Applications of tree data structure

Difficulty Level: Rookie

Why Tree?
Unlike Array and Linked List, which are linear data structures, tree is hierarchical (or non-linear) data structure.

1) One reason to use trees might be because you want to store information that naturally forms a hierarchy. For example, the file system on a computer:

file system
———

```
    /   <-- root
  /      \
...       home
        /          \
   ugrad          course
    /           /    |    \
  ...        cs101 cs112 cs113
```

2) If we organize keys in form of a tree (with some ordering e.g., BST), we can search for a given key in moderate time (quicker than Linked List and slower than arrays). Self-balancing search trees like AVL and Red-Black trees guarantee an upper bound of O(Logn) for search.

3) We can insert/delete keys in moderate time (quicker than Arrays and slower than Unordered Linked Lists). Self-balancing search trees like AVL and Red-Black trees guarantee an upper bound of O(Logn) for insertion/deletion.

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4) Like Linked Lists and unlike Arrays, Pointer implementation of trees don't have an upper limit on number of nodes as nodes are linked using pointers.

As per Wikipedia, following are the common uses of tree.
1. Manipulate hierarchical data.
2. Make information easy to search (see tree traversal).
3. Manipulate sorted lists of data.
4. As a workflow for compositing digital images for visual effects.
5. Router algorithms

References:
http://www.cs.bu.edu/teaching/c/tree/binary/
http://en.wikipedia.org/wiki/Tree_%28data_structure%29#Common_uses

Please write comments if you find anything incorrect, or you want to share more information about the topic discussed above.

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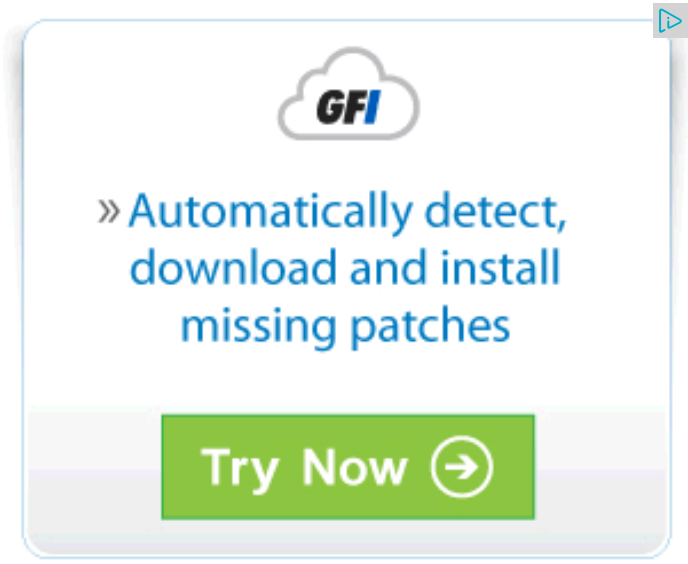

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Binary Search Tree - Used in many search applications where data is constar
and set objects in many languages' libraries.
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Hash Trees - used in p2p programs and specialized image-signatures in whic
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Heaps - Used in heap-sort; fast implementations of Dijkstra's algorithm; and ir
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Huffman Coding Tree (Chip Uni) - used in compression algorithms, such as th
formats.
GGM Trees - Used in cryptographic applications to generate a tree of pseudo-
Syntax Tree - Constructed by compilers and (implicitly) calculators to parse ex
Treap - Randomized data structure used in wireless networking and memory
T-tree - Though most databases use some form of B-tree to store data on the
(most) their data in memory often use T-trees to do so

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