Lab Class Protocol-Design

P2P-Overlay, Part II

P2P-Protokol, Version 0.1

- Extending the P2P Node Software by Adding 'Standard' Features:
  - Peer Search / Overlay Mapping
  - Information Lookup
  - (Information Transfer)

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- New message concepts:
  - Originator spec.: `FROM`
  - Destination spec.: `FOR`
  - Message-IDs: `MESSAGE-ID`
  - Message reach: `TTL`
  - Matching of replies with responses: KEY
- Order of fields is predefined! (see Assignment 5)

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- Peer Search (1):
  - Node only knows neighbours
  - Want to know more about other nodes (peers)
  - Send information request (ping) into network
  - Collect responses (pongs)
  - But: might result in *huge* number of replies!

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- Peer Search (2):
  - New message type:
    `PING FROM viper:2000 MESSAGE-ID 1 TTL 3 P2P/0.1`
  - Contains originator spec: `FROM VIPER:2000`
    - needed to send replies
    - used for duplicate message detection
  - Message ID: `MESSAGE-ID 1`
    - used for duplicate message detection
    - (Node-ID, Message ID) globally unique!

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- Peer Search (3):
  `PING FROM viper:2000 MESSAGE-ID 1 TTL 3 P2P/0.1`
  - Time-to-Live Counter: `TTL 3`
    - limits message reach...
    - ... and thus overlay network load

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- Peer Search (5):
- Reply message:
  `P2P/0.1 PONG FOR viper:2000 FROM boa:2000 MESSAGE-ID 24 TTL 3`
  - Contains destination node ID:
    `FOR VIPER:2000`
  - Contains new message ID!!
  - Reply message with both originator and destination:
    first destination spec (FOR),
    then originator spec (FROM)!

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- Information Lookup (1):
  - 'Information' usually means file names :-)
  - Can have multiple simultaneous lookup requests in progress:
    -> what reply belongs to what request?
  - Again potentially many replies.

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- Information Lookup (2)
  - New message type:
    `SEARCH FROM viper:2000 KEY readme.txt MESSAGE-ID 2 TTL 3 P2P/0.1`
  - Contains sender spec, message ID, TTL
  - Contains search term spec: `KEY readme.txt`

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- Information Lookup (3)
  - New reply message type:
    `P2P/0.1 FOUND FOR viper:2000 FROM boa:2000 MESSAGE ID 10 TTL 3 KEY readme.txt`
  - Reply message, so first destination (FOR), then originator (FROM)
  - New message ID!
  - Contains search term (KEY) to enable matching of requests to replies.

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- Downloading Information (1):
  - Need to know where to find information (SEARCH/FOUND)
  - Request with explicit destination!

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- Downloading Information (2):
  - New message type:
    GET FROM viper:2000 FOR boa:2000 KEY readme.txt MESSAGE-ID 101 TTL 3 P2P/0.1
  - Request message, so
    - first originator (FROM)
    - then destination (FOR)
  - Note: opposite order of orig. and dest.!

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- Downloading Information (3):
  - Protocol not ***yet*** powerful enough for information transfer
  - Respond with error message:
    ```
    P2P/0.1 510 NOT IMPLEMENTED FOR viper:2000 FROM
    boa:2000 MESSAGE-ID 13 TTL 3 KEY readme.txt
    ```


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- Uploading Information (1):
  - Works like downloading:
    ```
    PUT FROM viper:2000 FOR boa:2000 KEY readme.txt
    SIZE 1024 MESSAGE-ID 19 TTL 3
    ```
  - New field to warn receiver about size:
    ```
    SIZE 1024
    ```
  - *For now*, reply with same error message as for downloading (510 NOT IMPLEMENTED)

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- Newly generated (non-handshake) messages:
  - request: broadcast
  - reply: send only to neighbour from which the request has been received
- Forwarding:
  - ignore duplicate messages
  - flood with regard to TTL

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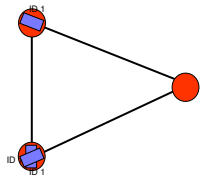
Duplicate Message Detection

- With flooding, message may arrive multiple times



  - React to message once only!
  - Need to recognize duplicates
  - Use tuple (Node-ID, Message-ID)
  - For each originator node:
    - store message IDs already seen as ordered list
    - check new messages against list
    - generate Message IDs using counter

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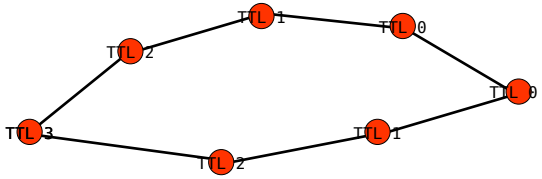
TTL Handling



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TTL Handling

- Node generates message
  - send new message: `...TTL 3...`
  - receive, decrement (TTL now 2)
  - process message
  - check TTL > 0
    - Yes: flood as `...TTL 2...`
    - No: discard
- Decrement TTL *after* receiving, *before* checking!
- Forwarding changes Message!!!

Additional Commands

- Reading short commands from keyboard:
  - `ping`
  - `search legal.mp3`
  - `get legal.mp3 viper:2100`
  - `put legal.mp3 boa:2200`