Description
We plan to implement a file sharing P2P system based on the Gnutella2 like protocol. The network consists of a two-level hierarchical structure along with a central web cache which has the information about all the active hubs. The leaves can connect to multiple hubs. The hubs are also inter-connected(not more than a constant number).

Features:

1. Clients can search a file present with any leaf in the network .
2. Clients can download file from any other client in the network.
3. Support for asynchronous crash of leaves/hubs.
4. Support for asynchronous joining of new leaves/hubs.
5. Leaf may start temporary Hub if less number of hubs alive in the system and convert back to leaf when sufficient hubs come up

Assumptions:

- Crash fault model is assumed for leaves/hubs.
- Web cache can tolerate single crash fault.(Two active Web Caches)
- Every node is made aware of any crash eventually.

Consistency Model : Eventual Consistency is maintained for hublist at WebCache and leaves connected at hubs.

Protocol

- **Joining** Any new hub or leaf gets the complete list of hubs from the central Web cache and connects to the hubs with low load. Each hub obtains the file-list of the leaves and hubs connected to it.
- **Searching** The leaf searches for the desired file, one by one, at each hub in the global hub list, obtained from the Web cache, till a file match is found at a hub (in its neighbouring leaf or hub) and the corresponding address is obtained. The host leaf then connects to the target leaf and obtains the desired file.
- **A minimum Hub Count** Leaves are asked to start new temporary hubs dynamically if the existing Hub count goes less than a threshold.
- **Fault Tolerance**
    - **Hub Crash** If a leaf is unable to connect to a hub in the hublist, provided by the Web Cache, the leaf informs the Web cache about the faulty hub. The hubs send a heartbeat to the Web Cache periodically. The leaf also informs the neighbouring hubs about a hubs crash.
    - **Leaf Crash** If a leaf is unable to connect to a leaf whose address is provided by a hub, it informs the hub about the inactivity of the leaf.
    - **Web Cache Crash** One crash fault tolerant. One replica is kept.

Test Cases:

Network Test Cases:

1. Hub Up/Down:
    a. Search : Search continue after timeout
    b. Topology : Leaf informs WebCache and other connected hubs about Hub failure. Webcache then informs leaves about the hub failure.
    c. Download : Independent
    d. Temp hub up if total hubs less than threshold
    e. Temp hub down if total hubs more than threshold
2. Leaf Up/Down:
    a. Search : Independent
    b. Topology : Leaf informs connected hub about Leaf failure when download fails.
    c. Download : Download fails and Searches again for new leaf (for Leaf Down)
    d. Files : Filelist updated at hubs connected (for Leaf Up/Down)
3. Web Cache down:
    a. 1 crash-fault tolerant

File Transfer Test Cases:

1. File Added to leaf
2. File removed from leaf