

DCL Integration Tutorial

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Abstract

This article aims in providing a simple tutorial on how to use the Decentralized Communication Layer with third party applications written in Java.

Introduction

The Decentralized Communication Layer (DCL) is a network of decentralized peer-to-peer networks that can be used to route communication of third party applications through secure and private channels. Each of these networks has a unique network identifier.

At the time of writing, the only network defined for DCL is the circle network with the identifier `org.dclayer.circle`. In this network, each node has an address which is computed by hashing the RSA public key of an RSA keypair the node generates at startup. As hash algorithm, **SHA-1** is used, which yields addresses that are 20 bytes in length. Those addresses can then be validated by performing a crypto challenge with the node that should be checked.

Messages in the circle network are routed in a way similar to the Kademlia model. Each node forwards the message to the neighbor with the address that is numerically closest to the message's destination address. In order for this to work, each node needs to be connected to many nodes with addresses that are numerically close to its own address and each node must be connected to the two nodes that have addresses with the shortest possible distance to its own. The amount of connections to nodes with numerically distant addresses does affect the number of hops required for routing messages, but does not influence routing as much.

Communication

There are two ways application instances can communicate over the DCL. The first is via unconnected packets, which are routed through a specific DCL network and may or may not arrive at their destination. The second method is via encrypted and connected application channels, which provide reliable transmission of data. For both initiating application channels and sending unreliable packets over the circle network, the public key of the remote node is required as destination address.

Overview

For integration of DCL communication features in third party applications, DCL provides a Java library that manages the TCP connection to the DCL service, including creating and accepting application channels and sending and receiving unconnected messages.

The `org.dclayer` package contains all required classes.

Usage

Connecting to the DCL service

To use DCL in an application, a `Service` object needs to be created first. Below is an example, where `port` is an integer containing the port number the DCL service is listening on.

```
Service service
    = new Service(port);
```

Afterwards, an `ApplicationInstance` object needs to be created for the application to be connected to the service. This works best by utilizing

an `ApplicationInstanceBuilder` object, which is returned by `Service.applicationInstance()`.

```
ApplicationInstanceBuilder builder
    = service.applicationInstance();
```

This fluent interface can be used to set the address keypair to use for the application, to join DCL networks and to connect the application to the service. The code below will use the `KeyPair` object referenced by `addrKeyPair` as this application's address, join the default DCL networks, register the object referenced by `listener` as the `NetworkEndpointActionListener` for the default networks and connect the application to the DCL service.

```
ApplicationInstance application
    = builder
        .addressKeyPair(addrKeyPair)
        .joinDefaultNetworks(listener)
        .connect();
```

The call to `connect()` will block until the TCP connection to the service is established and the application-to-service protocol is initiated. If an error occurs, a `ConnectionException` will be thrown. Otherwise, `connect()` will return a new `ApplicationInstance` object, which can be used to send unconnected packets and to initiate application channels.

Callbacks

`NetworkEndpointActionListener`

The `NetworkEndpointActionListener` interface defines methods for receiving callbacks upon joining of DCL networks, receipt of unconnected packets and incoming application channel requests.

Unconnected packets

Sending

In order to send unconnected packets, the `send()` method of an `ApplicationInstance` object needs to be called.

Receiving

Application channels

Accepting

Initiating

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