**ABSTRACT**

Summary: CytoscapeRPC is a plugin for Cytoscape which allows users to create, query and modify Cytoscape networks from any programming language which supports XML-RPC. This enables them to access Cytoscape functionality and visualize their data interactively without leaving the programming environment with which they are familiar.

Availability: Install through the Cytoscape plugin manager or visit the web page: http://wiki.nbic.nl/index.php/CytoscapeRPC for the user tutorial and download.

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1 INTRODUCTION

Cytoscape (Shannon et al., 2003) is a network visualization and analysis tool which is mainly used in the life sciences. It enables users to display the data as graphs and helps them to perform basic actions such as gathering network-topological statistics. It comes with its own plugin management system to facilitate the easy implementation of new functionality.

Researchers in the life sciences often use scripting languages to process their data and use Cytoscape to visualize it. Their workflow when using Cytoscape comes down to running their algorithm, converting the output data such that Cytoscape can use it, loading the data into Cytoscape and then setting the appropriate layout and visualization rules to control how the data is displayed. The last three steps of this process are repetitive and time consuming.

We present CytoscapeRPC, a Cytoscape plugin created to solve the aforementioned problems by enabling users to create a connection to Cytoscape using XML-RPC, allowing them to create, modify and query Cytoscape networks from within their own programming environment.

2 METHODS AND IMPLEMENTATION

CytoscapeRPC builds on top of the Cytoscape libraries, making these components easily accessible. Nodes, edges and networks etc. can be accessed through their human-readable identifiers. Attributes for these components can be created, queried and modified. They can also be linked to visual mappers. For example, the user can perform a mapping from molecule type (receptor, ligand) to the shape of a node (triangle, square) or, by using the P-value of an interaction, change the colour of the edges between molecules.

Layouts can be applied or the positions of nodes can be set manually by specifying the x- and y-coordinates.

Fig. 1. CytoscapeRPC design. The plugin is split up into a function (handlers), a translation (call handler) and a communication layer. These layers ensure that the API can be kept stable.

The plugin consists of and relies on a number of components, as shown in Figure 1. The different components are explained from top to bottom:

2. Handler classes: classes which provide abstract functions to Cytoscape. Classes have been implemented for nodes, edges, networks, layouts, vizmappers etc. Their functionality consists of translating basic data types such as numbers and strings that can be

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Fig. 2. Example Python session for creating a network using CytoscapeRPC. Setup: initializing the XML-RPC library of Python and creating a connection to the server. Network & nodes: creating a network with the title ‘Test network’ and adding three nodes, ‘a’, ‘b’ and ‘c’. Edges & layout: adding three edges to the network and performing the ‘force directed’ layout. Attributes: Adding attributes to nodes and edges. Note that two errors were introduced: for one node no ‘type’ was specified and the edge from node ‘c’ to node ‘a’ got a ‘P-value’ of 1.2. Node shape: setting the node shape based on the ‘type’ attribute. A default value has been specified to give nodes without that attribute a different shape, in this case a square. Edge colour: setting the edge colour based on the ‘P-value’ attribute. One has to specify between which points the values should be interpolated. Significant P-values get a bright red colour while invalid P-values are either green (lower than zero) or blue (larger than one). Colours are represented with their HTML values.

3 CONCLUSION
CytoscapeRPC allows users to develop applications which leverage the functionality of Cytoscape without having to leave their programming environment. This lowers the barrier for people to start developing their own tools for Cytoscape.

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REFERENCES