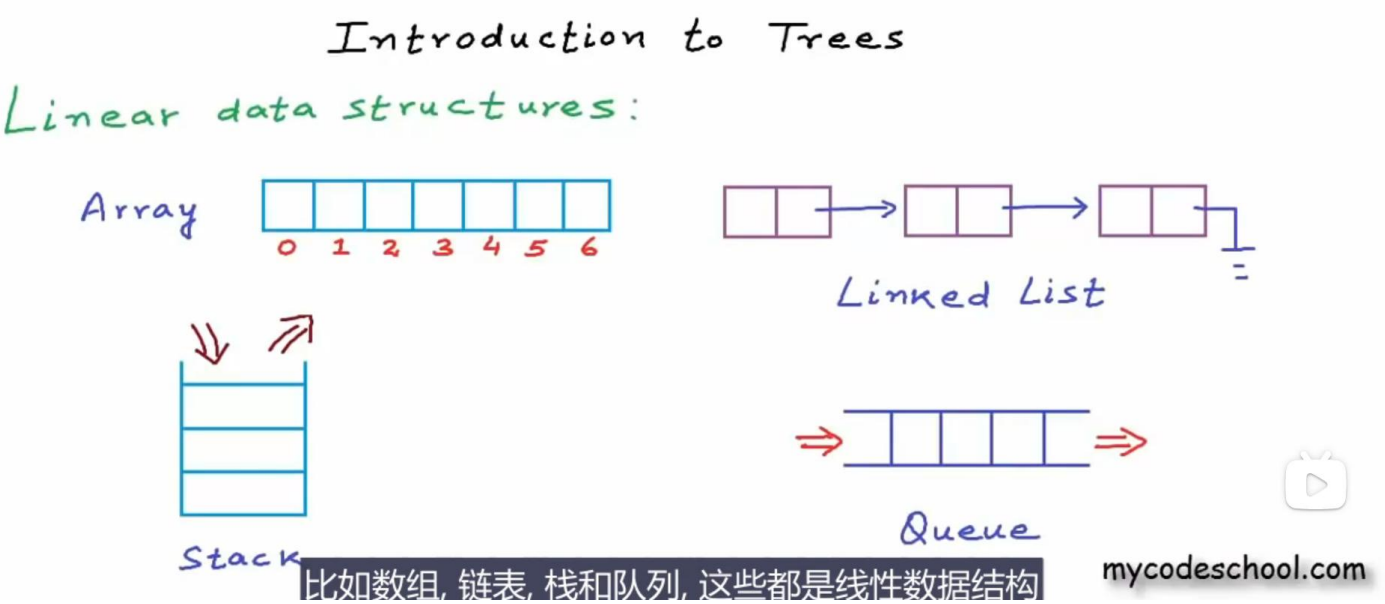
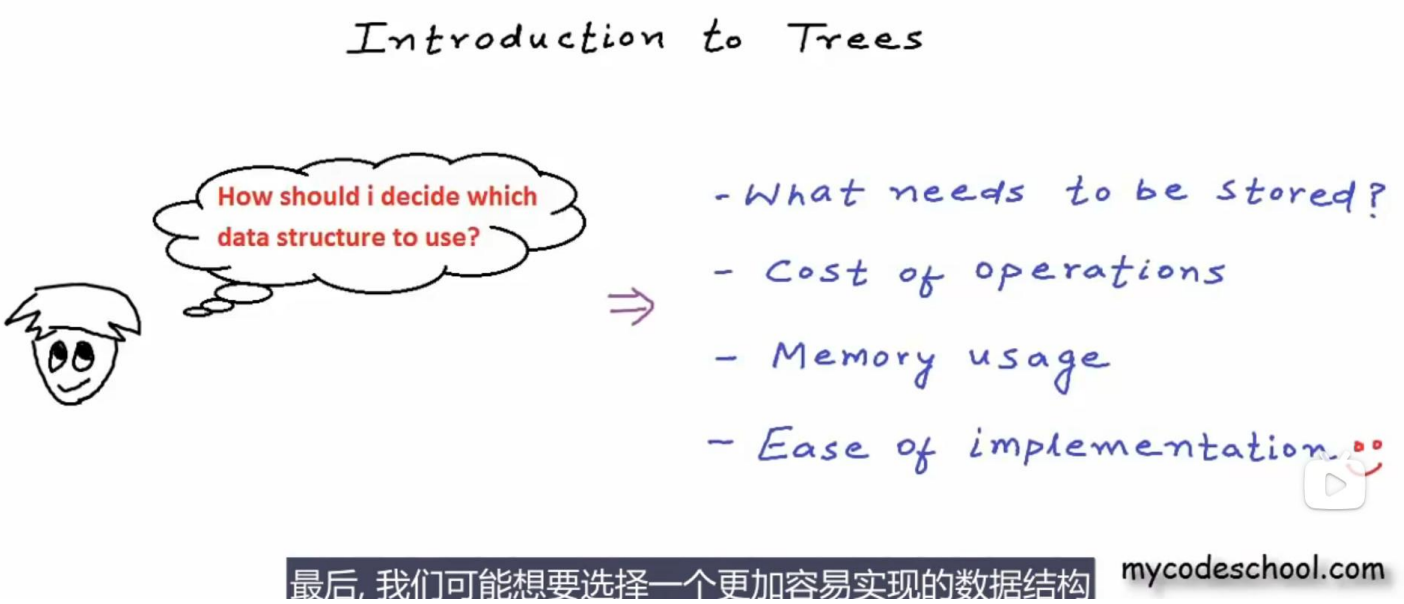
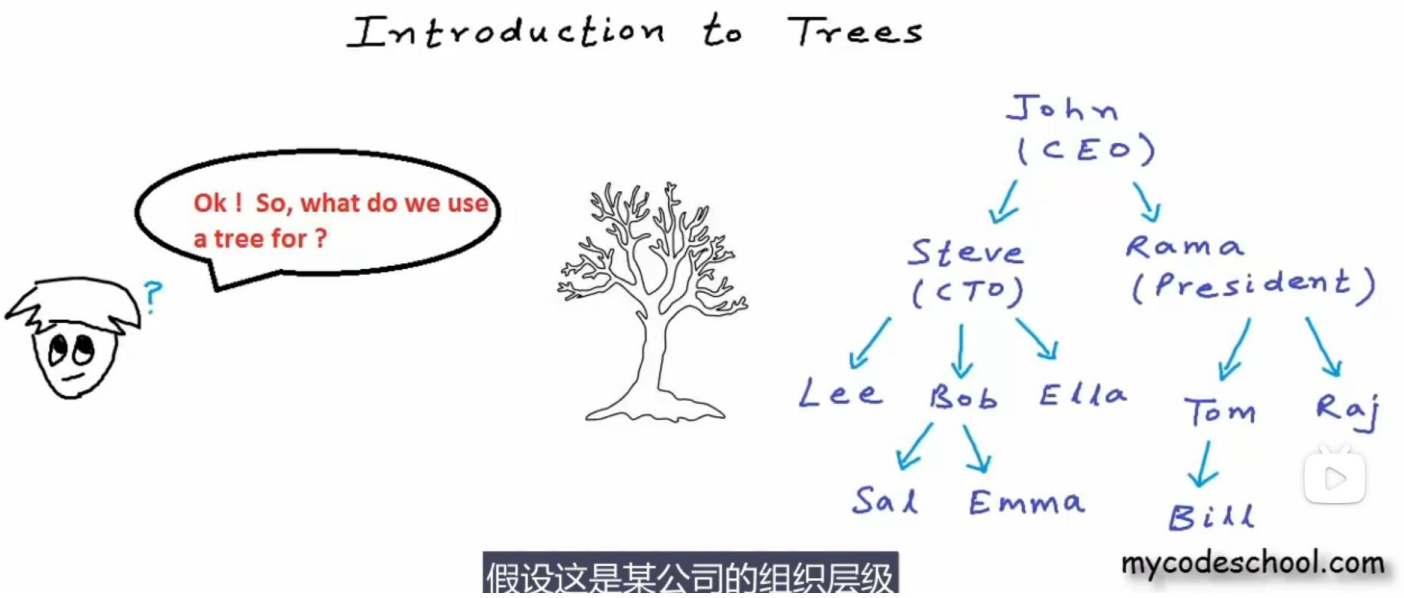
4 Tree（树）

总结：

4.1 树：基本介绍



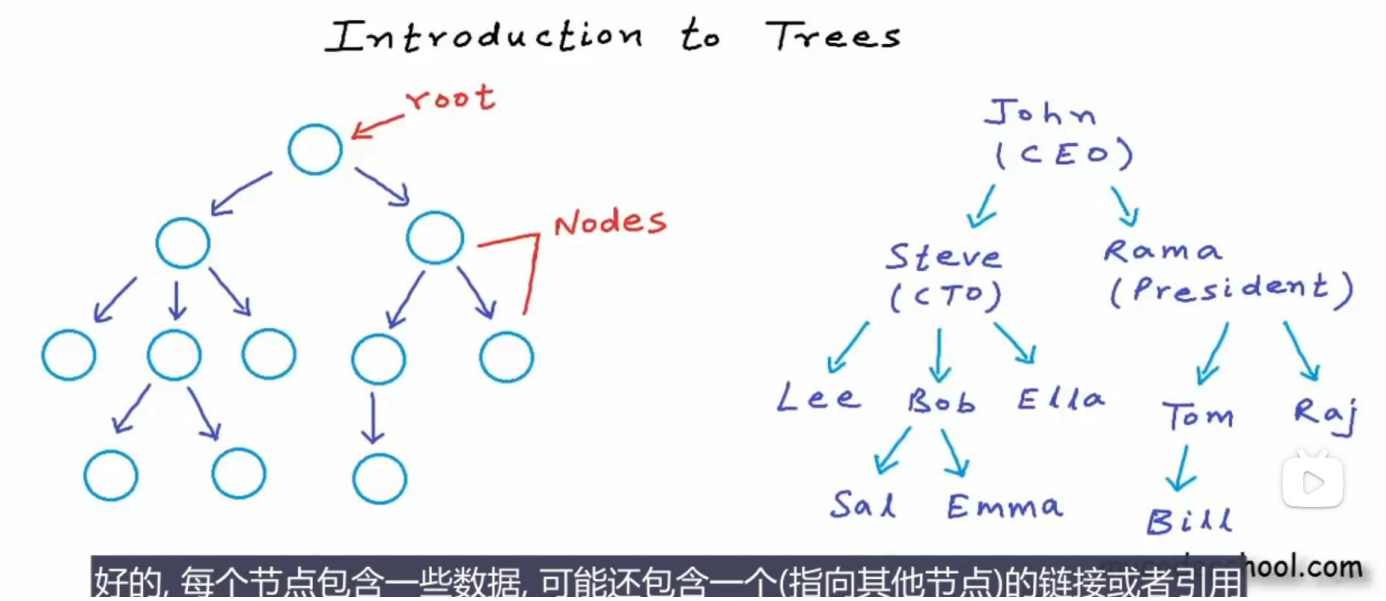




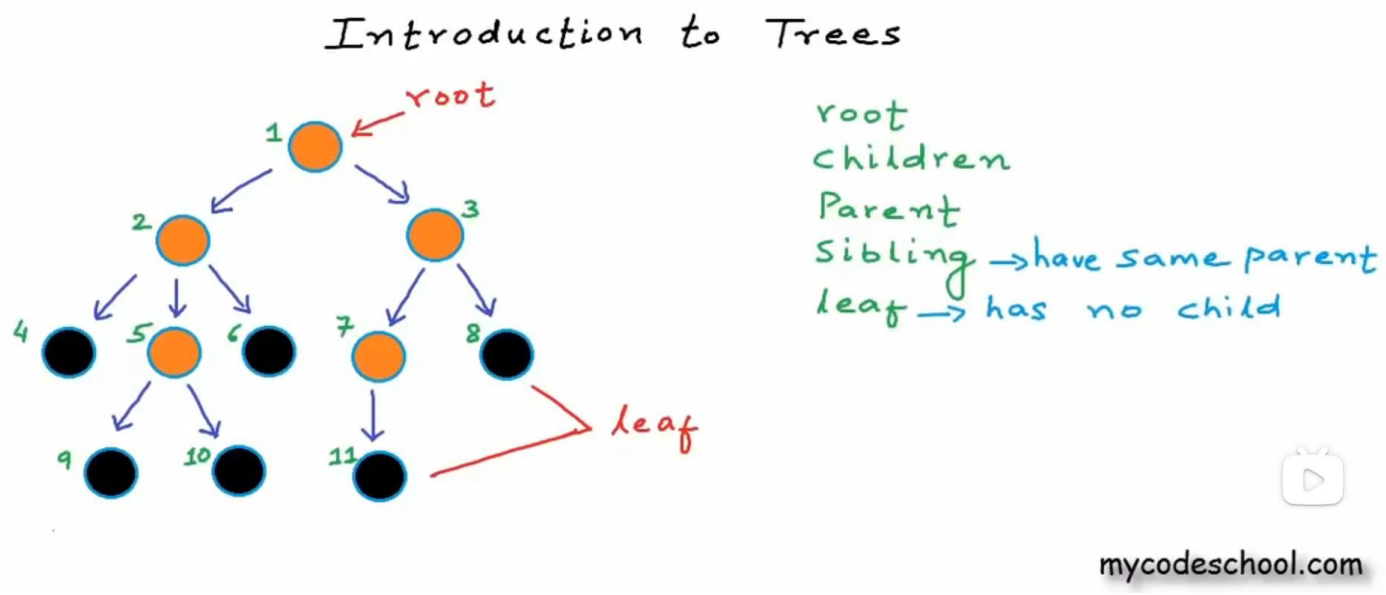
树，是经常用来表示层次数据的一种数据结构，它是一种用来存储和组织天然地具有层级结构的数据的有效方式。但这不是树在计算机科学中的唯一应用。

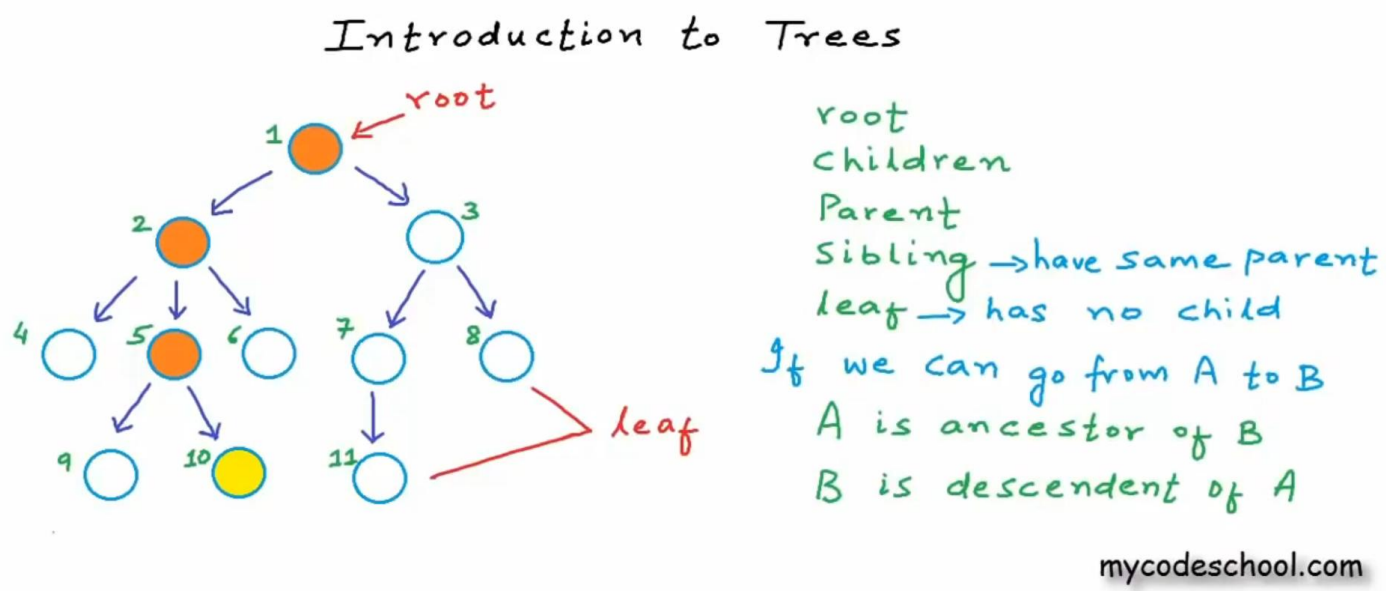
总结：

2.1 基本介绍



树是一种非线性的数据结构，它是一种层级结构。一个节点可能有（指向其它节点的）链接或者引用。子节点。

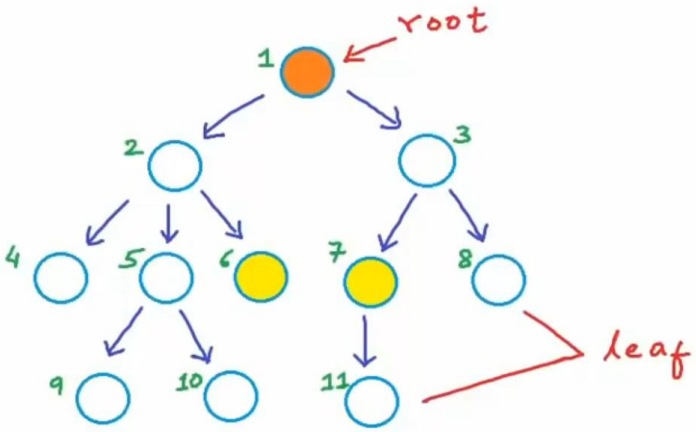




当我们遍历树的时候，只能从一个方向进行。

总结:

Introduction to Trees



root
children
Parent
Sibling → have same parent
leaf → has no child
If we can go from A to B
A is ancestor of B
B is descendent of A

cousins

父母不同但是祖父母相同的节点被称为堂兄弟

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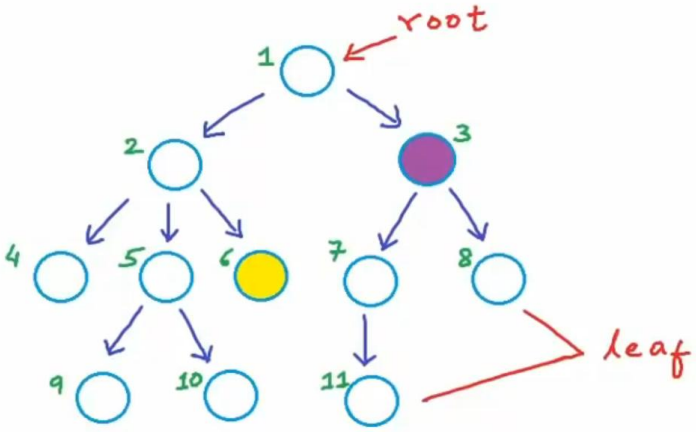
Introduction to Trees



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If we can go from A to B
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我们也可以说节点 3 是 6 的叔叔

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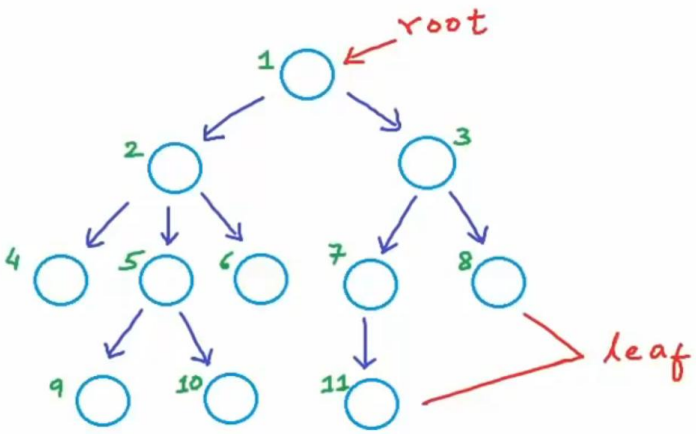
Introduction to Trees



root
children
Parent
Sibling
leaf
ancestor
descendent
cousin

好的，现在我们来讨论一下树的一些属性

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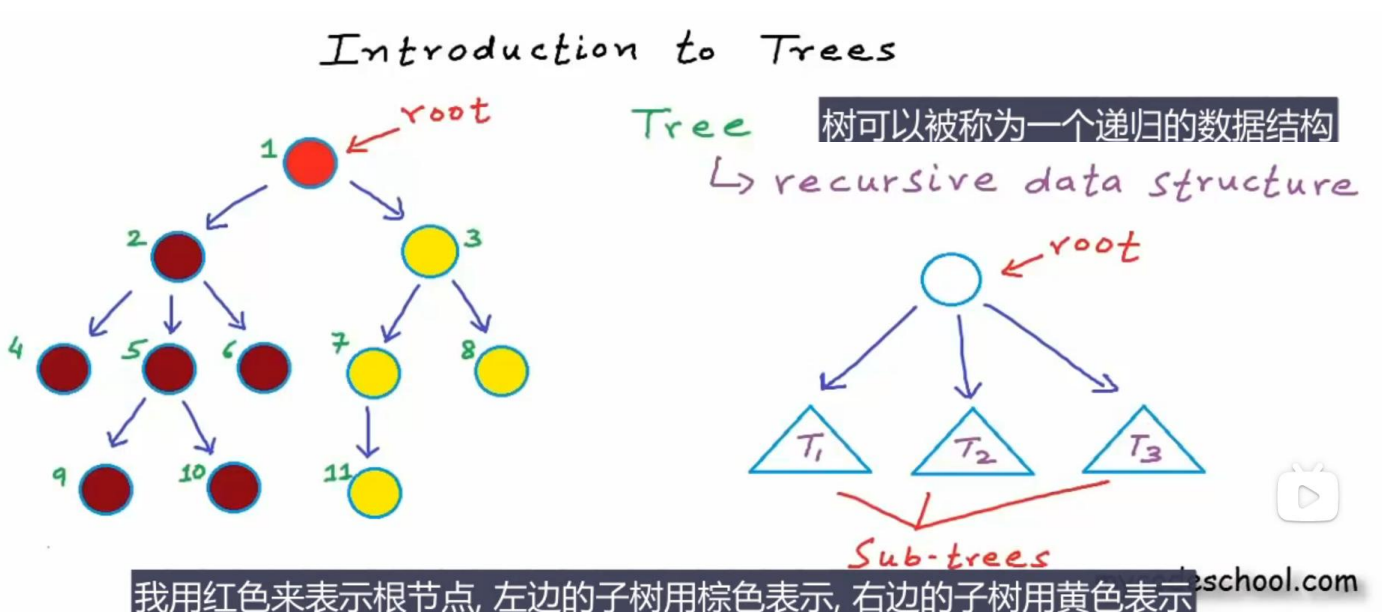
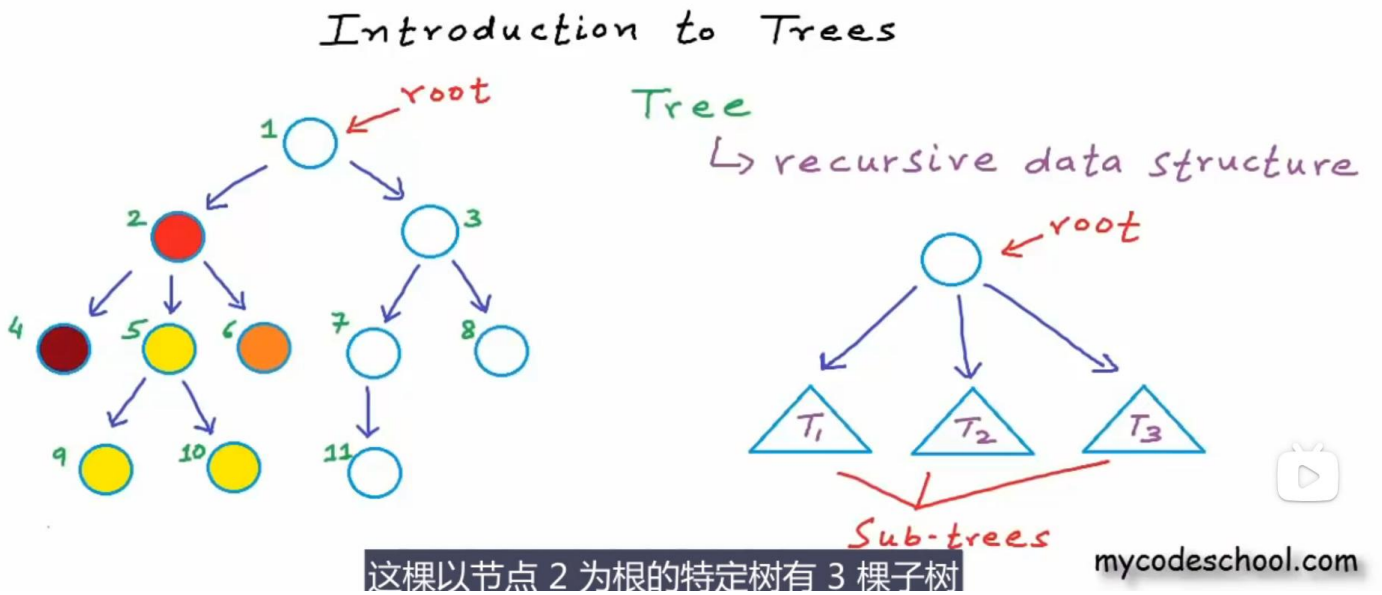
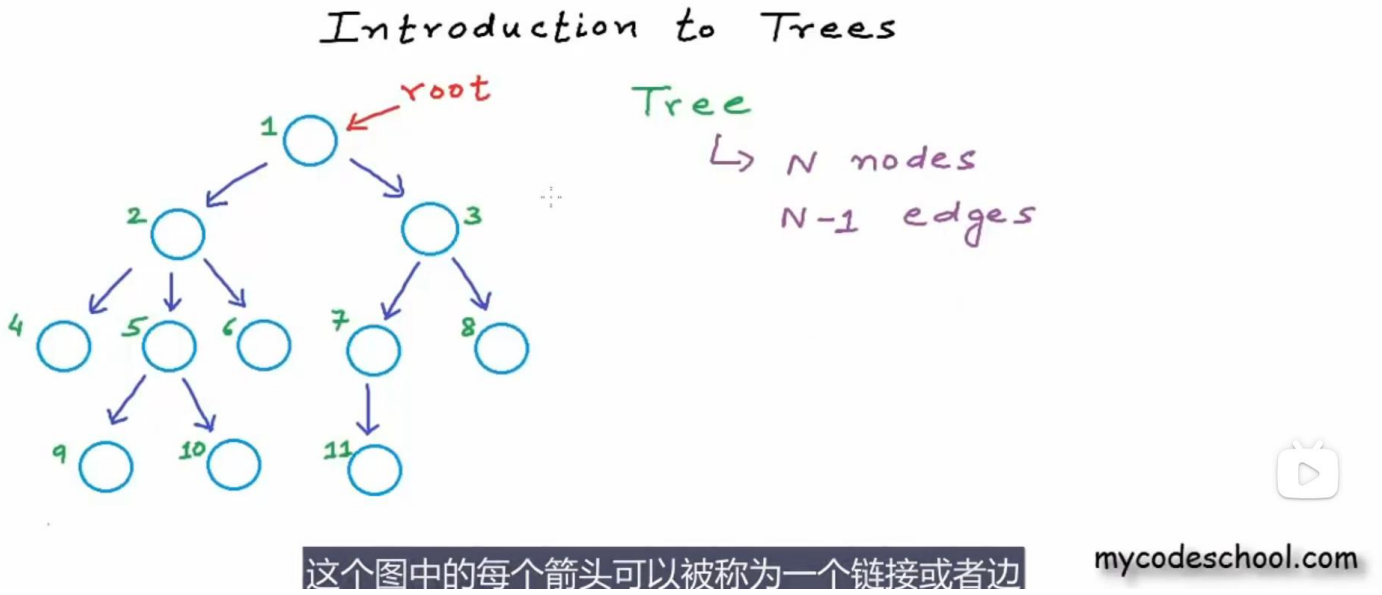
总结：





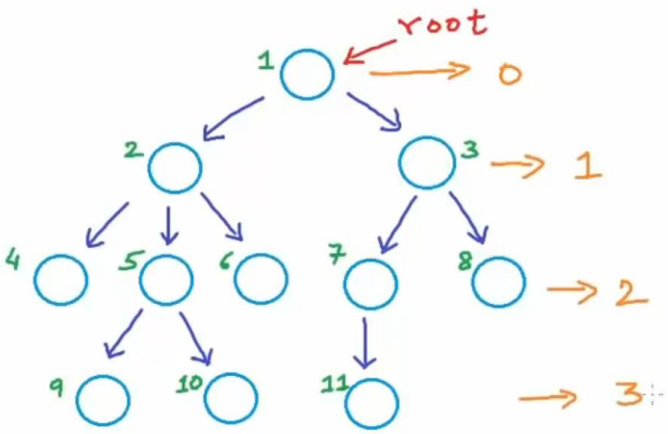
递归基本上就是用调用自身的方式来解决问题。在具体实现和使用树的过程中，我们将会到处使用树的这种递归属性。



树的下一个属性是：如果一棵树有N个节点，那么恰好会有 N-1 个链接或者边。除了根节点之外的所有节点刚好有一个传入的边。

总结：

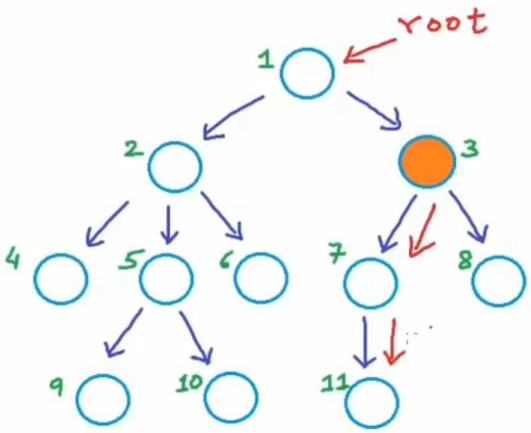
Introduction to Trees



Depth and Height

Depth of x =
length of path from root to x
OR
No. of edges in path from root to x

Introduction to Trees



Depth and Height

Depth of x =
No. of edges in path from root to x

Height of x =
No. of edges in longest path from x to a leaf

因此, 节点3的高度是2

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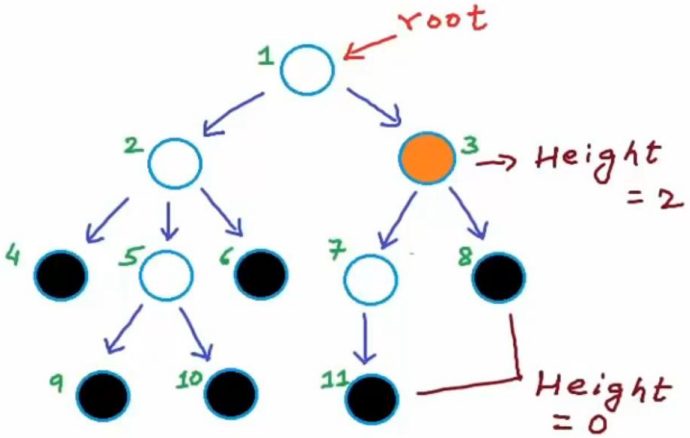
Introduction to Trees



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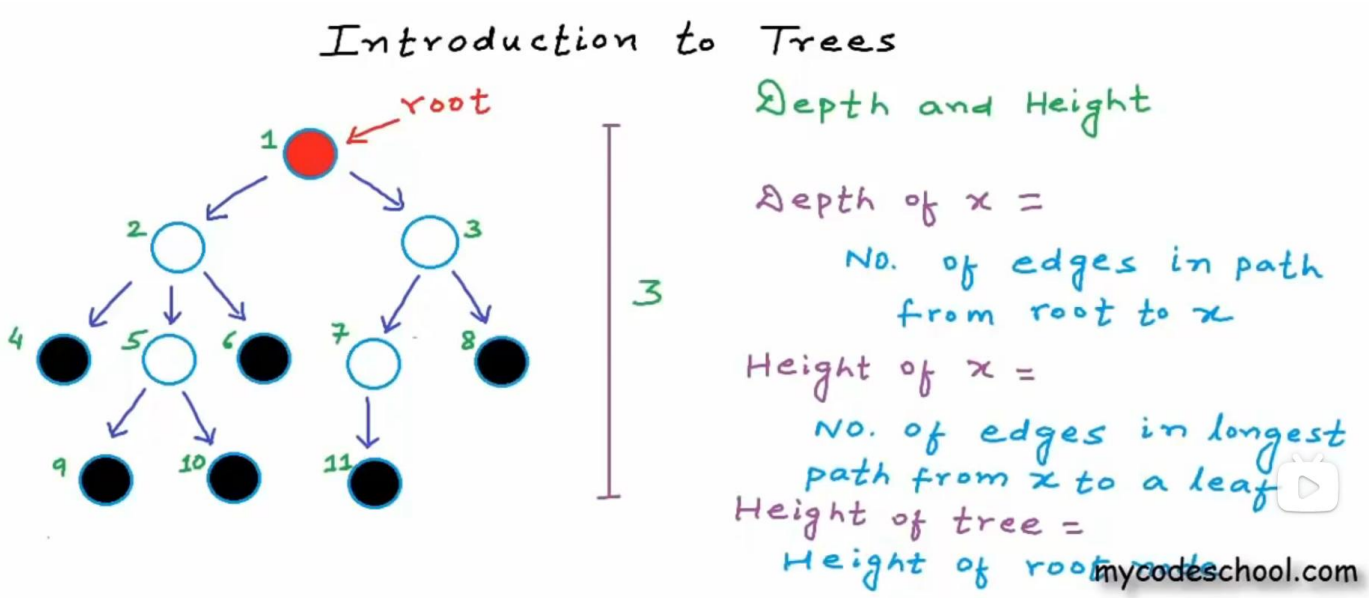
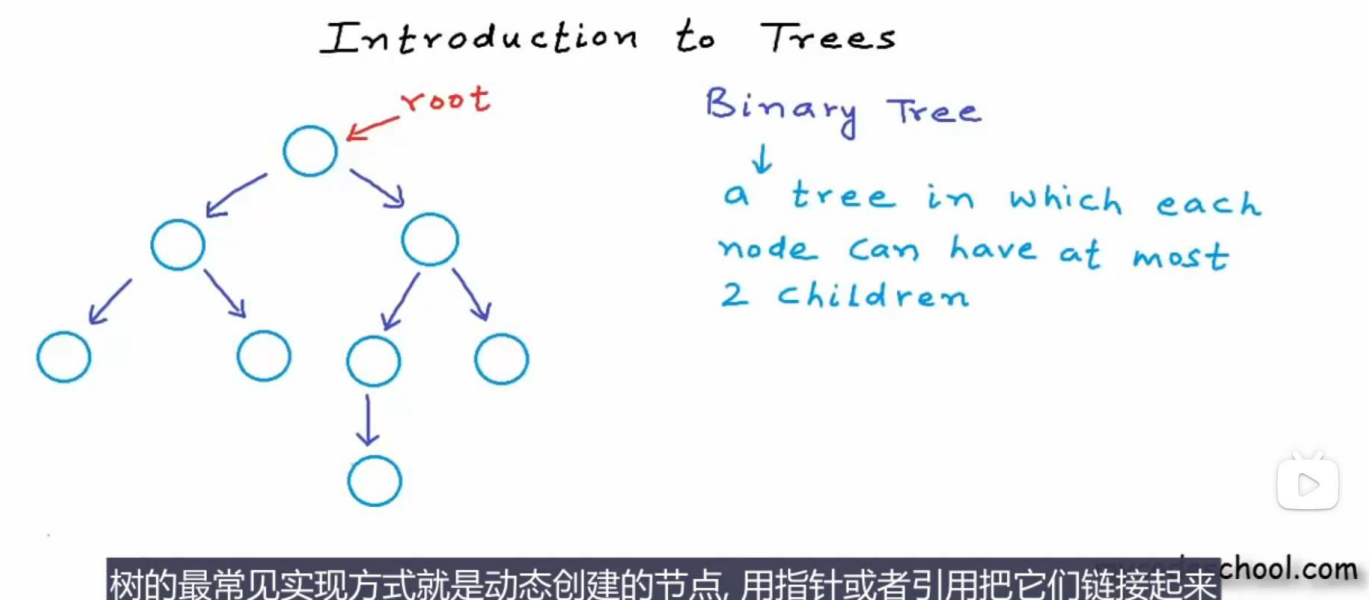
总结:

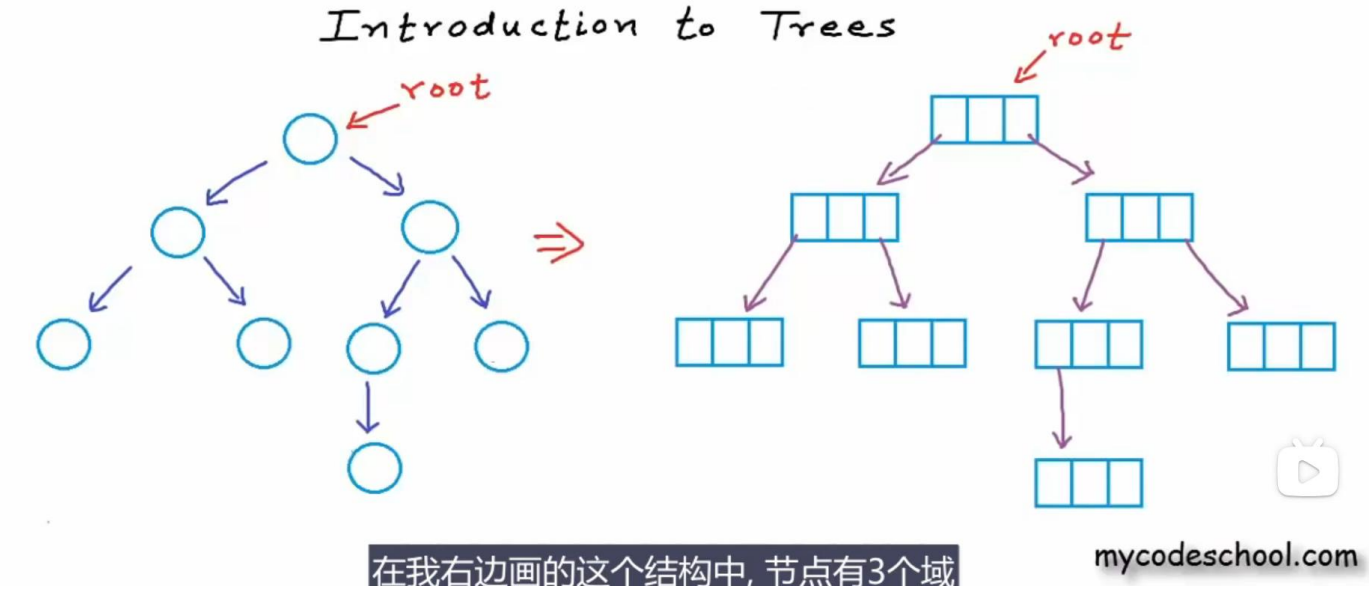


高度和深度是不同的属性，一个节点的高度和深度可能相等，也可能不等，我们经常会把这两者搞混淆。

根据属性，树可以被分为不同的类型。不同的场景中使用不同类型的树。
最简单的也是最常见的类型是具备这种属性的：即任何节点最多包含两个子节点，叫**二叉树（binary tree）**。

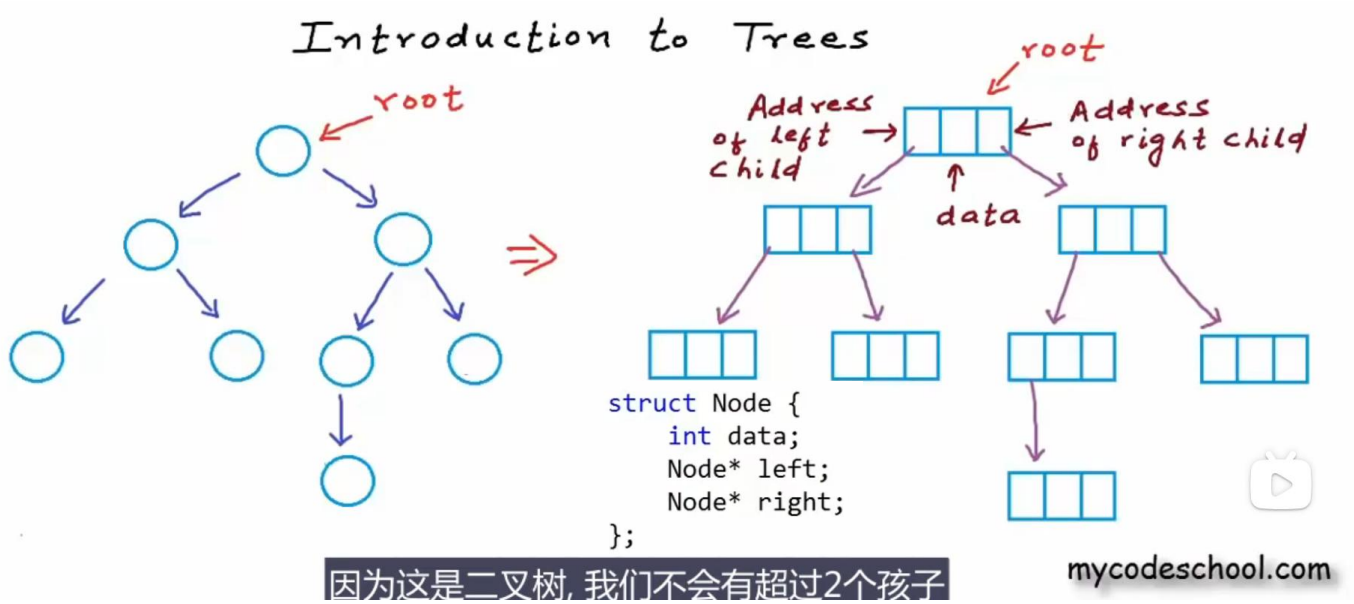


树的最常见实现方式就是动态创建的节点，用指针或者引用把它们链接起来



在我右边画的这个结构中，节点有3个域

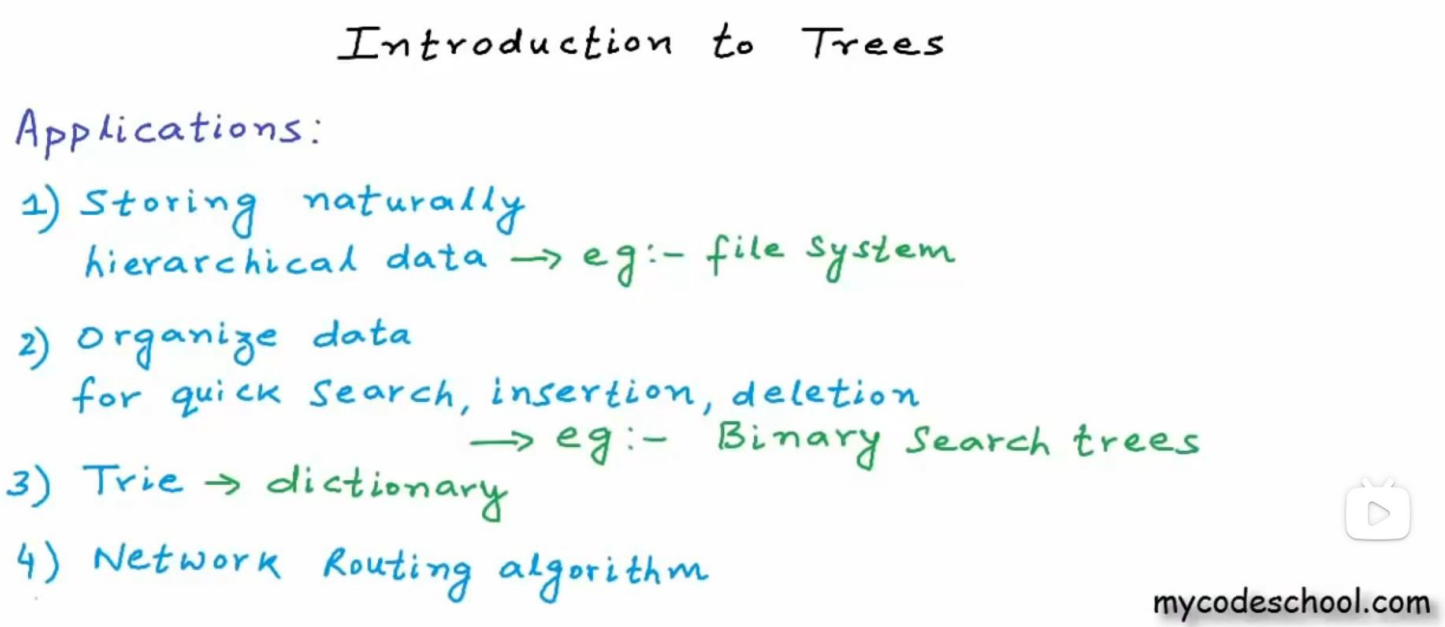
总结：



对于可以有任意多个孩子的通用树，我们使用其它的结构。

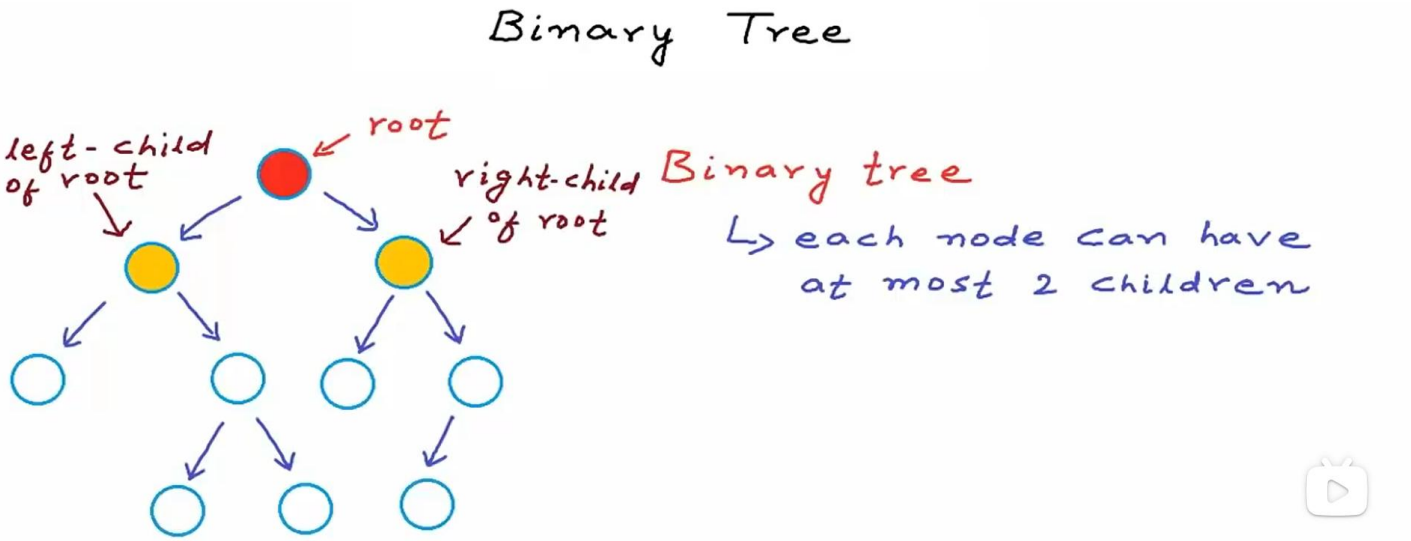
开头我们也讲了，存储天然具备层级结构的数据不是树的唯一应用。让我们来快速地看一下计算机科学中对于树的应用。

- 比如磁盘驱动器上的文件系统，文件和文件夹就是天然的层次化的数据。它是按照树的形式存储。
- 组织数据，以便让该集合能够做到快速查找、插入和删除。比如我们接下来要讲的二叉搜索树，它查找的时间复杂度为 O(log N)。
- Trie 树，被用来存储字典。它非常快速和高效，可以被用来做动态的拼写检查。
- 树这种数据结构还可以被用作网络路由算法。
- .....



总结:

4.2 二叉树



ering

The read and modify data.

Based on the author entity example, we created the table using the entity name author and the entity attributes as the columns of the table. Rows were added to the author table to populate the table.

总结:

2.1 基本介绍

Hello and welcome to the UPDATE Statement and the DELETE Statement. In this video, we will learn about altering and deleting data in a relational database table. At the end of this lesson, you will be able to

- identify the syntax of the UPDATE statement and DELETE statement.
- explain the importance of the WHERE clause in these statements.

After a table is created and populated with data, the data in a table can be altered with the UPDATE statement. The UPDATE statement is one of the data manipulation language or DML statements. DML statements are used to read and modify data.

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