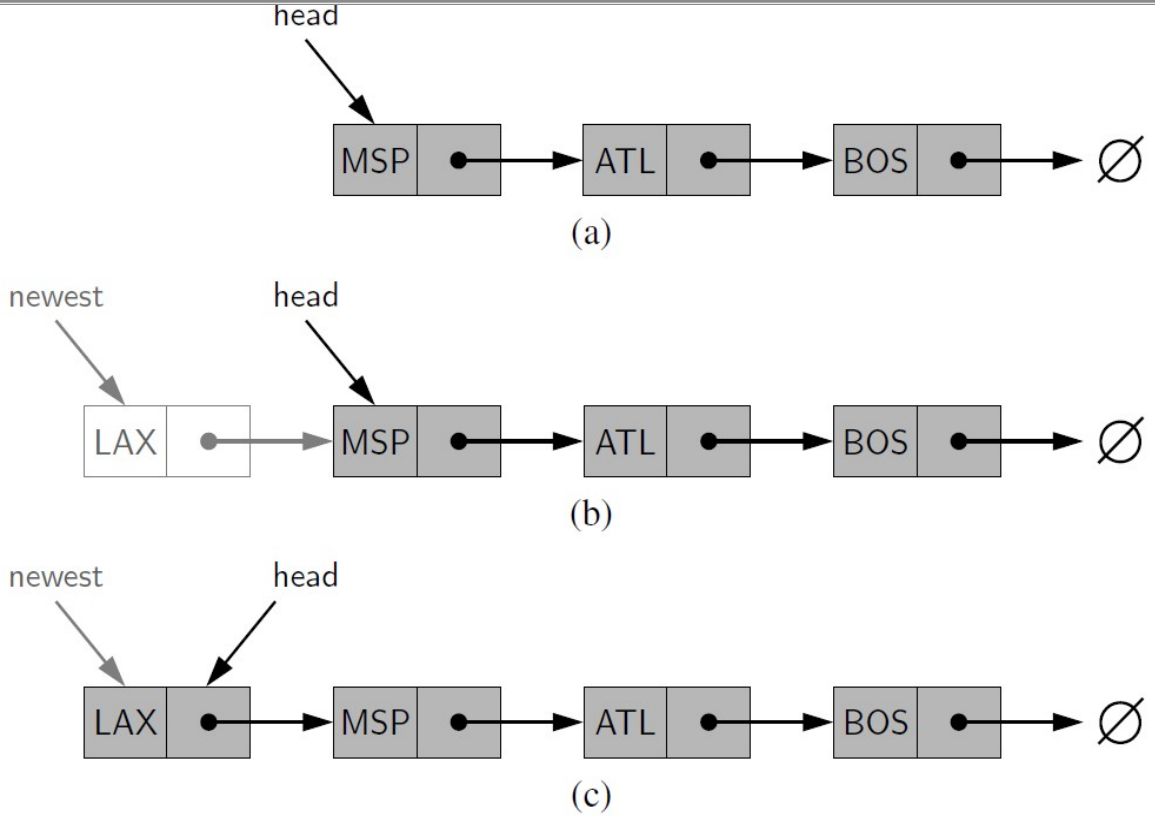


Inserting an Element at the Head of a Singly Linked List

- An important property of a linked list is that it does not have a predetermined fixed size
- It uses space proportionally to its current number of elements.
- To insert a new element at the head of the list:
  - We create a new node
  - Set its element to the new element
  - set its next link to refer to the current head
  - then set the list’s head to point to the new node.

Inserting an Element at the Head of a Singly Linked List

- (a) before the insertion
- (b) after creation of a new node
- (c) after reassignment of the head reference.

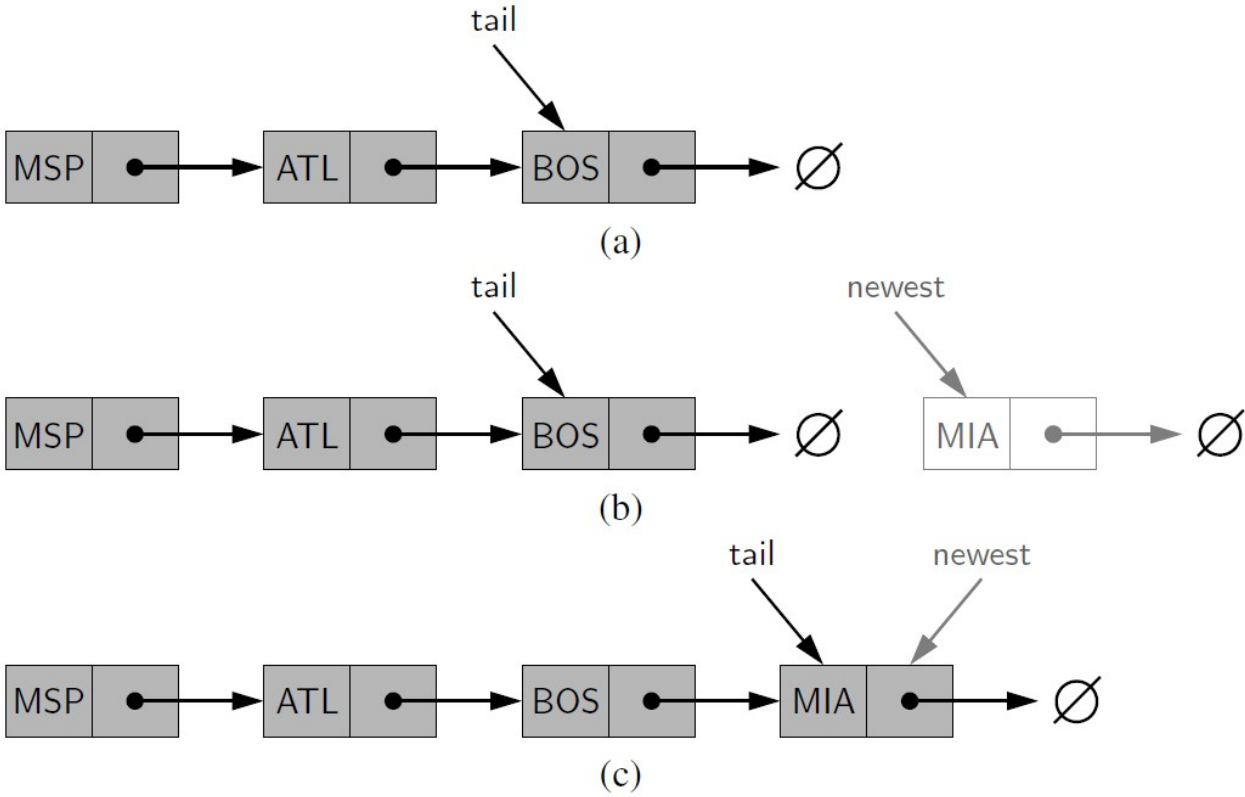


Inserting an Element at the Tail of a Singly Linked List

- We can also easily insert an element at the tail of the list, provided we keep a reference to the tail node
  - Create a new node
  - Assign its next reference to None
  - Set the next reference of the tail to point to this new node
  - Then update the tail reference itself to this new node.

Inserting an Element at the Tail of a Singly Linked List

- (a) before the insertion
- (b) after creation of a new node
- (c) after reassignment of the tail reference.
- Note that we must set the next link of the tail in (b) before we assign the tail variable to point to the new node in (c).

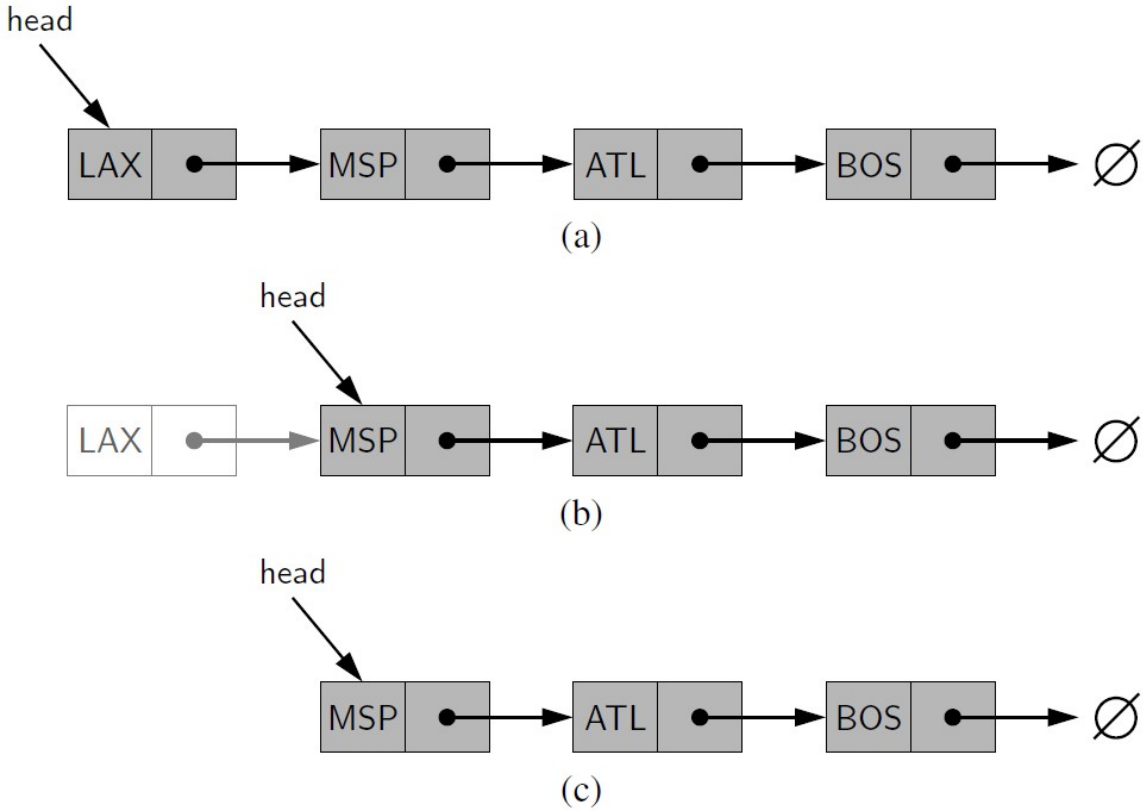


Removing an Element from a Singly Linked List

- Removing an element from the ***head*** of a singly linked list is essentially the reverse operation of inserting a new element at the head.

Removing an Element from a Singly Linked List

- (a) before the removal
- (b) after “linking out” the old head
- (c) final configuration



Removing an Element from a Singly Linked List

- We cannot easily delete the last node of a singly linked list.
- Even if we maintain a tail reference directly to the last node of the list, we must be able to access the node ***before*** the last node in order to remove the last node.
- But we cannot reach the node before the tail by following next links from the tail.
- If we want to support such an operation efficiently, we will need to make our list ***doubly linked***

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Review

- We learned about singly linked lists and how to add and remove elements from them.
- Up next we will implement a Node class an create a Singly Linked list