Exercise No. 4

Peer-To-Peer Networks

Summer 2008

Exercise 7  Network diameter
Let $D$ the diameter of an arbitrary network of $n$ nodes and a degree bounded by $c$.

1. Show that $D \geq \frac{\log n}{\log c}$. *Hint: Approximate the maximum number of nodes reachable within $s$ steps.*

2. Consider the different peer-to-peer networks in the lecture so far. How do they compete with this bound?

3. What is the minimum degree of a network, if the diameter is 2?

Exercise 8  $k$-connectivity
Connectivity is an important property for peer-to-peer networks. A graph is called $k$-connected, iff at least $k$ disjoint paths exist between any two nodes.

1. How many disjoint paths between two arbitrary nodes exist at least in CAN, if
   - no fragmentation is allowed, and
   - fragmentation is possible? *Hint: Think about the worst case!*

2. Consider a perfect Chord ring, i.e. all $2^m$ positions are occupied by exactly one peer, $n = 2^m$. Find at least three disjoint paths from a peer $A$ to a peer $B$!

3. There are two different possibilities to create the routing table of a joining peer in Pastry. Consider them with respect to $k$-connectivity of the resulting graph structure and discuss which one is preferable!