CSC2231 – Internet Systems and Services

Paper Review – Impact of DHT Routing Geometry on Resilience and Proximity
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The authors present a comparison between several prominent DHT algorithms – analyzing how their fundamental geometries affect network resilience and performance. They find that ring geometries have a great deal of flexibility in selecting neighbours and paths while also providing high performance. The authors leave as an open question: whether there are disadvantages to using ring geometries as opposed to other DHT geometries.

In addition to producing some very interesting comparisons, the authors also introduced some (seemingly) less prominent algorithms: butterfly and XOR. The most useful result is their charts depicting how each geometry reacts in the face of failures. Considering that having 30% of the nodes go down is considered a large failure, it was reassuring to see that several of the algorithms maintained good connectivity. This supports the fact that overlays are indeed robust in the face of failures. The addition of sequential neighbours further ensured that no connectivity was lost. Unfortunately, neither the butterfly nor tree geometries maintained good connectivity – indicating that neither method is suitable for overlay networks (there's no point in using a distributed system that loses 90% connectivity when 30% of the nodes fail).

However, it seems that the tree geometry they analyzed was a simple binary tree. Srivasta and Lui proposed an *R*-resilient tree topology that guarantees that there are *R* independent paths from any node to any of its child nodes. Their scheme is an adaptation of Byzantine Fault Tolerant information dissemination which is completely resilient to message dropping attacks (what effectively happens when a node goes down). Unfortunately, BFT is an expensive algorithm whereas the *R* parameter can be used to balance the tradeoff between overhead and resiliency. By using an *R*-resilient tree rather than a simple binary tree, PRR and Pastry could become significantly more resilient to failures. For instance, a 2-resilient tree would ensure that 2 independent paths exist from any node to any child node.