A Scalable Content-Addressable Network

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Overloading Coordinate Zones

Overloading Coordinate Zones

- So far, a zone is assigned to a single node
- Now multiple nodes share the same zone
- Nodes that share the same zone are termed peers
- Is defined a system parameter MAXPEERS, which is the maximum number of allowable peers per zone (i.e., 3 or 4)

Overloading Coordinate Zones

- A node maintains a list of its peers and neighbors
  - Must know all the peers in its own zone
  - Need not track all the peers in its neighboring zones (selects one neighbor from amongst the peers in each of its neighboring zones)
- Zone overloading does not increase the amount of neighbor information
- Zone overloading requires to hold additional state for up to MAXPEERS peer nodes

Overloading Coordinate Zones

- When a new node A joins the system, it discovers an existent node B whose zone it is meant to occupy
- Node B first checks whether it has fewer than MAXPEERS peer nodes
- If so, the new node A merely joins B's zone without any space splitting
- Node A obtains both its peer list and its list of coordinate neighbors from B
- Periodic soft-state updates from A serve to inform A's peers and neighbors about its entry into the system

Overloading Coordinate Zones

- If the zone is full, is split into half
- Node B informs each of the nodes on it's peer-list that the space is to be split
- The nodes on the peer list together with the new node A divide themselves equally between the two halves of the now split zone
- As before, A obtains its initial list of peers and neighbors from B

Overloading Coordinate Zones

Periodically:

- A node measures the round-trip-time to all the nodes in each neighboring zone
- Retains the node with the lowest RTT as its neighbor in that zone
  - This node is the closest – lowest latency

Overloading Coordinate Zones

- The contents of the hash table itself may be either divided or replicated across the nodes in a zone
- Partitioning data among a set of peer nodes
  - Does not require consistency mechanisms
  - Does not increase data storage
  - Does not improve availability

Overloading Coordinate Zones

- Replication:
  - Provides higher availability
  - Increases the size of the data stored at every node by a factor of MAXPEERS
  - Data consistency must be maintained across peer nodes

Advantages

Overloading zones offers many advantages:

- Reduced path length (number of hops), and hence reduced path latency
- Reduced per-hop latency because a node now has multiple choices in its selection of neighboring nodes and can select neighbors that are closer in terms of latency
- Improved fault tolerance because a zone is vacant only when all the nodes in a zone crash simultaneously

Disadvantages

- On the negative side:
  - Overloading zones adds somewhat to system complexity because nodes must additionally track a set of peers

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