Evaluation of Peer-to-Peer models in OverSim

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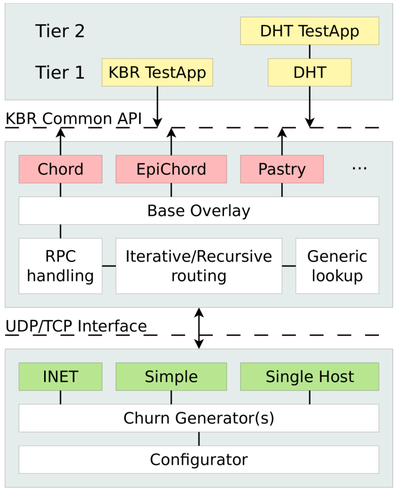
P2P Simulation

Peer-to-peer (P2P) simulation frameworks are excellent tools for developing and testing P2P algorithms, however there has been very little work done on validation of the models within these frameworks. Validation of these models is an important issue, as without knowing the models are valid we can not necessarily rely on the results generated using such models.

In this work we provide an independent evaluation of the Chord and Pastry Distributed Hash Table (DHT) models within OverSim, and present our model of the EpiChord DHT. We validate the models by comparison against results presented in the original papers.

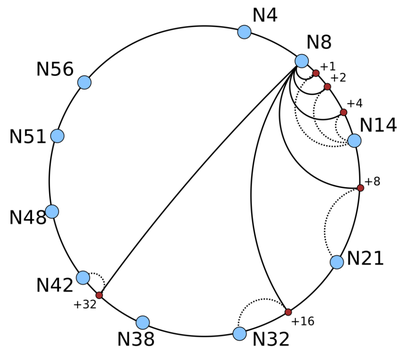
OverSim Framework

OverSim is an open-source P2P simulation framework that we are using in our ongoing work, based on the discrete event simulation system OMNeT++.

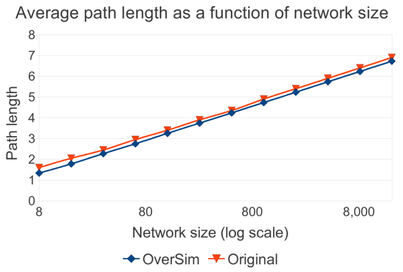


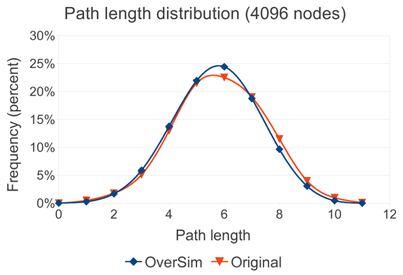
Chord

Nodes in a Chord network form a unidirectional ring. Each node maintains information for O(log(N)) other nodes, chosen at logarithmically increasing distance around the ring. Messages in a Chord network can be routed with, in the worst case, O(log(N)) hops.



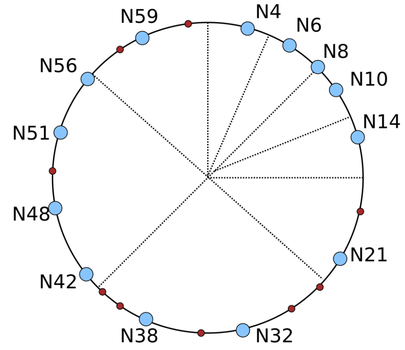
To evaluate the Chord model we compare the average path length, path length distribution, and average success rate against that reported in the original paper. This is done for networks ranging from 2^3 nodes to 2^{13} nodes.



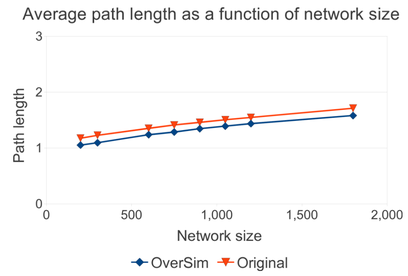


EpiChord

Nodes in an EpiChord network form a bidirectional ring. Each node maintains a cache containing information for up to O(N) other nodes. Whenever a node learns of another node, usually through observing lookup traffic, it is stored in the cache. Consequently the size of the cache, and hence the expected routing performance, depends on the amount of traffic within the network. In the worst case, messages in an EpiChord network can be routed with O(log(N)) hops.

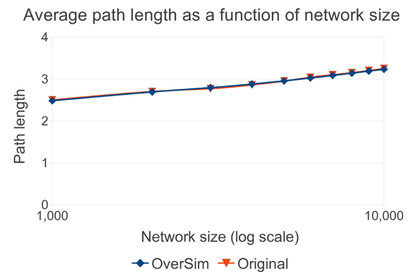


To evaluate EpiChord we compare the average path length, average success rate, cache size, and cache accuracy against that reported in the original paper, for both lookup intensive and churn intensive workloads.



Pastry

Nodes in a Pastry network also form a bidirectional ring. Each node maintains a routing table with $O(\log_{2^b}(N))$ nodes. Nodes fill the rows of their routing table such that nodes in row x match the first x digits of their identifier. Messages in a Pastry network can be routed with, in the worst case, $O(\log_{2^b}(N))$ hops.



Conclusions

- OverSim provides and supports many different P2P network models.
- The existing models for both Chord and Pastry provide results which very closely match those in the original papers.
- Our implementation of EpiChord for OverSim provides results very close to those in the original paper.
- From this we conclude that the OverSim models are valid implementations of their respective algorithms and hence the results generated can be trusted.

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