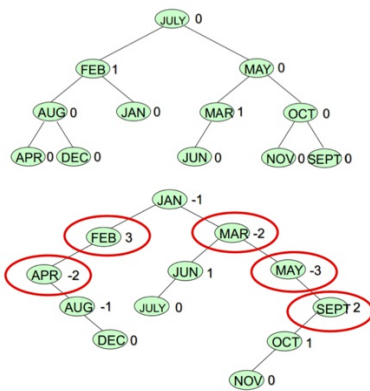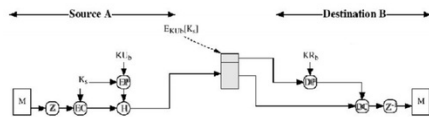1. **AVL trees/Splay trees**

AVL Balance Factors

To make searches faster and also need sorted order (e.g., subscriber table, OSPF neighbor table)

2. **BSP tree**

3D computer graphics

3. **Cryptographic algorithms**

Security is extremely important for networking devices

They are full of cryptography algorithms
Security Aspects: Confidentiality; Integrity
SSH instead of Telnet: Supports authentication using cryptography; Uses DES etc
IPSEC instead of bare-bones IP: Supports encryption (e.g., AES)
OSPF uses MD5 hash for integrity

Almost every protocol has to deal with security aspects!

4. **Dynamic Programming**

A method for solving complex problems by breaking them down into simpler sub-problems (e.g. Used in the routing protocols)

5. **Graph Algorithms**
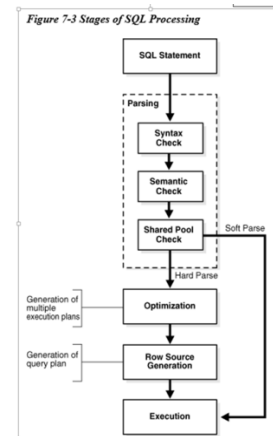

A network is a graph

Spanning Trees are used in...
STP:
Stands for "spanning tree protocol";
For avoiding loops

6. **Graphs**

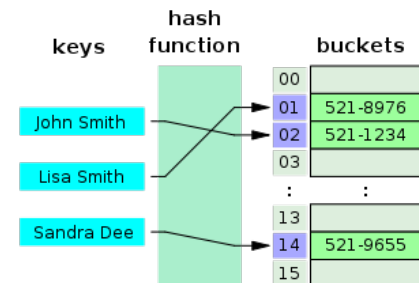Connections/relations in social networking sites, Routing ,networks of communication, data organization etc.

7. **Hashing**

Figure 7-3 Stages of SQL Processing

Used when order is not important but lookup needs to be fast (e.g. Hashing for MAC table)
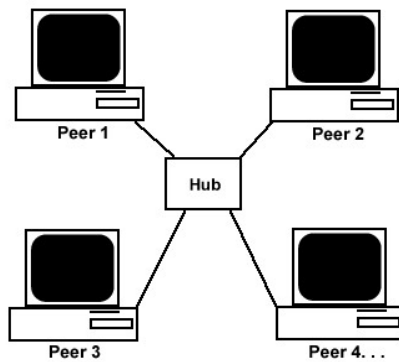
8. **Hash Table**

Used for fast data lookup - symbol table for compilers, database indexing, caches, Unique data representation.
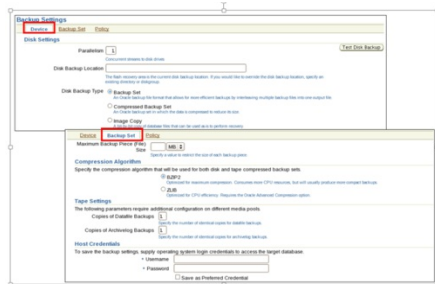
9. **Heap**

Dynamic memory allocation in lisp

10. **Linear Data Structures in the Networking Industry**

Stacks, queues, singly linked lists, doubly linked lists are very commonly used.

11. **Parallel Algorithms**

Multi-cores are getting important for networking

Two ways:
1.) Each processor will run a set of processes
2.) Split a process so that we can make it faster

GP-GPUs use hundreds of processors
1.) They need parallel algorithms
2.) Many cryptography algorithms are implemented in parallel fashion on GP-GPUs

12. **Priority queues**

Process scheduling in the kernel

13. **Queues**

Transport and operations research where various entities are stored and held to be processed later i.e. the queue performs the function of a buffer.
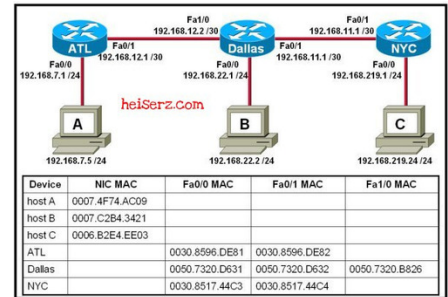
14. **Queues**

Continues until all data transferred

e.g. Managing IDs

15. **Radix tree**   IP routing table

16. **Searching Techniques**

Lot of lists are maintained: List of users, MAC addresses, List of neighbors, etc

Searching: e.g. When someone logs out
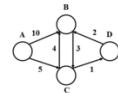
Linear search is common/Binary search is rarely used

17. **Shortest Path algorithms**

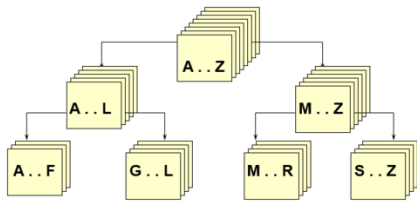Shortest path algorithms are common in networking

Shortest path algorithms used in...

OSPF: Name itself includes the algorithm name; open shortest path first

IS-IS: Yet another routing protocol based on Dijkstra's shortest path

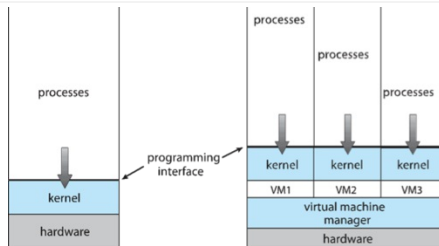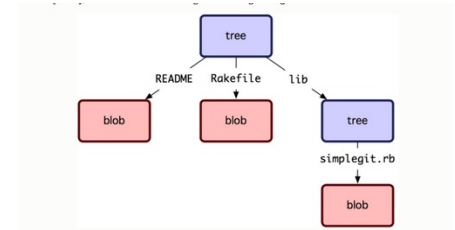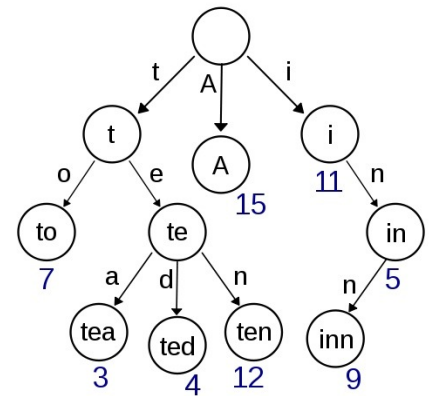|	
18. **Sorting Techniques**	**Using quick sort algorithm** 59 © 2007 Jones and Bartlett Publi **Sorting**: E.g., to display list of users in a show command E.g., to show the forwarding table used for Quick sort is sometimes used In general, it is common to use the sorting data structure (e.g., tree) rather than sorting on the fly Sometimes a structure is kept under multiple data structures
19. **Stack**	Undo\redo operation in word processors, Expression evaluation and syntax parsing, many virtual machines like JVM are stack oriented.
20. **Stacks**	```cpp void SetJumpOrder(const shared_ptr<PostingListNode>& L) { int order = 0; SetJumpOrderHelper(L, &order); } void SetJumpOrderHelper(const shared_ptr<PostingListNode>& L, int* order) { if (L && L->order == -1) { L->order = (*order)++; SetJumpOrderHelper(L->jump, order); SetJumpOrderHelper(L->next, order); } } void SetJumpOrder(const shared_ptr<PostingListNode>& L) { stack<shared_ptr<PostingListNode>> s; int order = 0; s.emplace(L); while (!s.empty()) { auto curr = s.top(); s.pop(); if (curr && curr->order == -1) { curr->order = order++; // Stack is last-in, first-out, and we want to process // the jump node first, so push next, then push jump. s.emplace(curr->next); s.emplace(curr->jump); } } } ``` e.g. Conversion of recursive routines to non-recursion
21. **String matching algorithms**	`zip.matches("\\d{5}");` Networking devices deal with strings They support regular expressions The commands support grep operation Many debugging tools use string matching (e.g., log file analysis looking for patterns)
22. **Suffix tree**	Fast full text searches used in most word processors.
23. **Trees**	Parsers, Filesystem
24. **Trie**	Dictionary, such as one found on a mobile telephone for autocompletion and spell-checking.
25. **Tries**	Used in radix trees for maintaining routing table (e.g. Longest prefix match)
26. **Use of libraries in the industry**	Libraries are common for data structures and algorithms (e.g. CDT http://www2.research.att.com/~gsf/download/ref/cdt/cdtspe

27. **What is a parser?**
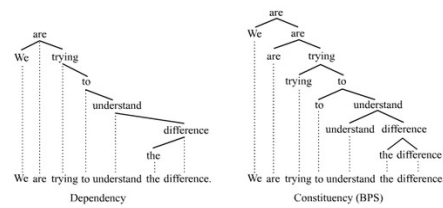
A software component that takes input data (frequently text) and builds a data structure - often some kind of parse tree, abstract syntax tree or other hierarchical structure - giving a structural representation of the input, checking for correct syntax in the process.

28. **Why are linked lists more common than arrays to maintain stacks or queues?**
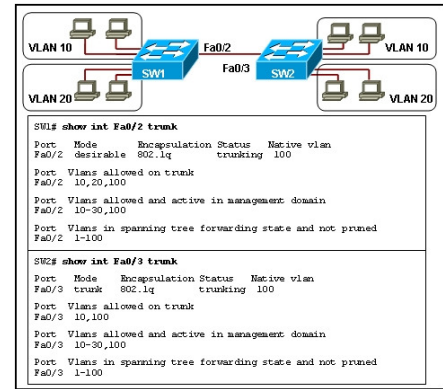
To have flexibility in the number of entries and for memory efficiency