

## P2P & DISTRIBUTED SHARED MEMORY

### PEER TO PEER COMPUTING AND OVERLAY GRAPHS

Peer to peer (P2P) systems refers to the applications that take advantage of resources like storage, time cycles, content, manpower available at the end systems of the internet. In other words, the peer to peer computing architecture contains nodes that are equal participants in data sharing. All the tasks are equally divided between all the nodes. The nodes interact with each other as required as share resources. This deals with application layer organization of network overlay for flexibility of sharing resources.

The prominent feature of P2P networks is their ability to provide a large combined storage, CPU power, and other resources while imposing a low cost for scalability, and for entry into and exit from the network.

The ongoing entry and exit of various nodes, as well as dynamic insertion and deletion of objects in P2P network is called **churn**. The impact of churn should be as transparent as possible. There are two types of P2P systems: structured and unstructured.

#### Differences between structured and unstructured P2P

Unstructured P2P	Structured P2P
The construction of overlay network is highly flexible.	The construction of overlay network has low level of flexibility.
The resources are indexed locally.	The resources are distributed remotely and indexed using hash tables.
The messages can be broadcast or random walk.	The messages are unicast.
The network puts best effort content location.	The network guarantees the content location.
High overhead.	Comparatively low overhead.
This supports high failure rates.	Supports moderate failure rates.
This is suitable for small scale and highly dynamic applications.	This is suitable for large scale and relatively stable applications.

Overlay network is constructed over another network. For example, connecting internet over telephone lines is an overlay network. The topology of the overlay network is independent from the underlying network.

### **Characteristics of Peer to Peer Computing**

- Peer to peer networks are usually formed by groups computers. These computers all store their data using individual security but also share data with all the other nodes.
- The nodes in peer to peer networks both use resources and provide resources. So, if the nodes increase, then the resource sharing capacity of the peer to peer network increases.
- The nodes in peer to peer networks act as both clients and servers. Hence, it is difficult to provide adequate security for the nodes. This can lead to denial of service attacks.
- Most modern operating systems such as Windows and Mac OS contain software to implement peer to peer networks.
- Efficient usage of resources.
- Self -organizing nature: because of scalable storage, CPU power and other resources.
- Distributed control: fast and efficient searching for data.
- Symmetric: highly scalable
- Anonymity: efficient management of churns
- Naming mechanism: selection of geographically close server.
- Security, authentication, trust: Redundancy in storage

### **Advantages of Peer to Peer Computing**

- Each computer in the peer to peer network manages itself. The network is quite easy to set up and maintain.
- The server handles all the requests of the clients. This provision is not required in

peer to peer computing and the cost of the server is saved.

- It is easy to scale the peer to peer network and add more nodes. This only increases the data sharing capacity of the system.
- None of the nodes in the peer to peer network are dependent on the others for their functioning. Hence the network is fault tolerant.
- Easy deployment and organization.

### **Disadvantages of Peer to Peer Computing**

- It is difficult to back-up the data as it is stored in different computer systems and there is no central server.
- It is difficult to provide overall security in the peer to peer network as each system is independent and contains its own data.

### **Napster P2P system**

- The developers of the original Napster launched the service as a peer-to-peer (P2P) file sharing network.
- The software application was easy to use with a free account, and it was specifically designed for sharing digital music files (in the MP3 format) across a Web-connected network.

Napster used a server-mediated, central index architecture organized around clusters of servers that store direct indices of the files in the system.

- The central server maintains a table with the:
  - i) the client's address (IP) and port, and offered bandwidth
  - ii) information about the files that the client can allow to share
- The basic steps of operation to search for content and to determine a node from which to download the content are the following:
  - A client connects to a meta-server that assigns a lightly loaded server from one of

the close-by clusters of servers to process the client's query.

- The client connects to the assigned server and forwards its query along with its own identity.
- The server responds to the client with information about the users connected to it and the files they are sharing.
- On receiving the response from the server, the client chooses one of the users from whom to download a desired file. The address to enable the P2P connection between the client and the selected user is provided by the server to the client.
- The directory serves to provide the mapping from a particular host that contains the required content, to the IP address needed to download from it.

### Application Layer Overlays

- The fundamental mechanism in P2P networks is data searching.
- This depends on the organization of data and networks.
- The search algorithms for P2P networks tend to be data-centric.
- P2P search uses the P2P overlay, a logical graph among the peers that is used for the object search and object storage and management algorithms.
- Overlays can be thought as a network built over another network.
- Above the P2P overlay is the application layer overlay, where communication between peers is point-to-point once a connection is established.
- The P2P overlay can be structured or unstructured, i.e., no particular graph structure is used.
- Structured overlays use some rigid organizational principles based on the properties of the P2P overlay graph structure, for the object storage algorithms and the object search algorithms.
- Unstructured overlays use very loose guidelines for object storage. As there

is no definite structure to the overlay graph, the search mechanisms are more ad-hoc, and use some forms of flooding or random walk strategies.

- Thus, object storage and search strategies are intricately linked to the overlay structure as well as to the data organization mechanism
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