

**Peer to Peer Systems and Blockchains**  
**Academic Year 2019/2020**  
**Mid Term**  
**Monitoring the Interplanetary File System**  
**Deadline 17-04-2020**

The mid term consists in carrying out both the following assignments.

## 1 IPFS Swarm Monitoring

This assignment requires to implement a simple application to monitor the IPFS peer-to-peer network for a certain period of time. In particular, the goal of the assignment is

- to analyse the amount and the type of peers belonging to the IPFS swarm, during a period of time
- to detect the provenance of the peers, i.e. locate each country the peer belongs to.

The application may be implemented by a script exploiting the commands of the IPFS CLI <sup>1</sup> or by developing a simple Javascript <sup>2</sup> application. It is also possible to exploit the Java-IPFS library <sup>3</sup>. It is required to submit:

- the code of the application
- a set of plots showing at least the following statistics<sup>4</sup>
  - the number of peers monitored during the observed period, for each hour of the day. Show the hour-daily behaviour and the average hour-behaviour in the considered period.
  - the number of peers for each country, during the observed period

The period of monitoring must be at least 2 days long.

*OPTIONAL:* IPFS defines a command, *IPFS-DHT-Query* which allows to analyse the content of the routing table of the peer which executes the command. Investigate the possibilities given by this command to monitor the buckets of the local Kademlia routing table, for instance to check their level of churn.

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<sup>1</sup><https://docs.ipfs.io/introduction/usage/>

<sup>2</sup><https://github.com/ipfs/js-ipfs>

<sup>3</sup><https://github.com/ipfs/java-ipfs-http-client>

<sup>4</sup>Discussion on the Moodle forum of the course is greatly encouraged

## 2 The Kademlia DHT

Consider the Kademlia DHT [1] presented in Figure 1, where the size of the buckets in the routing tables of the peers is 2, the value of  $\alpha$  is 2 and the identifiers are 8 bits long.

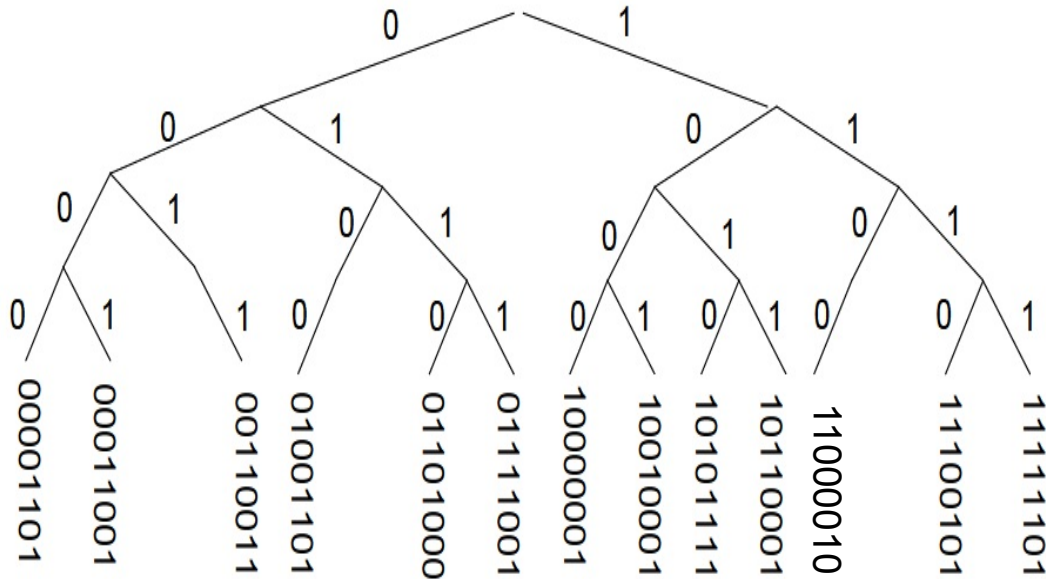


Figure 1: A Snapshot of a Kademlia overlay

- Node 11111101 inserts the content identified by the identifier 01000001. Which node is responsible for that content?
- Node 11010101 joins the network. Node 00110011 is the bootstrap peer that joining node uses to join. Describe the join operation step by step, describing how the buckets of the joining peer are filled over time.

Justify in the final report each assumption made, not explicitly stated in the text of this assignment.

## 3 Requirements

The mid term must be done individually and the deadline is 17 April 2020. If the evaluation of both the mid and of the final term will be positive, the student will be relieved from the oral exam. The mid term is not mandatory, if it is not presented, the student will be required to pass the oral exam on the first part of the course and the student will be allowed to submit the final term. The student must submit through Moodle a report including the solution of the two assignments. The rating of the assignment will be published on the Moodle as well and discussed during the question time (likely through Skype/Meet call).

## References

- [1] *Kademlia: A peer-to-peer information system based on the xor metric*, P. Maymounkov, D. Mazieres, International Workshop on Peer-to-Peer Systems, Springer 2002.