Communications Protocol

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Abstract

This document defines the communication protocol used by the clients and servers in the collaborative spreadsheet. The protocol is designed to enable multiple users (clients) to edit a spreadsheet simultaneously in such a way that all changes are reflected in real-time for all clients. This protocol defines the behavior of the server and clients and the messages that are exchanged.

Contents

1 Introduction

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2 Common Client-Server interactions

2.1 Connecting to the Server

The client will open a TCP connection to the server on port 2112 after the connection has been opened, the server will start accepting messages formatted as JSON strings. This connection may be closed and reopened at the clients' discretion, but any open spreadsheet will need to be re-opened.

2.2 Managing Spreadsheets

The protocol defines four basic commands that manipulate spreadsheets as a unit: create, delete, rename, get_name and list_spreadsheet. Every spreadsheet is identified by an *id* and associated with a *name* that need not be unique. The *name* is primarily for display purposes, while the spreadsheet *id* is used to identify it in all operations pertaining to a specific spreadsheet.

2.2.1 Creating a new spreadsheet

To create a new spreadsheet the client will use the *create* command, which accepts the name of the spreadsheet to create, and responds with the *id* of the newly created spreadsheet. The newly created spreadsheet will persist on the server until it is deleted. See create for a description of the *create* command.

2.2.2 Deleting a spreadsheet

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2.2.3 Renaming a spreadsheet

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2.2.4 Listing all spreadsheets

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2.3 Accessing a spreadsheet

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2.4 Editing a spreadsheet

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3 Commands

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Command	Description
create	Creates a new spreadsheet
delete	Deletes a spreadsheet
rename	Renames a spreadsheet
get_name	Gets the name of a spreadsheet
list_spreadsheets	Lists all spreadsheets
open	Subscribes the client to updates
close	Unsubscribes the client to updates
get_history	Gets the edit history of a spreadsheet
get_spreadsheet	Gets the contents of a spreadsheet
push	Pushes edits to be applied to the spreadsheet
undo	Undoes the most recent edit of a spreadsheet

3.1 Common Data Types

3.1.1 Command

All *Command*s contain the *command* field which is used to identify the command being executed. All *Command*s will contain the following fields:

Field	Type	Description
command	string	The command to execute
...	any	Command parameters

3.1.2 Result

There server will respond to each *Command* with a *Result*. *Result*s have two variants: *ok* and *error*. All *Result*s will contain the following fields:

Field	Type	Description
result	string	Identifies the command this result is for
ok	boolean	Whether or not the command was successful

If the *Result* is ok ($ok = true$) then the *Result* may contain addition fields that contain the results of the command. Otherwise the *Result* will contain the following fields:

Field	Type	Description
error	string	A description of the error that occurred.

3.1.3 Edits and Spreadsheet

Various commands will accept as parameters or return as a result the contents of a spreadsheet, both *Edit*s and *Spreadsheet*s will contain spreadsheet contents. They differ in that a *Spreadsheet* object must contain the contents of a whole spreadsheet while a *Edit* object may contain a subset of the contents of a spreadsheet. Both *Edit*s and *Spreadsheet*s will contain the following fields:

Field	Type	Description
$CellName	string	The contents of $CellName.

These data types are simply a mapping between cell names and their contents, valid cell names are a capital letter from "A" to "Z" followed by a number from 1 to 99.

3.2 Create

The create command is used to create a new spreadsheet. Create expects a *name* field to be provided to serve as the name of the new spreadsheet. Any errors resulting from this command will be purely due to an error occurring on the server, for example, if the server does not have the capacity for a new spreadsheet.

3.2.1 Create Command

In addition to the *command* field which will have a value of "create", this command expects the following fields:

Field	Type	Description
name	string	The name of the newly created spreadsheet.

The following is an example of a *create* command:

```
{
    "command": "create",
    "name": "sheet1"
}
```

Listing 1: create command message

3.2.2 Create Results

The result of this command will contain the standard result fields, in addition to the following fields to be included for ok results:

Field	Type	Description
id	number	The id of the newly created spreadsheet.

The following are examples of results of the *create* command:

```
{
    "result": "create",
    "ok": true,
    "id": 1
}
```

Listing 2: create result (ok) message

```
{
    "result": "create",
    "ok": false,
    "error": "failed to create a new spreadsheet"
}
```

Listing 3: create result (error) message

3.3 Delete

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3.3.1 Delete Command

In addition to the *command* field which will have a value of "delete", this command expects the following fields:

Field	Type	Description
id	number	The *id* of the spreadsheet to delete.

The following is an example of a *delete* command:

```
{
    "command": "delete",
    "id": 1
}
```

Listing 4: delete command message

3.3.2 Delete Results

The result of this command will contain the standard result fields. The following are examples of results of the *delete* command:

```
{
    "result": "delete",
    "ok": true,
}
```

Listing 5: delete result (ok) message

```
{
    "result": "delete",
    "ok": false,
    "error": "failed to delete the spreadsheet"
}
```

Listing 6: delete result (error) message

3.4 Rename

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3.4.1 Rename Command

In addition to the *command* field which will have a value of "rename", this command expects the following fields:

Field	Type	Description
id	number	The *id* of the spreadsheet to rename.
name	string	The new *name* of the spreadsheet.

The following is an example of a *rename* command:

```
{
    "command": "rename",
    "id": 1,
    "name": "sheet1-old"
}
```

Listing 7: rename command message

3.4.2 Rename Results

The result of this command will contain the standard result fields. The following are examples of results of the *rename* command:

```
{
    "result": "rename",
    "ok": true
}
```

Listing 8: rename result (ok) message

```
{
    "result": "rename",
    "ok": false,
    "error": "failed to rename the spreadsheet"
}
```

Listing 9: rename result (error) message

3.5 Get Name

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3.5.1 Get Name Command

In addition to the *command* field which will have a value of "get_name", this command expects the following fields:

Field	Type	Description
id	number	The *id* of the spreadsheet to whose name to get.

The following is an example of a *get_name* command:

```
{
    "command": "get_name",
    "id": 1
}
```

Listing 10: get_name command message

3.5.2 Get Name Results

The result of this command will contain the standard result fields, in addition to the following fields to be included for ok results:

Field	Type	Description
name	string	The *name* of requested spreadsheet.

The following are examples of results of the *get_name* command:

```
{
    "result": "get_name",
    "ok": "true",
    "name": "sheet1"
}
```

Listing 11: get_name result (ok) message

```
{
    "result": "get_name",
    "ok": false,
    "error": "Spreadsheet does not exist"
}
```

Listing 12: get_name result (error) message

3.6 List Spreadsheets

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3.6.1 List Spreadsheets Command

The *command* field which will have a value of "list_spreadsheets", and will the *Command* will not need to contain any other fields.

The following is an example of a *list_spreadsheets* command:

```
{
    "command": "list_spreadsheets"
}
```

Listing 13: list command message

3.6.2 List Spreadsheets Results

The result of this command will contain the standard result fields, in addition to the following fields to be included for ok results:

Field	Type	Description
spreadsheets	number[]	The *id*s of all the spreadsheets.

The following are examples of results of the *list_spreadsheets* command:

```
{
    "result": "list_spreadsheets",
    "ok": true,
    "spreadsheets": [
        1, 2, 3, 4
    ]
}
```

Listing 14: list result (ok) message

```
{
    "result": "list_spreadsheets",
    "ok": false,
    "error": "failed to read spreadsheets"
}
```

Listing 15: list result (error) message

3.7 Open

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3.7.1 Open Command

In addition to the *command* field which will have a value of "open", this command expects the following fields:

Field	Type	Description
id	number	The *id* of spreadsheet to open.

The following is an example of a *open* command:

```
{
    "command": "open",
    "id": 1
}
```

Listing 16: open command message

3.7.2 Open Results

The result of this command will contain the standard result fields, in addition to the following fields to be included for ok results:

Field	Type	Description
spreadsheet	Spreadsheet	The contents of the opened spreadsheet.

The following are examples of results of the *open* command:

```
{
    "result": "open",
    "ok": true,
    "spreadsheet": {
        "A1": "foo",
        "A2": "bar"
    }
}
```

Listing 17: open result (ok) message

```
{
    "result": "open",
    "ok": false,
    "error": "Spreadsheet does not exist"
}
```

Listing 18: open result (error) message

3.8 Close

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3.8.1 Close Command

In addition to the *command* field which will have a value of "close", this command expects the following fields:

Field	Type	Description
id	number	The *id* of spreadsheet to close.

The following is an example of a *close* command:

```
{
    "command": "close",
    "id": 1
}
```

Listing 19: close command message

3.8.2 Close Results

The result of this command will contain the standard result fields. The following are examples of results of the *close* command:

```
{
    "result": "close",
    "ok": true
}
```

Listing 20: close result (ok) message

```
{
    "result": "close",
    "ok": false,
    "error": "Spreadsheet is not open"
}
```

Listing 21: close result (error) message

3.9 Get History

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3.9.1 Get History Command

In addition to the *command* field which will have a value of "get_history", this command expects the following fields:

Field	Type	Description
id	number	The *id* of the spreadsheet whose history to get

The following is an example of a *get_history* command:

```
{
    "command": "get_history",
    "id": 1
}
```

Listing 22: get_history command message

3.9.2 Get History Results

The result of this command will contain the standard result fields, in addition to the following fields to be included for ok results:

Field	Type	Description
edits	Edit[]	The edit history in order from oldest to newest.

The following are examples of results of the *get_history* command:

```
{
    "command": "get_history",
    "ok": true,
    "edits": [
        {
            "A1": 1,
            "B1": "=A1"
        },
        {
```

```
            "A2": "bar"
        }
    ]
}
```

Listing 23: get_history result (ok) message

```
{
    "result": "get_history",
    "ok": false,
    "error": "Spreadsheet does not exist"
}
```

Listing 24: get_history result (error) message

3.10 Get Spreadsheet

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3.10.1 Get Spreadsheet Command

In addition to the *command* field which will have a value of "get_spreadsheet", this command expects the following fields:

Field	Type	Description
id	number	The *id* of the spreadsheet whose contents to get.

The following is an example of a *get_spreadsheet* command:

```
{
    "command": "get_spreadsheet",
    "id": 1
}
```

Listing 25: get_spreadsheet command message

3.10.2 Get Spreadsheet Results

The result of this command will contain the standard result fields, in addition to the following fields to be included for ok results:

Field	Type	Description
spreadsheet	Spreadsheet	The contents of the requested spreadsheet.

The following are examples of results of the *get_spreadsheet* command:

```
{
    "result": "get_spreadsheet",
    "ok": true,
```

```
    "spreadsheet": {
        "A1": "foo",
        "A2": "bar"
    }
}
```

Listing 26: get_spreadsheet result (ok) message

```
{
    "result": "get_spreadsheet",
    "ok": false,
    "error": "Spreadsheet does not exist"
}
```

Listing 27: get_spreadsheet result (error) message

3.11 Undo

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3.11.1 Undo Command

In addition to the *command* field which will have a value of "undo", this command expects the following fields:

Field	Type	Description
id	number	The *id* of the spreadsheet to perform the undo on.

The following is an example of a *undo* command:

```
{
    "command": "undo",
    "id": 1
}
```

Listing 28: undo command message

3.11.2 Undo Results

The result of this command will contain the standard result fields. The following are examples of results of the *undo* command:

```
{
    "result": "undo",
    "ok": true
}
```

Listing 29: undo result (ok) message

```
{
    "result": "undo",
    "ok": false,
    "error": "Spreadsheet does not exist"
}
```

Listing 30: undo result (error) message

3.12 Push

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3.12.1 Push Command

In addition to the *command* field which will have a value of "push", this command expects the following fields:

Field	Type	Description
id	number	The *id* of the spreadsheet to perform the push on.
edits	Edit[]	The edits to apply to the spreadsheet.

The following is an example of a *push* command:

```
{
    "command": "push",
    "id": 1,
    "edits": [
        {
            "A1": "=A2",
            "A2": 1
        },
        {
            "A2": "=A1",
            "A1": 1
        }
    ]
}
```

Listing 31: push command message

3.12.2 Push Results

The result of this command will contain the standard result fields. The following are examples of results of the *push* command:

```
{
    "result": "push",
    "ok": true
}
```

Listing 32: push result (ok) message

```
{
    "result": "push",
    "ok": false,
    "error": "Edits cause a circular dependency"
}
```

Listing 33: push result (error) message