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New interfaces for the collaboration tool Trello

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Abstract

Trello is a collaboration web service to manage projects and assign their to-do items to co-workers. There are many collaboration tools available today, but most of them are very basic. Nevertheless, it also has its limitations. Trello, as it is now, is a closed system. Nothing gets in or out unless Trello itself is used. It sometimes would be handy though, if it would be possible to apply Trello data to other applications. For example a CMS containing a list of posts which already managed in Trello.

Therefore, several scripts were developed for this thesis which let Trello interact with other web services and applications. To accomplish this task in the most dynamic way possible, an API wrapper of the Trello API in the Ruby programming language was implemented.

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Nomenclature

API	Application Programming Interface
CLI	Command Line Interface
CMS	Content Management System
ERB	embedded Ruby
HTML	Hyper Text Markup Language
HTTP	Hyper Text Transfer Protocol
ISO	International Organization for Standardization
JSON	JavaScript Object Notation
MIME	Multipurpose Internet Mail Extensions
MVC	Model View Controller
REST	Representational State Transfer
RFC	Request For Comments
RSS	Really Simple Syndication
UCS	Universal Character Set
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
UTC	Universal Time Coordinated

UTF-8	8-Bit UCS Transformation Format
XHTML	Extensible Hyper Text Markup Language
XML	Extensible Markup Language

Chapter 1

Introduction

Trello¹ is a web service by the New York City based web corporation Fog Creek Software². It is a collaboration tool to manage projects and was launched in 2011³.



Figure 1.1: A Trello board.

The service focuses on the concept of so called *boards* containing several configurable lists. Figure 1.1 shows a board with the three standard lists *To Do*, *Doing*, and *Done*. In these lists, the user can create to-do items called *cards* containing additional data. Each card has a title and an optional description,

¹<http://www.trello.com>

²Official Fog Creek Software website: <http://www.fogcreek.com>

³The original launch post in the Trello blog: <http://blog.trello.com/launch/>

some assigned members, a due date, some labels, votes, checklists, comments, and attachments. The creator of the board is the owner and can invite other Trello users to his boards and cards. This way, everyone who's working on a project can see what is going on at the moment. Users who are assigned to a board can even create new to-do items by themselves. If it should be the case that somebody works at more than one company with many projects each, there is the concept of *organizations* to ensure clear separation.

It is possible to manage complete projects within Trello, but sometimes the information in Trello should be displayed in a different manner. For example if there are due dates managed by Trello. It would be useful to display them in the calendar application the user uses otherwise. Trello can't provide information to other applications or web services itself. To work with data outside of Trello, there is a API to access all kinds of data in Trello. The wrapper written for this thesis represents the Trello API in Ruby, and extends it with useful methods to allow developers a convenient possibility to access Trello.

The thesis is organised as follows: The basics are discussed in Chapter 2. This mainly includes a description of the Trello API, a brief introduction to the Ruby programming language and the explanation of the used formats and procedures. Chapter 3 deals with the development of an API wrapper in Ruby for the Trello API. Here, the most important methods are described in detail. In the [applications section](#) the API wrapper is used to link Trello to other services and to extract application-specific data from Trello respectively add new information to Trello. A discussion and a brief outlook on further possible applications of the API wrappers in Chapters 5 and 6 conclude this thesis.

Chapter 2

Principles

2.1 Trello

2.1.1 Why Trello

Trello is different from most to-do applications. It is streamlined for the purposes of small businesses. It therefore works perfectly for the needs of a university with small groups of people working on the same tasks. Trello has already proved its value for several months. The Trello website is written in HTML 5 with the use of AJAX where necessary. Trello provides an iOS [tre12a] and Android [tre12c] app, both of which are constantly evolving. So the system is state-of-the-art. In addition, the company behind Trello is not just a start-up with three employees, which is also of importance. A product of a small business, which is just based on the enthusiasm of the founders, often doesn't last long. Fog Creek Software is over ten years old and has several products.

The first aim was to see the due dates of the cards someone is assigned to in Google Calendar. Considering this, there were many other use cases for small scripts which could run as cron jobs on a server to serve several regular tasks. These scripts are described in more detail in Chapter 3.

2.1.2 Trello API

The Trello API is still in beta, but it is already very extensive. [tre12d]

Authentication

Because the scripts which are used here need access to private boards in Trello, there has to be some kind of authentication. For user applications with a front end, the Trello API provides OAuth2. Because of the concept of OAuth2, however, the user is required to enter his Trello username and password. [oau12] The scripts developed for this thesis are supposed to run on servers as cron jobs, so there is no user who could manually enter data. For this kind of applications, Trello provides a key/token-system. Every user has a private key with which they can generate a token. This token will be sent along every request to the Trello API. The token tells Trello which scope the request can access. While generating a token the user can specify the scope of the token and when it will expire. The possible expiration date of a token is between one day and never. In our case we will use *never*. To generate a token the user has to visit a certain URL: `https://trello.com/1/authorize?key=SUBSTITUTEWITHYOURPRIVATEKEY&name=My+Application&expiration=never&response_type=token&scope=read,write` In this example the token would never expire and could read and write everything the user can access with the API. Other valid values instead of *never* for expiration would be *1day*, *30days*. *30days* is the default value. [tre12b]

2.2 Ruby

Ruby is a modern general-purpose object-oriented programming language. The big difference to most other languages is that it focuses on humans rather than computers.

Yukihiro Matsumoto, the designer of Ruby, once said:

Ruby is simple in appearance, but is very complex inside, just like our human body.[rub00]

That means that Ruby is very easy to read and is intuitive for humans even though it can perform complex tasks. This is achieved with English keywords instead of brackets and curly brackets. The result of this consistent philosophy

is a very easy to read language which is also very plain. Because of the English words instead of abstract characters, Ruby is easy to understand. Even non-programmers are mostly able to understand what is going on. Programmers, as a result, produce a lot fewer errors while writing the code. A wrongly spelt word is more intuitively recognisable than a missing bracket or semicolon. [rub12a] More about Ruby can be found at <http://www.ruby-lang.org>.

2.2.1 RubyGems

Ruby has many methods and classes every Ruby installation provides¹. In addition, there are hundreds of extensions for special use cases – to communicate with RESTful web APIs for example – made by third party developers. In Ruby, such extensions are called *gems*. To manage and publish these third party libraries, there is the standard *RubyGems*. It provides a standard format for third party libraries for Ruby, a tool to manage the installation of them, and a server for distributing the gems. [rub12d] Some Ruby distributions are delivered with several gems. Gems can be added to an existing Ruby installation at any time.

To install an additional gem on a Unix operating system, where the Ruby standard library is installed, the following command can be used:

```
gem install gemname
```

gemname is here referring to the name of the respective gem. If the installation performed without errors, the gem is ready to use. [rub12e]

To use an installed gem in a Ruby script, the following code at the top of the script before the beginning of the code is necessary:

```
1 require 'gemname'
```

Listing 2.1: Using the gem *gemname*

Again, *gemname* stands for the name of the respective gem. If any gems that are not part of the Ruby standard library are used in this script, they are listed

¹Libraries that are included with the Ruby standard library: <http://www.ruby-doc.org/stdlib-1.9.3/>

at the beginning of the related description. Further information at <http://doc.rubygems.org> and <http://rubyforge.org/projects/rubygems/>. Additionally, <http://rubygems.org> is a reference book like website for Ruby gems.

2.2.2 Ruby and MySQL

In order to access databases in Ruby, there are additional libraries needed as the Ruby standard library doesn't support any databases. In this API wrapper, the MySQL gem is used. This gem is an API wrapper around the MySQL C client API. MySQL is used here because it is the most popular open source database. [mys08] It is especially popular for data-handling in web applications. Therefore, the scripts described here will support MySQL.

```
1 my = Mysql.init
2 my.options(Mysql::SET_CHARSET_NAME, 'utf8')
3 my.real_connect(dbhost, dbuser, dbpassword, db)
4 my.query("SET NAMES utf8")
```

Listing 2.2: Initialising a database connection.

Listing 2.2 above shows the initialisation of a new connection to a MySQL database with the Ruby MySQL gem. The variable `my` is a new database handler. If the correct charset isn't set, it won't work. The host, the user, the password, and the database name should be stored in separate variables so they are easily editable. `SET NAMES utf8` in line 4 of listing 2.2 is a first execution of a MySQL query. It tells the server the charset name of future connections. In this example, the server expects all future queries as UTF8 charset.

MySQL statements can be executed directly or as *prepared statements*. The example in line 4 of 2.2 is a normal statement which is executed directly. Listing 2.3 shows a longer example.

```
1 response = my.query("
2     SELECT fieldname1
3     FROM tablename
```

```
4 WHERE fieldname2=value
5 AND fieldname3=value
6 ")
7 response.each do |row|
8   puts row
9 end
```

Listing 2.3: Example for a directly executed MySQL query.

The MySQL statement between line 2 and 5 responds with data, so the result of the query must somehow be read. The response of a **SELECT** statement is an array of rows from the given table. To get the lines of the response table, the `each` method is used to iterate through the array and print each row.

```
1 statement = my.prepare("
2   INSERT INTO tablename (
3     fieldname1,
4     fieldname2
5   )
6   VALUES (
7     ?,
8     ?
9   )
10 ")
11 statement.execute value1, value2
12 statement.execute othervalue1, othervalue2
```

Listing 2.4: `joomlaMultiple.rb` usage.

The listing above shows how the MySQL library for Ruby handles prepared statements. The big difference to directly executed statements are the wildcards in the **VALUES** part. It's more like a template for a statement. Although the statement doesn't contain all required values, it is sent to the underlying DBMS of MySQL. The DBMS can already perform query optimisation on this statement template. To fill in the actual values, the statement must be executed with the `execute` method. The lines 11 and 12 are two executions of the specified statement. In this step, the wildcards are replaced by the actual values. The DBMS performs additional query optimisation if needed.

Sometimes, query optimisation depends on the values of the fields. Prepared statements can be executed multiple times. That saves performance, because the initial query optimisation must be performed only once. In addition, prepared statements are safer than directly executed statements. Because the DBMS processes the MySQL code separately to the actual data, it can distinguish between valid and invalid data. The DBMS checks every given value before writing it to the database. Because of that, SQL injection isn't possible with prepared statements. For every MySQL statement that writes data to the database, it is therefore reasonable to use prepared statements. [mys12]

2.2.3 Error handling

Because these scripts access mostly web servers, sometimes multiple in a single execution, error handling is essential. There are many reasons why an API call can't be executed properly, but the connection is a common reason. It's very useful to the user if they know the reason why a script failed to execute. Error handling ensures, that the script posts an error message, at least. So the user has a chance to find out what's the reason for the problem and if he can do anything about it.

Error handling in Ruby is realised with *begin* blocks. A *begin* block is like an *if* expression but for *exceptions*.

```
1 begin
2   my = Mysql.init
3   my.real_connect(dbhost, dbuser, dbpassword, db)
4 rescue => e
5   puts e.message
6 else
7   puts "It works!"
8 ensure
9   mysql.close if mysql
10 end
```

Listing 2.5: Error handling with *begin* blocks.

A *begin* block has several sections. The first section is the *begin* section. Here, the code to check is executed. The example in listing 2.5 shows a simple database connection. With the *begin* block around it, Ruby checks if any exceptions occur while executing this code. If there indeed are exceptions, the *rescue* section comes to help out. The error is stored in the variable *e*. At least the message can be printed here, to inform the user. A *begin* block may contain multiple *rescue* sections. It's possible to specify special types of exceptions, so corresponding actions can be performed.

```
1 rescue Mysql::Error => e
```

Listing 2.6: joomlaMultiple.rb usage.

In listing 2.6 the `Mysql::Error` class is specified. In this *rescue* section only exception of this class will be handled.

An *else* section in a *begin* block like in line 6 of listing 2.5, is allowed only if there are one or more *rescue* blocks. It is executed if there are no exceptions. The last section is the *ensure* block. It is executed no matter whether there is an exception or not. In the example, the initialised database connection is closed. This section is supposed to finish the execution of the whole block. [sko09]

2.3 REST

The Trello API is a *RESTful* web API. That means that the API is conform to the REST design model. REST is a common style of software architecture for distributed systems. It is built on four of the HTTP request methods: GET, POST, PUT and DELETE. An implementation of a RESTful web service follows four basic design principles:

- Use HTTP methods explicitly.
- Be stateless.
- Expose directory structure-like URIs.
- Transfer XML , JSON, or both.

[res12]

Following these conventions a GET URL of a RESTful web service looks like this:

```
https://api.trello.com/1/cards/4fc8dd3e1b9ecf0c3571902f?  
key='PRIVATEKEY&token=TOKEN
```

This is a GET request to get a specific card with the ID 4fc8dd3e1b9ecf0c3571902f. If this URL is visited in a browser (with correct *key* and *token*), the browser will show plain JSON. In order for Ruby to be able to work with it, it must somehow capture this data. To fulfill the requirements of REST in Ruby, there are several gems. Here the RestClient gem is used. This GET request executed with the RestClient gem in Ruby looks like 2.7.

```
1 member = RestClient.get('https://api.trello.com/1/cards/4  
    fc8dd3e1b9ecf0c3571902f?key='+$key+'&token='+$token)  
2 pp JSON.parse(member)
```

Listing 2.7: GET request using RestClient.

In comparison to the open-uri library, which is included in the Ruby standard library, using RestClient results in much cleaner code, especially when it comes to POST requests.

```
1 response = RestClient.post(  
2   'https://api.trello.com/1/boards',  
3   :name => board['name'],  
4   :desc => board['desc'],  
5   :key => $key,  
6   :token => $token  
7 )
```

Listing 2.8: POST request using RestClient.

```
1 uri = URI('https://api.trello.com/1/boards')  
2 req = Net::HTTP::Post.new(uri.path)
```

```
3
4 req.set_form_data(
5   'name' => board['name'],
6   'desc' => board['desc'],
7   'key' => $key,
8   'token' => $token
9 )
10
11 Net::HTTP.start(uri.host, uri.port, :use_ssl => uri.
12   scheme == 'https') do |http|
13   response = http.request(req)
14 end
```

Listing 2.9: POST request with open-uri.

Listing 2.8 and listing 2.9 show the very same API call. But 2.8 is realised with RestClient and listing 2.9 with open-uri. Not only is the open-uri code much longer, but open-uri also doesn't detect the correct scheme from the given URI. If the call should be performed in HTTPS, this has to be set explicitly. This implies that for the handling of RESTful web services, RestClient is the better choice.

2.4 JSON

All the responses of Trello API calls are in the JSON² format, which is a subset of the JavaScript programming language. Despite its relation to JavaScript, it is language independent. JSON is a data-interchange format like XML, but it is built on two structures. One is a list of key/value pairs. In most programming languages, this is realised as a hash, struct, object, or associative array. The other structure is an ordered list of values. This is realised as an array, list, vector, or sequence in popular programming languages. In JSON itself, these structures are called *object* and *array*. Objects start and end with curly brackets. Each key is followed by a colon and the key/value pairs are separated by commas. Arrays start and end with squared brackets, the values

²RFC document for JSON: The application/json Media Type for JavaScript Object Notation (JSON) <http://www.ietf.org/rfc/rfc4627.txt>

are again separated by commas. Both can be arbitrarily nested. Every time one of the scripts saves content to any other place than Trello, it is also in the JSON format in order to guarantee easy compatibility with Trello. JSON can be saved in files, too. A JSON file has the suffix `.json`. [\[jso12a\]](#)

```
1 {  
2   "id": "4eea4ffc91e31d1746000046",  
3   "name": "Example Board",  
4   "desc": "This board is used in the API examples",  
5   "lists": [{  
6     "id": "4eea4ffc91e31d174600004a",  
7     "name": "To Do Soon"  
8   }, {  
9     "id": "4eea4ffc91e31d174600004b",  
10    "name": "Doing"  
11  }, {  
12    "id": "4eea4ffc91e31d174600004c",  
13    "name": "Done"  
14  }]  
15 }
```

Listing 2.10: JSON example.

In listing 2.10, a JSON example is shown. This is the response of

```
https://api.trello.com/1/boards/4eea4ffc91e31d1746000046?  
lists=open&list_fields=name,desc&key=PRIVATEKEY&token=TOKEN
```

The JSON in listing 2.10 starts with a curly bracket. That means the uppermost structure is an object. Here are a few key/value pairs like `"id": "4eea4ffc91e31d1746000046"`. The key `"list"` has an array as value, so their value is in squared brackets. Each element of the array is, again, an object.

To process the received JSON, Ruby needs to parse it first. For that purpose, there is the a gem simply called *JSON*. It parses the JSON with the

```
JSON.parse(receivedJson)
```

command, where `receivedJson` is a variable that contains the plain JSON received from the Trello API with a GET request. After the parsing, the JSON objects are now represented as Ruby hashes and the JSON arrays as Ruby arrays. To post content to the Trello API, it has to be in JSON, too. There is another method of the JSON class in Ruby which generates JSON from Ruby hashes and arrays.

```
JSON.generate(hashBoards)
```

The result is a valid JSON formatted string, ready to be written to a JSON file or sent to an API.

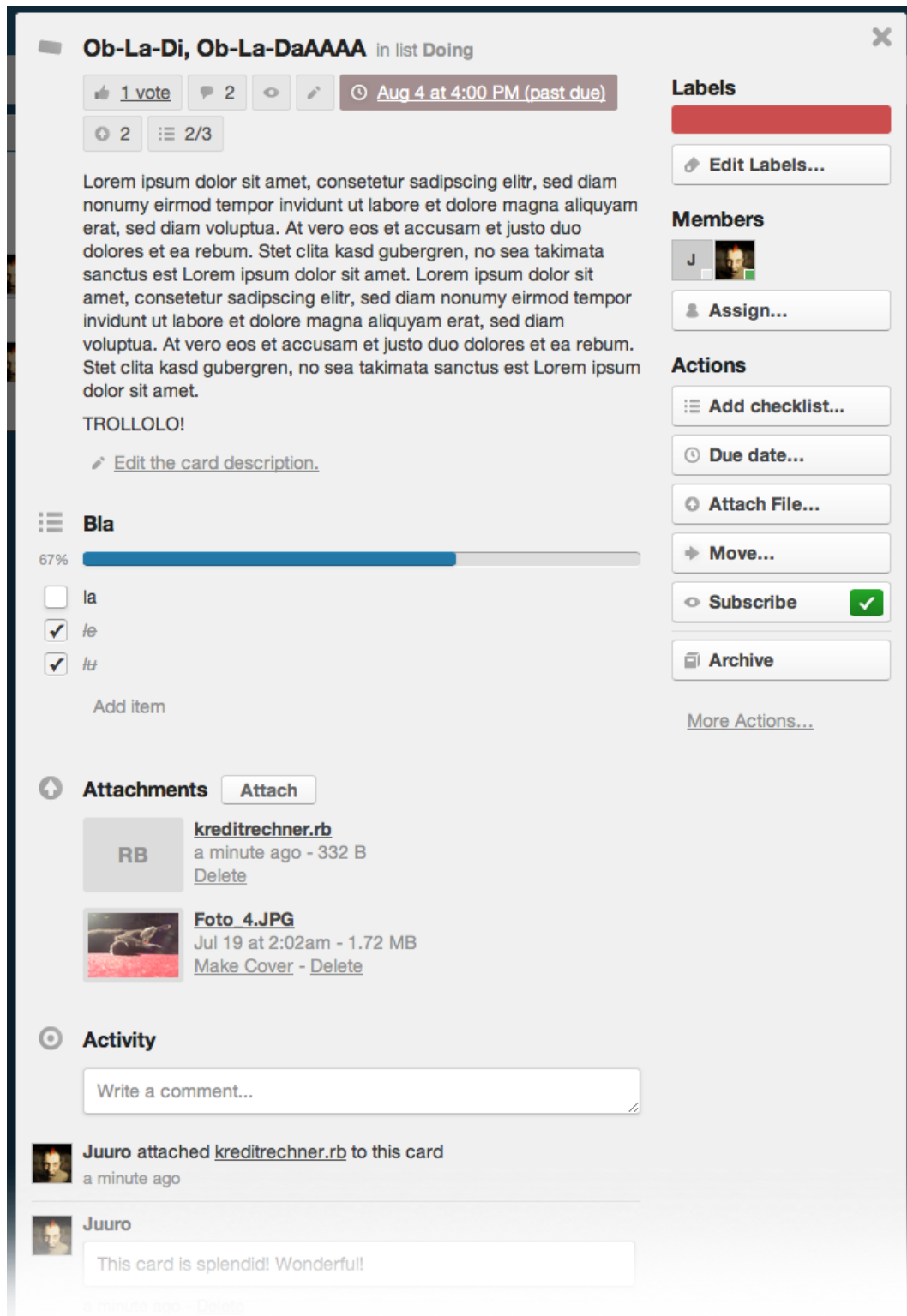


Figure 2.1: A opened card in Trello.

Chapter 3

Trello API wrapper

These scripts fulfill very different tasks, but they have also much in common. For example, almost every script potentially loads single cards. This API wrapper makes Trello accessible in Ruby. Additionally, the scripts can now use the same methods multiple times and, in consequence, they can stay very lightweight and clean. Almost everything that is possible with the Trello API is also possible with this API wrapper. It doesn't cover all features, though, because the API is still in beta phase, so it changes quite quickly.

The API wrapper also has methods to pre-process data for Ruby. From a developer's point of view, Trello is all about cards. Cards are the only things in Trello with real data, not just meta data. So if the task is to get a board from the API, it means to get the cards of the board. Although the developer won't be able to read out all information, there is an API call to get all cards belonging in a specific board. So the API wrapper has to execute the API call for a single card to cumulate all the information about all the cards of the board. This is the function of the API wrapper, to keep the actual script clean. So the developer can work with the data and doesn't have to worry about determining it.

The API wrapper is meant to perform all API calls which are required by the scripts. None of the API calls should be performed by the scripts that use the API wrapper.

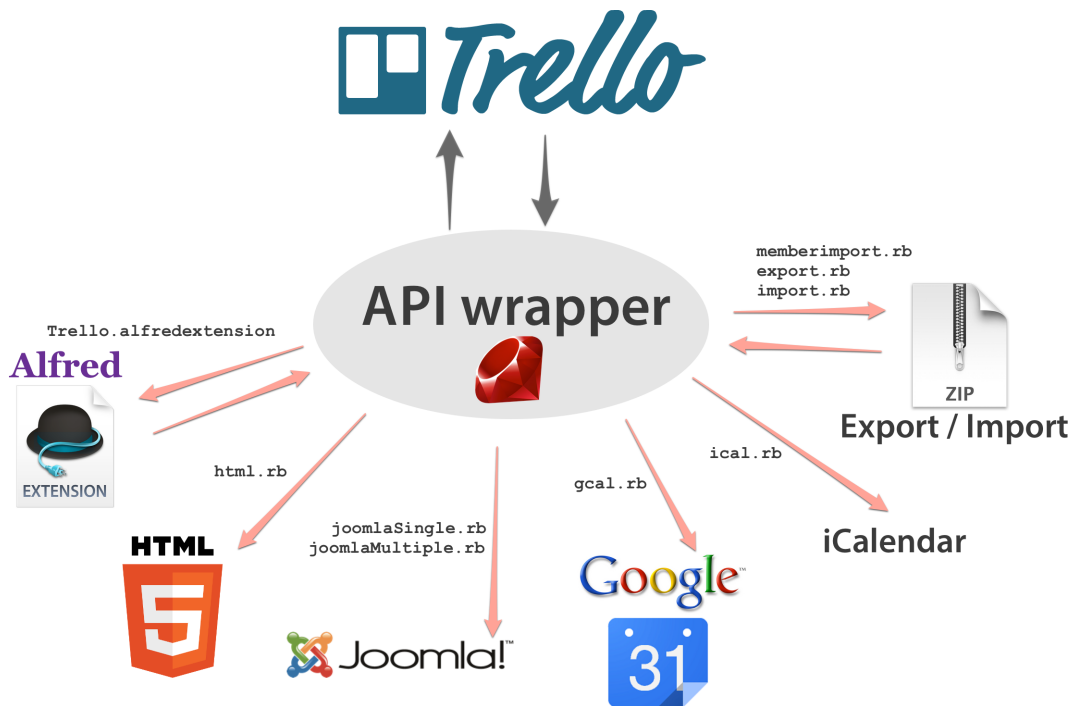


Figure 3.1: Connections between Trello, the API wrapper, and the actual features. [rub][htm][joo12c][goo12a]

3.1 Command Line Interface

Almost every script needs some information to run properly. The information which every scripts needs, is the key and token of the user whose account is supposed to be used to access Trello. The scripts have to know which cards, lists, and boards they have to look at. Therefore, this information has to be passed on to the scripts, too. This information could be set at the top of each script. But it is obvious that that it would be very unpractical to hard code this in each script. This way, it would be impossible to use the same Ruby file with several Trello accounts. For every Trello account, the user has to generate a dedicated file. The solution for this problem is a command-line interface (CLI). With a CLI, the user can pass on information to the script in a predefined format, so the script knows exactly what to do. For every other call, the user can specify different information for the same script.

The Ruby class `OptionParser`[rub12c] provides easy customisable command-line option analysis. The developer is able to specify their own options for each script. For this purpose, a dedicated class is used. In order to let the

actual script *know* about the CLI arguments, the developer has to require the respective CLI class with the command-line option definitions.

```
1 ruby html.rb -c 4ffd78a2c063afeb066408b8
```

Listing 3.1: Example usage of a script with CLI.

An example usage of a script with CLI would look like Listing 3.1. The `-c` is a command-line option. If there is a string behind the option, like in this case, the string is a so called *argument*. But there are command-line options which stand by themselves. These are called *flags*, which are for polar decisions only.

```
1 # Trello list(s)
2 opts.on("-l", "--lists x,y,z", Array, "Ids of one or more
   Trello lists.") do |lists|
3   options.lists = lists
4 end
```

Listing 3.2: Definition of a command-line option

Listing 3.2 shows the definition of the option `-l` for passing one or more IDs of lists to a script. In Line 2 the word `Array` casts the list argument to an `Array` object.

`OptionParse` provides an automated help option. If the user types

```
ruby script.rb -h
```

they get the explanation the developer wrote in the CLI class for this script with all possible options. This list is automatically generated by the definitions of the command-line options like in Listing 3.2. It works with `-help` and `--help` instead of `-h`, too.

```
1 Usage: ical.rb [options]
2 Select the input cards with -c, -l, -b or -a
3
4 Specific options:
5 -a, --[no-]all          Set this if all due dates of all
   cards of all boards this user can see shall be used.
```

```
6 -l, --lists x,y,z      Ids of one or more Trello lists.
7 -b, --boards x,y,z    Ids of one or more Trello boards.
8 -o, --organizations x,y,z Ids of one or more Trello
   organizations.
9 -c, --cards x,y,z     Ids of one or more Trello cards.
10 -k MANDATORY, --key   Your Trello key.
11 -t MANDATORY, --token The Trello token.
```

Listing 3.3: Output of the `-h` option.

Listing 3.3 shows the Output of `ruby ical.rb -h`. These are the basic CLI commands used by every script. For some scripts there are additional commands, which are explained in their respective sections.

All information from the command-line is stored in the `options` variable. This is an instance of Ruby's `OpenStruct` class, which is a data structure that allows the definition of random attributes. In line 3 of listing 3.2 the attribute `lists` is initialised with a new value. [rub12b] To read the command-line the script has to instruct the command-line class to parse the command-line arguments considering the specified options. After the command-line is parsed the data is available in a `OpenStruct`:

```
1 options = CLHtml.parse(ARGV)
2
3 $key = options.key
4 $token = options.token
```

Listing 3.4: Reading the `OpenStruct` containing the command-line information.

Listing 3.4 shows how to instruct the corresponding command-line class to parse the command-line information and how to access the data in the `OpenStruct`. Here the token and key specified in the command-line are provided as global variables to the programme.

3.2 Methods

The API wrapper contains a huge amount of methods. The API calls wrapped by the following methods need a private key and a token to access content in private boards. Thus, private key and token need not be sent to each method, it will be initialised in each script as global variables. The variable for the private key is called `$key` and the one for the token is called `$token`. Global variables can be accessed from anywhere within the programme during the runtime.

The methods which wrap a GET or DELETE request look like listing 3.5. A special URL is visited by the RestClient gem and the response JSON is parsed and returned as hash.

```
1 def getBoardsByMember(memberId)
2   boards = RestClient.get("https://api.trello.com/1/
   members/"+memberId+"/boards?key="+$key+"&token="+
   $token+"&filter=open")
3   boards = JSON.parse(boards)
4 end
```

Listing 3.5: `getBoardsByMember()`

The methods which wrap POST or PUT requests look like in listing 3.6. Several arguments have to or can be passed to the URL.

```
1 def postCard(cardName, cardDesc, cardPos, idList)
2   response = RestClient.post(
3     'https://api.trello.com/1/cards',
4     'name' => cardName,
5     'desc' => cardDesc,
6     'pos' => cardPos,
7     'idList' => idList,
8     'key'=>$key,
9     'token'=>$token
10  )
11  response = JSON.parse(response)
12 end
```

Listing 3.6: postCard()

In this case a new card is created. The Trello API needs the title of the new card, the description, if the card should have one, the position in the list, and the ID of the list it which it should be placed. A example JSON response of a POST request to Trello is shown in listing 3.7.

```
1 {"id"=>"504bf790e9e68a282c8b3df6",
2  "checkItemStates"=>[],
3  "closed"=>false,
4  "desc"=>"",
5  "idBoard"=>"4ffa4c5ce75c29032a88ea31",
6  "idChecklists"=>[],
7  "idList"=>"4ffa4c5ce75c29032a88ea32",
8  "idMembers"=>[],
9  "idShort"=>27,
10 "manualCoverAttachment"=>false,
11 "labels"=>[],
12 "name"=>"Woot!",
13 "pos"=>3,
14 "url"=>"https://trello.com/card/woot/4
    ffa4c5ce75c29032a88ea31/27",
15 "badges"=>
16  {"votes"=>0,
```

```
17  "viewingMemberVoted"=>false ,
18  "subscribed"=>false ,
19  "fogbugz"=>"",
20  "checkItems"=>0 ,
21  "checkItemsChecked"=>0 ,
22  "comments"=>0 ,
23  "attachments"=>0 ,
24  "description"=>false ,
25  "due"=>nil}}
```

Listing 3.7: JSON response of a POST request.

This JSON response is parsed to a Ruby hash, as well.

For a documentation on every method of the API wrapper there is a documentation in HTML available.

3.2.1 Handling of date and time

Content in Trello may have set dates. These dates are represented by the Trello API as an ISO 8601¹ formatted string. The timezone of the date is UTC. To ensure that the correct time is always displayed, the date has to be adapted to local time.

`getDate(date, format='de')`

```
1  def getDate(date, format='de')
2    fdate = Time.iso8601(date).getlocal
3
4    if format=='de'
5      return fdate.strftime('%d.%m.%Y %H:%M:%S')
6    elsif format=='us'
7      return fdate.strftime('%m/%d/%Y %I.%M.%S %P')
```

¹More information about ISO 8601 on the website of the International Organization for Standardization: http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=40874. The RFC 3339 is a profile of ISO 8601: <http://www.ietf.org/rfc/rfc3339.txt>

```
8   elsif format=='joomla'  
9       return fdate.strftime('%Y-%m-%d %H:%M:%S')  
10  elsif format=='ical'  
11      return fdate.strftime('%Y%m%dT%H%M%S')  
12  elsif format=='year'  
13      return fdate.strftime('%Y')  
14  elsif format=='iso8601'  
15      return fdate.iso8601  
16  end  
17 end
```

Listing 3.8: getDate()

In line 2 of listing 3.8 the given date string in ISO 8601 format is parsed to a Ruby Time object. `getlocal` is the important part here. This function of the Time class determines the server's time zone and readjusts the time accordingly. This method respects the daylight saving time in several time zones, too. For this method working as intended it is important that the correct time zone is set on the used server.

The `getDate()` method additionally converts the date to other formats. For example date formats which are required by the iCalendar format or the Joomla CMS.

3.2.2 Special methods

Special methods don't just wrap a Trello API call, but accumulate basic information with additional data to get information which the Trello API doesn't provide directly.

`getCardsAsArray(arrayCardsStd, downloads = true)`

```
1 def getCardsAsArray(arrayCardsStd, downloads = true)  
2   arrayCardsFull = Array.new  
3   directoryNameAttachments = File.join(Dir.tmpdir, "  
   attachments")
```

```
4
5 arrayCardsStd.each do |card|
6   # export members
7   memberArray = Array.new
8   card['idMembers'].each do |memberId|
9     member = getMember(memberId)
10    memberArray << member
11  end
12  membersForCard = Hash.new
13  membersForCard['members'] = memberArray
14  card = card.merge(membersForCard)
15  # end export members
16
17  # export checklists
18  hasChecklist = getChecklist(card['id'])
19
20  if hasChecklist[0] != nil
21    arrayChecklists = Array.new
22    checkItemStates = card['checkItemStates']
23    hasChecklist.each do |checklist|
24      hashChecklist = Hash.new
25      hashChecklist['id'] = checklist['id']
26      hashChecklist['name'] = checklist['name']
27      arrayItems = Array.new
28      checklist['checkItems'].each do |item|
29        hashItem = Hash.new
30        hashItem['name'] = item['name']
31        hashItem['completed'] = false
32        checkItemStates.each do |state|
33          if state.value?(item['id'])
34            hashItem['completed'] = true
35          end
36        end
37        hashItem['pos'] = item['pos']
38        arrayItems.push(hashItem)
39      end
40      hashChecklist['items'] = arrayItems
```

```
41     arrayItems = nil
42     arrayChecklists.push(hashChecklist)
43     hashChecklist = nil
44   end
45
46   hashCheckListsForCard = Hash.new
47   hashCheckListsForCard['checklists'] =
48     arrayChecklists
49
49   card = card.merge(hashCheckListsForCard)
50 end
51 # end export checklists
52
53 # export comments
54 if card['badges']['comments'] != 0
55   comments = getCardComments(card['id'])
56   hashCommentsForCard = Hash.new
57   hashCommentsForCard['commentsContent'] = comments
58   card = card.merge(hashCommentsForCard)
59 end
60 # end export comments
61
62 # export attachments
63 if card['badges']['attachments'] != 0
64   attachments = getAttachment(card['id'])
65   hashAttachmentsForCard = Hash.new
66   hashAttachmentsForCard['attachments'] = attachments
67   card = card.merge(hashAttachmentsForCard)
68
69   if downloads
70     # download files
71     attachments.each do |attachment|
72       fileDomain = URI.parse(attachment['url']).host
73       filePath = attachment['url'].gsub(URI.parse(
74         attachment['url']).scheme+"://" + URI.parse(
75           attachment['url']).host, '')
76       fileExtension = File.extname(attachment['url'])
```



```

75
76         fileName = attachment['id']+File.basename(
77             attachment['url'])
78         puts "Downloading \'"+fileName+"\' "
79
80         if !Dir.exists?(directoryNameAttachments)
81             Dir::mkdir(directoryNameAttachments)
82         end
83
84         Net::HTTP.start(fileDomain) do |http|
85             resp = http.get(filePath)
86             open(directoryNameAttachments+"/"+fileName,
87                 "wb") do |file|
88                 file.write(resp.body)
89             end
90         end
91     end
92 end
93 # end export attachments
94
95 # export votes
96 if card['badges']['votes'] > 0
97     response = RestClient.get(
98         'https://api.trello.com/1/cards/'+card['id']+'/'
99         'membersVoted?key='+$key+'&token='+$token
100    )
101    members = JSON.parse(response)
102    membersVotedArray = Array.new
103    members.each do |member|
104        membersVotedArray.push(member['id'])
105    end
106    hashMembersVotedForCard = Hash.new
107    hashMembersVotedForCard['membersVoted'] =
108        membersVotedArray
109    card = card.merge(hashMembersVotedForCard)

```

```
108     end
109     # end export votes
110
111     arrayCardsFull.push(card)
112 end
113
114 return arrayCardsFull
115 end
```

Listing 3.9: `getCardsAsArray()`

The `getCardsAsArray()` method is one of the biggest methods of the API wrapper. The methods to get all cards of a board or a list don't provide all information of the cards. If those functions don't supply all data which is needed for a specific task the missing information has to be added. That is what `getCardsAsArray()` is doing. The method is provided with an array of cards. Then it accumulates all information about all cards in this array. That includes members which are assigned to a card, checklists and according check items of a card, comments, attachments and votes. The developer can decide if attachments should be downloaded to a directory in the temporary directory of the operating system. In order to complete that task the method has to iterate through all cards and execute specific API calls to get the required information from Trello. Those API calls are wrapped in other methods which are structured like the method in listing 3.5. The return value of `getCardsAsArray()` is an array with the whole information about the required cards.

`isThisMe(memberId)`

```
1 def isThisMe(memberId)
2   if getMember('me')['id'] == memberId
3     return true
4   else
5     return false
6   end
7 end
```

Listing 3.10: `isThisMe()`

The `isThisMe()` method can be used to check if some content of a backup belonged to the actually used Trello account. For example to get all own comments out of an older backup.

3.2.3 Accessing CMS

To access CMS there are two methods. `trelloToJoomlaSingle(joomlaArticleId, articles)` and `trelloJoomlaSync(cardId, sectionid, catid, joomlaVersion)`. These are both to write data into the database of the Joomla CMS.

`trelloJoomlaSync(cardId, sectionid, catid, joomlaVersion)`

```
1 card = getSingleCard(cardId)
2 title = card['name']
3 description = Kramdown::Document.new(card['desc']).
  to_html
```

Listing 3.11: Getting standard card information.

`trelloJoomlaSync()` must determine a card's whole information itself. The `getSingleCard()` supplies the standard information of a card such as the title in line 4 of listing 3.11 and the description in line 3. Again, the `kramdown` gem is used to convert the Markdown formatted description string to HTML. But attachments and checklists would also be meaningful to depict in a CMS. Besides, the cards creation or update date is required to decide whether a card has changed or not.

```
1 changed = nil
2 if !cardUpdated(cardId).empty?
3   changed = getDate(cardUpdated(cardId).first['date'], '
      joomla')
4 else
5   changed = getDate(cardCreated(cardId).first['date'], '
      joomla')
6 end
```

Listing 3.12: Getting the date of a cards last change.

There is an API call for the last update of a card. But if the card has never been updated, the response would be empty. So in this case, the API call for the creation date must be used.

```
1 hasAttachment = getAttachment(cardId)
2
3 if hasAttachment[0] != nil
4   description += "<ul>"
5   hasAttachment.each do |att|
6     description += "<li><a href=\""+att['url']+"\">\"+
       att['name']+"\"</a></li>"
7   end
8   description += "</ul>"
9 end
```

Listing 3.13: Processing the attachments of a card.

To get the attachments of a card, the `getAttachment(cardId)` method is used in line 1 of listing 3.13. If the API call contains attachment data, the HTML tag `` is appended to the description. After that, the attachments are appended as list items. Their names are simply linked with the URL to the file on Trello's servers.

```
1 hasChecklist = getChecklist(cardId)
2
3 if hasChecklist[0] != nil
```

```

4   hasChecklist.each do |checklist|
5       description += "<h4>"+checklist['name']+"</h4>"
6       description += "<ul>"
7       checklist['checkItems'].each do |item|
8           if isCompleted(cardId, item['id'])
9               description += "<li><del>"+item['name']+"</del></li>"
10              else
11                  description += "<li>"+item['name']+"</li>"
12              end
13          end
14          description += "</ul>"
15      end
16  end

```

Listing 3.14: Processing the checklists of a card.

To process the checklists of a card, the method `getChecklist(cardId)` is called first. If the response contains checklist data, a `<h4>` HTML tag with the checklist's name is added to the description. After that, another `` is started. The `isCompleted()` method must be called for every checklist item to resolve its status. In dependency of the result, the name of the item is displayed as crossed out or not. Ruby's append method is used because the description already is a HTML string.

Now, that the content is available to the script, it must be written to the database. Because the `trell JoomlaSync()` method supports Joomla versions 1.5 and 2.5, every database query exists twice. From Joomla 1.5 to Joomla 2.5, the underlying database structure has changed a bit.

```

1  begin
2      existingArticleQuery = my.query("
3          SELECT id, created, modified
4          FROM jos_content
5          WHERE metadata='"+cardId+"',
6          ")
7  rescue Mysql::Error => e
8      puts e

```

```
9  else
10    # if article doesn't exist insert it into the db
11    if existingArticleQuery.num_rows == 0
12      begin
13
14        # Insert new article, see listing 3.16
15
16        rescue Mysql::Error => e
17          puts e
18          return
19        ensure
20          stmt.close if stmt
21        end
22      else
23        # this should be only one because per Trello card ID
24        # should only exist one article in Joomla
25        existingArticleQuery.each do |thisArticle|
26
27          existingId = thisArticle[0]
28          existingCreated = thisArticle[1]
29          existingModified = thisArticle[2]
30
31          # check if the modified timestamp in Trello is
32          # different to the modified timestamp in Joomla
33          begin
34            if existingModified != changed
35
36              # Update article, see listing 3.17
37
38              puts 'Changed: '+cardId+" : "+title
39            else
40              puts 'Nothing changed: '+cardId+" : "+title
41            end
42          rescue Mysql::Error => e
43            puts e
44            return
45          ensure
```

```
44         stmt.close if stmt
45     end
46 end
47 end
48 ensure
49     my.close if my
50 end
```

Listing 3.15: joomlaMultiple.rb usage.

In the first *begin* block of listing 3.15, from line 2 to line 6, the method scans the database table `jos_content` for an article with the actual handled card ID in the `metadata` field. If the response of this query is an empty array, the card isn't in the database. The script then must insert a new article into the database. This is performed in line 14. The corresponding MySQL code is showed in listing 3.16. If the resulting array in line 2 contains a row, the script must check if the new data is more recent than the data in the database. This array cannot contain more than one row because the script inserts the article just once if it is new, otherwise it replaces the old article with an updated version. In order to do that, the script looks at the `modified` field of the existing article. This date is saved in the `existingModified` variable. The update date of the actual Trello card, which is determined in listing 3.12, is stored in the `changed` variable. If `existingModified` differs from `changed`, the article is updated with the new date of the Trello card in line 34. The script assumes that the Trello card always contains correct data. So it's not necessary to check back if the `changed` is actually more recent. The MySQL statement of the update statement is showed in listing 3.17.

```
1 begin
2     stmt = my.prepare("
3         INSERT INTO jos_content (
4             title,
5             alias,
6             'introtext',
7             state,
8             sectionid,
9             catid,
```

```
10         created,
11         created_by,
12         modified,
13         parentid,
14         ordering,
15         access,
16         metadata
17     )
18     VALUES (
19         ?,
20         ?,
21         ?,
22         1,
23         ?,
24         ?,
25         ?,
26         62,
27         ?,
28         0,
29         1,
30         0,
31         ?
32     )
33 ")
34
35 stmt.execute title, title.downcase, description.gsub(
36     /\', '&#39;', sectionid, catid, changed, changed,
37     cardId
38 puts 'New article: '+cardId+" : "+title
39 rescue Mysql::Error => e
40     puts e
41     return
42 ensure
43     stmt.close if stmt
44 end
```

Listing 3.16: Insert new article in the Joomla database.


```

1 stmt = my.prepare("
2     UPDATE jos_content
3     SET
4         title = '"+title+"',
5         alias = '"+title.downcase+"',
6         'introtext' = '"+description.gsub(/'/, '&#39;')+''',
7         state = 1,
8         sectionid = 5,
9         catid = 34,
10        created = '"+changed+"',
11        created_by = 62,
12        modified = '"+changed+"',
13        parentid = 0,
14        ordering = 1,
15        access = 0
16    WHERE
17        metadata = '"+cardId+"',
18    ")
19 stmt.execute

```

Listing 3.17: Updating existing Joomla article.

trellToJoomlaSingle(joomlaArticleId, articles)

`trellToJoomlaSingle()` works like `trellToJoomlaSync()`, but it writes all information in Joomla in one single article and in HTML format.

```

1 def trellToJoomlaSingle(joomlaArticleId, articles)
2     # Database connection
3     dbhost = 'host'
4     dbuser = 'user'
5     dbpassword = 'password'
6     db = 'dbname'
7
8     htmlSite = "<h3>Universit&auml;t T&uuml;bingen</h3>"
9

```

```

10  htmlSite << "<p> </p>
11  <table style=\"text-align: center;\" border=\"0\">
12  <tbody>
13  <tr style=\"background-color: #c3d2e5;\">
14  <td style=\"text-align: center;\">
15  <p style=\"text-align: left; padding-left: 5px;\"><
    strong><span><strong> Thema</strong></span></strong>
    </p>
16  </td>
17  </tr>"
18
19  i = 0
20  articles.each do |element|
21    title = element.title
22    description = element.description
23    if element.attachments != []
24      attachments = element.attachments
25    end
26
27    htmlSite << "
28    <tr style=\"background-color: "
29    if i.even?
30      htmlSite << "#e0e8ec;"
31    else
32      htmlSite << "#c3d2e5"
33    end
34    htmlSite << "\">
35    <td><p style=\"text-align: left; padding-left: 5px
    ;\"><span><strong>"
36    htmlSite << title
37    htmlSite << "</strong></span></p>
38    <div style=\"text-align: left; padding-left: 5px;\"><
    span style=\"font-size: xx-small;\">"
39    htmlSite << description
40    htmlSite << "</span></div>
41    <div style=\"text-align: left;\"><span style=\"font-
    weight: normal; font-size: small;\">

```

```
42     <ul>"
43     if element.attachments != []
44         attachments.each do |attachment|
45             name = attachment.name
46             url = attachment.url
47             htmlSite << "<li><a href=\"\"
48             htmlSite << url
49             htmlSite << "\">"
50             htmlSite << name
51             htmlSite << "<a/></li>"
52         end
53     end
54     htmlSite << "</ul>"
55     </span></div>
56     </td>
57     </tr>"
58     i += 1
59 end
60 i = nil
61
62 htmlSite << "</tbody>"
63 </table>"
64
65 #save to file
66 fileHtml = File.new("arbeiten.html.tmp", "w+")
67 fileHtml.puts "<!doctype html>"
68 <head>
69     <meta charset=\"UTF-8\">
70     <meta http-equiv=\"X-UA-Compatible\" content=\"IE=
71         edge,chrome=1\">
72
73     <title>Abgeschlossene Arbeiten</title>
74 </head>
75 <body>"
76 fileHtml.puts htmlSite
77 fileHtml.puts "</body></html>"
78 File.rename("arbeiten.html.tmp", "arbeiten.html")
```

```
78
79     #save to DB
80     my = Mysql.init
81     my.options(Mysql::SET_CHARSET_NAME, 'utf8')
82     my.real_connect(dbhost, dbuser, dbpassword, db)
83     my.query("SET NAMES utf8")
84
85     stmt = my.prepare("UPDATE jos_content SET 'introtext'='
86         "+htmlSite+"' WHERE id="+joomlaArticleId.to_s)
87     stmt.execute
88
89     my.close if my
90 end
```

Listing 3.18: trelloToJoomlaSingle()

Chapter 4

Applications

The following described scripts are example usages of the API wrapper. In one of the first lines of each script listing 4.1 is executed. This displays the name of the Trello member which is used to execute this script. It should prevent a developer accidentally uses the wrong account.

```
1 puts "Member: "+getMember('me')['username']
```

Listing 4.1: Print the name of the actually used Trello member.

4.1 Export to HTML

Used additional libraries:

- erb
- kramdown

```
1 ruby html.rb --title TITLE [-c CARDID[,CARDID]] [-l  
LISTID[,LISTID]] [-b BOARDID[,BOARDID]] [-a] [-t TOKEN  
] [-k KEY]
```

Listing 4.2: html.rb usage.

The `html.rb` script exports the data from one or more cards to an HTML file. The resulting HTML file lists the cards one below the other. The order is determined by the command-line argument. If the command-line looks like listing 4.3, the script will at first process the list with the ID `4ffd78ff7f0c71780cc5aa1c`. That means that all cards in the list are in the HTML file and below these the single card with the ID `4ffd78a2c063afeb066408b8`. In addition to the command-line options described in section 3.1, the option `--title` is used. Here, the user has to specify a title for the web page. The title will be displayed at the top of the page in `<h1>` HTML tags.

```
1 ruby html.rb -l 4ffd78ff7f0c71780cc5aa1c  
  -c 4ffd78a2c063afeb066408b8 --title 'Madness'
```

Listing 4.3: Example of a `html.rb` call.

Each card is displayed with all its information. This includes title, description, members, due date, labels, votes, checklists, comments, and attachments.

Trello itself distinguishes between photos and other attachments. Normal attachments are linked under the description. Photos are embedded in the HTML code as thumbnails. Trello detects JPEG, GIF, and PNG files as pictures and displays them as thumbnails. In addition to these formats, the resulting HTML file displays TIFF, PSD, BMP, and JPEG2000 as thumbnails, too. All modern browsers support these formats.

The `html.rb` script generates static HTML. Of course, the requirements could also be met by a dynamic solution with PHP or Ruby on Rails. But the upside is that the user of the respective website doesn't have to wait for the web server. Dynamic websites are mostly fast in the meantime, but with static HTML files, the developer is on the safe side. This approach pays off especially if the data to be displayed doesn't change every minute. The server doesn't have to generate the whole data with every visit. It just has to send the static HTML files.

4.1.1 Markdown

Markdown is a small lightweight plain text formatting syntax designed by John Gruber. It is designed for the use with blogs and CMS. In these cases, HTML is often too much. Markdown represents most of the features of HTML that are needed for writing. The designer of Markdown had the goal that a text, written in Markdown, is still easy to read. John Gruber provides a software tool written in the Perl programming language, that converts the Markdown formatted text to valid HTML. [mar04]

```

1  ### iCloud:
2
3  1.    Shared Photo Streams Now you can *share* just the **
      photos** you want, with just the people you choose.
4  2.    Reminder
5
6  -----
7
8  Here is an example of AppleScript:
9
10     tell application "Foo"
11         beep
12     end tell
13
14  ![Apple logo](http://upload.wikimedia.org/wikipedia/
      commons/f/fa/Apple_logo_black.svg "Apple logo")

```

Listing 4.4: Example for a text written in Markdown.

```

1  <h3>iCloud:</h3>
2
3  <ol>
4      <li>Shared Photo Streams Now you can <em>share</em>
        just the <strong>photos</strong> you want, with
        just the people you choose.</li>
5      <li>Reminder</li>

```

```
6 </ol>
7
8 <hr>
9
10 <p>Here is an example of AppleScript:</p>
11
12 <pre>
13   <code>tell application "Foo"
14     beep
15   end tell</code>
16 </pre>
17
18 <p></p>
```

Listing 4.5: Listing 4.4 converted to HTML.

Listing 4.4 shows a small example of Markdown. The `###` in line 1 is a heading equal to `<h3>` in HTML. The first list item of the ordered list in line 3 contains italic and bold words. In line 6, there is a horizontal line. After a normal line of text, a code block starts in line 10. At the end, in line 14, there is a picture with `title` and `alt` texts. After the conversion, it looks like listing 4.5 in HTML. The appearance, of course, depends on the used CSS on the respective websites. The appearance in Trello is as shown in figure 4.1.

Meanwhile, Markdown has become quite popular. Many blogging platforms support it, at least there are Markdown plug-ins for most platforms. Trello supports it in the description of cards. In the unlikely case that markdown reaches its limits, inline HTML can be used. The only restriction is that HTML block-level-elements have to be separated to the previous and following Markdown blocks.

kramdown

In order to convert Markdown to HTML, the gem kramdown is used. Figure 4.2 describes the convert options of kramdown. It converts HTML and Mark-

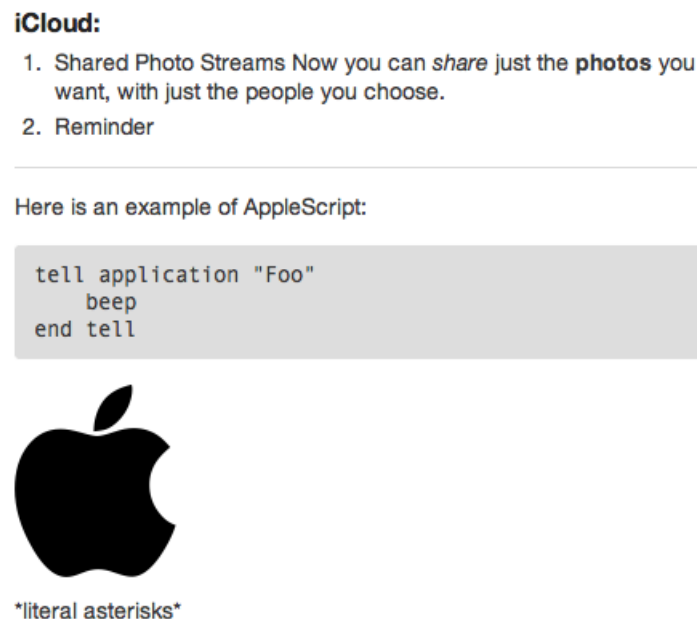


Figure 4.1: The browser view of the HTML converted from the Markdown in listing 4.4

down to LaTeX, PDF, and a special kramdown format, too. The kramdown format is an extended Markdown syntax. Like input formats, it accepts HTML and kramdown besides standard Markdown. [kra12] These additional features might be useful for future approaches. To generate lists of bibliographies for scripts, papers or books.

4.1.2 Twitter Bootstrap Framework

In 2011 Twitter released Bootstrap¹. Bootstrap is a collection of methods and scripts for creating front-ends of websites. It contains templates for site structuring, tables, text, buttons, menus, forms, lists, and some other often used elements of websites. Additionally, some functions are supported by JavaScript. Bootstrap is written in HTML, JavaScript, CSS, and LESS, which is a dynamic style sheet language and extension to CSS. This enables the use of variables, functions, nested selectors, and operators.[les12] Bootstrap is completely free of charge and under open source licence. [boo12]

¹Blog post from the lead developer about the launch of Twitter Bootstrap: <https://dev.twitter.com/blog/bootstrap-twitter>

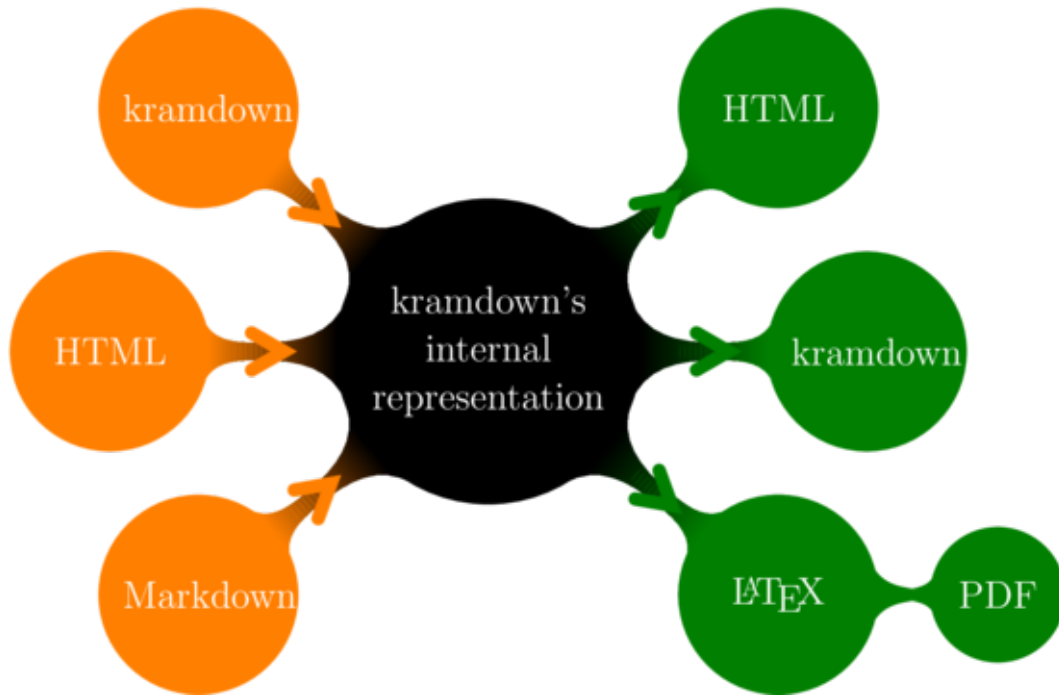


Figure 4.2: Overview about kramdowns converting options. [kra12]

Bootstrap evolved at Twitter during work on several projects with different libraries. The projects became inconsistent and a high administrative effort was needed in order to maintain the site?. Some developers at Twitter led by Mark Otto worked on a tool to document and share common designs within the company. Twitter determined that this toolkit could be more than an intern helper tool. So they equipped it with all the common function which are needed for modern web development and released it on GitHub. [mar12]

4.1.3 HTML5

Twitter Bootstrap supports HTML5. HTML is the markup language for displaying content in a web browser. HTML5 is the latest revision of the HTML standard. It is an open format developed by the World Wide Web Consortium (W3C). HTML5 has been a working draft since 2008. In 2011, the HTML Working Group at W3C advanced HTML5 to Last Call. At the moment, HTML communities all over the world are asked to confirm the standard. It is estimated that HTML5 will reach W3C Recommendation by 2014.[htm11] Although it is not yet finished, it is already widely used.

Before HTML5 there were two popular standards: HTML4 and XHTML1. XHTML1 defines a XML serialisation for HTML4. With HTML5, there is only one language called HTML. This language can be written in HTML syntax and XML syntax. [htm12d] The W3C realised the importance of smartphones in the future early on. They guided the development of HTML5 with the consideration of being able to run on low-powered devices. The market share of HTML5 enabled devices is still rising. [sma11] Smartphone sales even beat PC sales in 2012. Thus, it is becoming increasingly important for web applications to work well on small devices. HTML5 is used to ensure this. The foundation created here can therefore be used as a basis for the future.

HTML5 introduces several new elements. Some of these are used in `html.rb`. At first, there is the `<header>` element. A header is an area at the top of a web page. It is used for navigational aids, logos, or a search bar. [htm12a] At the bottom is the `<footer>` element, which can be used as a side wide footer and as a footer of sections. [htm12b] Here, it is just used as side wide footer as preparation for data like licencing information, imprint, and information about the author. The cards are enclosed in `<article>` elements. Every single card is represented as an `<article>` element. This makes sense because, typically, a card is an article, especially if the user would like the card to be displayed on a web page. The W3C requires an `<article>` element to be self-contained. [htm12c] A card is a collection of information which is ordered by the several types of data.

This foundation of generating HTML out of Trello can be used in various ways. It is predestinated for websites with recurring kinds of information. Every business card style web page can definitely be managed with this script. Very small websites right through whole blogs can build on it.

4.1.4 Templating with ERB

Every card is embedded in the same HTML structure. Templates specify this HTML without the actual data. Instead, there is just a wildcard and a few control structures. Templating systems are used to organise the source code in operationally distinct layers. The design is completely handled in the template file, which also contains parts of the control structure. Template

engines are, however, unsuitable for a real separation of the data models and the logic components. For this purpose, additional concepts such as Model View Controller are required (MVC).

ERB is a templating system for Ruby. It is part of the Ruby standard library. ERB accepts every string as a template, no matter whether it is stored in a file, a database, or some other kind of storage. ERB is mainly used for generating HTML files but is also able to generate any other kind of structured text, like RSS feeds and XML. [\[erb11\]](#) [\[erb12\]](#)

While generating the HTML, ERB copies the plain text parts of the template file directly to the resulting document. The parts which ERB has to process are marked with certain tags listed in listing 4.6

```
1 <% Ruby code -- inline with output %>
2 <%= Ruby expression -- replace with result %>
3 <%# comment -- ignored -- useful in testing %>
4 % a line of Ruby code -- treated as <% line %>
5 %% replaced with % if first thing on a line and %
   processing is used
6 <%% or %%> -- replace with <% or %> respectively
```

Listing 4.6: Recognised tags in ERB.

Only the first two tags are used here. The optimum would be if only `<%= Ruby expression -- replace with result %>` would be used, as this would imply the absence of control structures in the template file. Only wildcards for data remain.

A real example of an ERB template is listing 4.7.

```
1 <small><%= getDate(card['due'], format='de') %></small>
```

Listing 4.7: Ruby method in ERB template.

A Ruby method is used as wildcard here. When processing the template file, the method will be executed with the given variables and the result will be copied into the HTML file. But there are control structures, too. The block around the line in listing 4.7 is shown in listing 4.8

```

1 <% if card['due'] %>
2   <small><%= getDate(card['due'], format='de') %></small>
3 <% end %>

```

Listing 4.8: Ruby method in ERB template.

The *if* construct is embedded with the `<% ... %>` tag for ERB. This is because it is not a wildcard which is replaced with actual content. This tag is just for control structures.

The alternative to using a templating system is to write the HTML at the same time and in the same file when the data is processed. This would result in a very confusing file which produces equally confusing HTML code. If the developer made sure that the HTML code is well-structured, the source code in the script would look even messier. That is because character escape codes like `\t` and `\n` have to be inserted manually in the source code. Otherwise, the templating system takes over this task. An example of such a confusing mixing of HTML, character escape codes, and Ruby is shown in 4.9.

```

1 htmlSite << "</strong></span></p>
2   \t\t\t\t<div style=\"text-align: left; padding-left: 5
3     px;\"><span style=\"font-size: xx-small;\">
4 htmlSite << description
5 htmlSite << "</span></div>
6   \t\t\t\t<div style=\"text-align: left;\"><span style=\"
7     font-weight: normal; font-size: small;\">
8   \t\t\t\t\t\t\t<ul>
9 if element.attachments != []
10   attachments.each do |attachment|
11     name = attachment.name
12     url = attachment.url
13     htmlSite << "\t\t\t\t\t\t\t\t\t\t<li><a href=\"\"
14       htmlSite << url
15       htmlSite << "\">
16       htmlSite << name
17       htmlSite << "<a/></li>\"
18   end

```

```
17 end
```

Listing 4.9: Generating HTML without a templating engine.

To represent the list of cards with the title in Ruby, there is the Ruby class `webpage`. It is defined in listing 4.10.

```
1 class Webpage
2   def initialize( title )
3     @title = title
4
5     @cards = [ ]
6   end
7
8   def add_card( card )
9     @cards << card
10  end
11
12  def get_binding
13    binding
14  end
15 end
```

Listing 4.10: Generating HTML without a templating engine.

There are three methods. The `initialize(title)` method generates the actual instance of the class. The instances modeled thus contain the given title and an empty array for the cards. The `add_card(card)` method simply adds a new card to the `@cards` array. The last method is `get_binding` and generates a `Binding` object of the current local variables.

```
1 templateFile = File.open("templateHtml.html.erb", "rb")
2 template = templateFile.read
3
4 rhtml = ERB.new(template)
5
6 webpage = Webpage.new( @htmlTitle )
7
```

```
8 cardsFull.each do |card|
9   webpage.add_card(card)
10 end
11
12 html = rhtml.result(webpage.get_binding)
13
14 fileHtml = File.new("index.html", "w+")
15 fileHtml.puts html
16 fileHtml.close()
```

Listing 4.11: Generating HTML with ERB.

In listing 4.11, the template data is set up. At first, in line 1, the template file is opened. It is then read and saved in the `template` variable in the next line, so the template is saved as string in `template`. In line 4, an instance of ERB is created with `rhtml`. After that, in line 6, the `Webpage` class is used. One instance with the given title is generated. In line 8, each card is added to the instance of `Webpage`. Finally, in line 12, the `Binding` object of `webpage` is created. With the ERB method `result`, the data in the `Binding` object and the template come together. This is the step where the wildcards in the template file are filled with the actual data of the `Binding` object. The resulting HTML code is stored in the string variable `html` which is saved to the file `index.html` in line 14.

4.2 Google Calendar Synchronisation

Used additional libraries:

- `erb`
- `google/api_client`

Usage:

```
1 ruby gcal.rb [-c CARDID[,CARDID]] [-l LISTID[,LISTID]] [-  
  b BOARDID[,BOARDID]] [-a] [-t TOKEN] [-k KEY]
```

Listing 4.12: gcal.rb usage.

Google Calendar is a free web service by Google for time-management. The service can be enabled in several calendar applications such as Apple Calendar (it was called iCal prior to Mac OS X 10.8) and Microsoft Outlook. It is also supported by all important mobile operating systems. Google Calendar is one of the most popular calendar web services. One advantage over other suppliers is the excellent integration with all the other Google services, most of which are also very popular.

4.2.1 Google Calendar API

Google provides an API to access Calendar and even an API wrapper for Ruby. Google grants normal developers a courtesy limit of 10,000 requests per day. Developers who need more requests per day for their application have to negotiate with Google to contract into a higher request rate.

```
1 client = Google::APIClient.new  
2 client.authorization.client_id = ' '  
3 client.authorization.client_secret = ' '  
4 client.authorization.scope = 'https://www.googleapis.com/  
  auth/calendar'  
5 client.authorization.refresh_token = ' '  
6 client.authorization.access_token = ' '  
7  
8 result = client.authorization.fetch_access_token!  
9 client.authorization.access_token = result['access_token'  
  ]  
10  
11 service = client.discovered_api('calendar', 'v3')
```

Listing 4.13: Initialisation of the Google Calendar API connection.

Authentication with Google is much more complicated than with Trello. Listing 4.13 shows the initialisation of the Google Calendar API connection. At first, the project has to be registered in the Google APIs console. [goo12c] There, the developer can get the `client_id` and the `client_secret`. The `scope` depends on the Google API the developer wants to use. Here, it is `https://www.googleapis.com/auth/calendar`. [goo12b] To get the `access_token`, this URL must be called:

```
https://accounts.google.com/o/oauth2/auth?scope=https%3A%2F%2Fwww.
googleapis.com%2Fauth%2Fcalendar&redirect_uri=https%3A%2F%2Foauth2-
login-demo.appspot.com%2Fcode&response_type=code&client_id=CLIENTID.
apps.googleusercontent.com&access_type=offline
```

If the request succeeds the response is as noted in listing 4.14.

```
1 {
2   "access_token": "1/fFAGRnJru1FTz70BzhT3Zg",
3   "expires_in": 3920,
4   "token_type": "Bearer",
5   "refresh_token": "1/xEoDL4iW3cx1I7yDbSRFYNG01kVKM2C-259
   HOF2aQbI"
6 }
```

Listing 4.14: Response of the token request.

The access token is the actual important value, but it typically expires after about an hour. If it is used after the expiration date, the API will respond with an error. Because of that, it is important to store the refresh token. Otherwise, the user has to enter his Google login data every time an access token expires. If the application loses the refresh token, the API calls will no longer work, as no new access tokens can be generated. The user, or in this case the developer, has to obtain a refresh token manually again. [goo12d] Unfortunately, the duration of the refresh tokens' validity is unknown.

4.2.2 Synchronisation

For the synchronisation to Google Calendar, only cards with a due date are considered. At first, the script instructs the API wrapper to get all cards. The Trello API provides no filter method to get only the cards with a due date. The next step is to check if the cards have due dates. If a card has a due date, the script checks if this card is already added as an event in Google Calendar. To do so, the Google library looks for this card based on its id. If it is not already in Google Calendar, the script has to add a new event to Google Calendar.

```
1 event = {
2   'summary' => card['name'],
3   'description' => card['desc'],
4   'location' => 'trelloid '+card['id'],
5   'start' => {
6     'dateTime' => getDate(card['due'], format='iso8601'),
7     'timeZone' => 'Europe/Berlin'
8   },
9   'end' => {
10    'dateTime' => getDate(card['due'], format='iso8601'),
11    'timeZone' => 'Europe/Berlin'
12  }
13 }
14
15 insertevent = client.execute(:api_method => service.
16   events.insert,
17   :parameters => {'calendarId' => 'primary',
18     },
19   :body => JSON.generate(event),
20   :headers => {'Content-Type' => '
21     application/json'})
```

Listing 4.15: Adding a new event to Google Calendar.

In a first step, a new event object has to be created. This happens in listing 4.15 in lines 1 to 13 and is realised by a hash. The received information about

a card from Trello is stored in a hash, so to get the information, `card['KEYWORD']` is used, where `KEYWORD` stands for the respective name of the cards field that is needed. In the location field of an event, the script stores the card ID with the `trelloid` prefix, which is not exactly the correct kind of data to put in a location field. But to determine if a card is already represented as an event in Google Calendar, the script has to use a unique identifier. Since there is no location for Trello cards anyway, the location field can be used. Google doesn't provide any *hidden* fields which developers can use for such purposes.

It is from line 15 on, that the actual request is executed. The `service.events.insert` tells the Google API which method the developer wants to address. [goo12d] In this case it is the method to insert a new event to an existing calendar. In line 16, the developer has to specify the ID of the calendar in which the new event should appear. Clearly, `primary` is not an id, but stands for the primary calendar. In Google Calendar, the user can create several calendars for different purposes. One for work, one for private, and so forth. So `primary` is a valid value, too. In the following line, the body is being sent. To do that, the `event` object created before has to be converted to a JSON string. This is achieved by the `generate` method of the JSON class. [jso12b] In the last line of listing 4.15, the Google API is told that the body of this request is formatted as JSON.

If the event is already inserted in the calendar, the script checks if the card's summary, description, or due date have changed since the last synchronisation to Google Calendar. But before that, it checks back if this event really is the representation of the actual card. The Google API provides no method to search for events with a special location, so it isn't possible to search in the location of an event. The script looks in all fields of an event for the ID of the corresponding Trello card. To ensure that the currently handled card is the same the currently handled event is the representation for, the script compares the location field of the event and the card id. If the comparison matches, it runs almost the same code as in listing 4.15. But this time, the Google Calendar API method which is used for updating the event is called `service.events.update`.

The third possible scenario is an orphaned event in Google Calendar. If a user in Trello removes the due date of a card or the card itself, the event in Google

Calendar is no longer valid. To solve this problem the script loads all cards with due dates and all events from Google Calendar. For each event from Google Calendar that has a valid location field with the `trelloid` prefix and a 24 character string the script checks if it is still available in Trello. If that is the case its ID is saved in a new array called `keepEvents`. This array is subtracted from the array of all events from Google Calendar. The resulting array contains all events in Google Calendar which don't have a corresponding card in Trello. All these events are deleted from Google Calendar.

4.3 iCalendar Export

Used additional libraries:

- `icalendar`
- `date`

Usage:

```
1 ruby ical.rb [-c CARDID[,CARDID]] [-l LISTID[,LISTID]] [-b BOARDID[,BOARDID]] [-a] [-t TOKEN] [-k KEY]
```

Listing 4.16: `ical.rb` usage.

iCalendar is a popular format to exchange calendar data of all sorts. It is built on the prior vCalendar standard released in 1996 by the Internet Mail Consortium. [\[vca\]](#) Because of that, some object names begin with a V. Originally, it was introduced in 1998 by the Internet Engineering Task Force Calendaring and Scheduling Working Group in RFC 2445. [\[rfc98\]](#) Today, the actual specification is RFC 5545. [\[rfc09\]](#) Meanwhile, it is supported by many applications which work with events of any kind. iCalendar is the de facto standard in this field. Hence, it has great compatibility with many programs. The standard defines the MIME type `text/calendar`. iCalendar is mostly used for exchanging calendaring and scheduling information, like sending invitations, and for providing public calendars, the timetable of the football world championship for example.

4.3.1 iCalendar format

```
1 BEGIN:VCALENDAR
2 CALSCALE:GREGORIAN
3 METHOD:PUBLISH
4 PRODID:iCalendar-Ruby
5 VERSION:2.0
6 BEGIN:VTIMEZONE
7 TZID:Europe/Berlin
8 BEGIN:STANDARD
9 DTSTART:19960811T073001
10 RRULE:FREQ=DAILY;INTERVAL=2
11 TZNAME:UTC+01:00
12 TZOFFSETFROM:+0200
13 TZOFFSETTO:+0100
14 END:STANDARD
15 END:VTIMEZONE
16 BEGIN:VEVENT
17 CATEGORIES:FAMILY
18 DESCRIPTION:4ffa4c76e75c29032a88ed19
19 DTEND;TZID=Europe/Berlin:20120804T170000
20 DTSTAMP:20120829T184941
21 DTSTART;TZID=Europe/Berlin:20120804T170000
22 SEQUENCE:1
23 SUMMARY:Ob-La-Di\, Ob-La-DaAAAA
24 TRANSP:TRANSPARENT
25 UID:2012-08-29T18:49:41+02:00_158310425@u-081-c222.eap.
    uni-tuebingen.de
26 URL:https://trello.com/card/ob-la-di-ob-la-daaaaa/4
    ffa4c5ce75c29032a88ea31/2
27 END:VEVENT
```

Listing 4.17: iCalendar example.

Listing 4.17 shows an example of a file in the iCalendar format this script can produce. The top-level element of an iCalendar file is the core object. The first line is *BEGIN:VCALENDAR* and the ending line has to be *END:VCALENDAR*.

Between these two tags is the *icalbody*. Following are the iCalendar properties, which apply to the entire calendar. `CALSCALE:GREGORIAN` in line 2 of listing 4.17 defines the calendar scale of this calendar. As the standard calendar format is Gregorian world wide, it is not necessary to specify it in the iCalendar file. The method specification can have other values than `PUBLISH`, such as `REQUEST` and `CANCEL`. `REQUEST` would be used if the sender wants to know if the receiver is free at the time of this event. `CANCEL` would be used when the provided events in this calendar should be cancelled. The `PRODID` simply specifies the product by which the iCalendar file was generated. The `VERSION` property specifies the version which is required in order to interpret the iCalendar file. Version 2.0 is the last version. In line 6, the definition of the timezone starts. `TZID` specifies the identifier of this time zone. `TZOFFSETFROM` and `TZOFFSETTO` both specify the offset to UTC. `TZOFFSETFROM` does this for daylight saving time and `TZOFFSETTO` for standard time. `DTSTART`, in this context, describes the first onset date-time for the observance. The `RRULE` property defines a repeating pattern for recurring events. `TZNAME` is just a name for the specified timezone. In 16 the definition of the actual event begins. Every single event is specified within an `VEVENT` object. The `VEVENT` objects are listed one after each other. There is the possibility to divide the events into categories with the `CATEGORIES` property. The `DESCRIPTION` contains a description string of the event. Here, the script enters the ID of the respective card. `DTSTART` and `DTEND` specify the starting and ending times of the event. The `DTSTAMP` property contains the time of the export to iCalendar format. `SUMMARY` is the events title. The `SEQUENCE` is the revision counter of an event object. If the user makes significant changes to the event, the `SEQUENCE` must be incremented. When the event object is created, the `SEQUENCE` is zero. `TRANSP` determines whether the event object consumes time on a calendar or not. Events that consume time with the calendar should have the `TRANSP` value `OPAQUE`. Events which are marked as `OPAQUE` can be detected as consuming time by free/busy time searches on the calendar. If events don't consume actual time on the calendar, they should be marked as `TRANSPARENT`. Here, the script gives all events an `TRANSP` value of `TRANSPARENT` because the due date of a Trello card is not an actual appointment with a duration. It is more like a deadline for a particular task. The `UID` contains information about the creator of the iCalendar data. In this case, it is a time and the name of a computer in the network of the University of Tübingen.

Finally, the `URL` property contains the URL of the card at Trello. With this URL, the user can visit the card from within his calendaring application and edit the card without navigation through Trello by himself. [ica03]

This is just a subset of the iCalendar geared to use with the `ical.rb` script. iCalendar supports much more. For example todo lists, recurring events, journals, searching for free/busy time, and updating calendars. These features wouldn't be useful with the intended use with Trello.

4.3.2 Export

After the `ical.rb` script got all necessary information calculated by the API wrapper, a new `VCALENDAR` object must be generated. Of course, it is possible to write own methods to generate a valid iCalendar code, but there is a sophisticated Ruby gem that covers all needed features. This gem is simply called *icalendar*².

```
1 cal = Calendar.new
2
3 cal.timezone do
4   timezone_id      "Europe/Berlin"
5
6   standard do
7     timezone_offset_from "+0200"
8     timezone_offset_to   "+0100"
9     timezone_name        "UTC+01:00"
10    dtstart            "19960811T073001"
11    add_recurrence_rule "FREQ=DAILY;INTERVAL=2"
12  end
13 end
```

Listing 4.18: Generating a new `VCALENDAR`.

Listing 4.20 generates the iCalendar file in listing 4.17 until line 16. The `timezone` method creates a new `VTIMEZONE` object. In line 6, the *BEGIN:STANDARD* is generated and then filled in the following lines. The methods

²The iCalendar gem's GitHub repository: <https://github.com/sdague/icalendar>

used to add the properties are not exactly self-explanatory. Therefore, it is recommended to read the documentation carefully.

```
1 cardsFull.each do |card|
2   if card['due'] != nil
3
4     cal.event do
5       dtstart      getDate(card['due'], 'ical')
6       dtend        getDate(card['due'], 'ical')
7       summary      card['name']
8       description   card['id']
9       transp        "TRANSPARENT"
10      categories    ["FAMILY"]
11      sequence      0
12      url           card['url']
13    end
14  end
15 end
```

Listing 4.19: Generating the VEVENT object.

In listing 4.20, the iCalendar code for every event is created. The array `cardsFull` contains all cards which have to be checked for due dates. The source code block starting at line ?? must be executed for every card with a due date in Trello. In line 5 and 6, the `getDate` method is used. It computes the date in the correct format for iCalendar. When this is done, the iCalendar object is created.

```
1 cal.publish
2
3 icalendar = File.new("icalendar.ics", "w+")
4 icalendar.puts cal.to_ical
5 icalendar.close()
```

Listing 4.20: Saving the iCalendar file.

The last step is to write the generated iCalendar object to a file. In line 4 of listing 4.20, the `publish` method publishes the iCalendar object. This is an

important step, as it ensures that later, the `METHOD` property is set to `PUBLISH` in the iCalendar file. In line 4, the `to_ical` method converts the `Calendar` object instantiated in the first line of listing 4.20 to a string in iCalendar format. This string is saved to a file which is named `icalendar.ics`. [ica12]

Now, the `icalendar.ics` file can be sent via email or uploaded to a web server. No matter which way this file is distributed, if there is a software which is able to handle the iCalendar format, everybody can read it.

The iCalendar format has a field for attendees. If this is specified, everyone can see who is invited to the respective event. But unfortunately, it can't be used with this script because the Trello API doesn't provide a method to get a user's email address. Surely intended as a way to minimise privacy risks, this reduces the functionality a script can provide by using Trello data. From a developer's perspective, it would be highly desirable to have access to this data, even if only for private boards.

4.3.3 Comparison to the Google Calendar synchronisation

In comparison to the Google synchronisation, the script described in this thesis is much more simple. There is no need for synchronization because the iCalendar file is regenerated with each run of the script and there is no API to work with. There is only one file in the correct format to be created. This method is much faster than working with two APIs and perform several API calls. The server has to compute less data and there is less traffic to the APIs while updating. The iCalendar file, however, must be available on a server. With the Google solution, there is no need for an own web server. Another big problem with the web server is that the URL is accessible for everybody. If the calendar includes critical data, this is a criterion for exclusion for the user or the company. Although it is possible to provide the server with password protection, this would only be more complicated. Either the calendaring software doesn't support `.htaccess` or any other web authentication technology or the user has to enter his login information periodically. The only way to use it safely with critical data is to use it in an intranet, where there isn't any need for additional protection. But for domestic use and for most small companies,

the solution with Google should be sufficient. Google even provides a hosted iCalendar feed itself.

4.4 Joomla Synchronisation

Used additional libraries:

- icalendar
- date
- kramdown

Usage:

```
1 ruby joomlaMultiple.rb --section SECTIONID --category  
   CATEGORYID [-c CARDID[,CARDID]] [-l LISTID[,LISTID]]  
   [-b BOARDID[,BOARDID]] [-a] [-t TOKEN] [-k KEY]
```

Listing 4.21: joomlaMultiple.rb usage.

Trello is perfect to depict recurring structures. Blog posts, for example, have such a structure which is repeated for each post. Each post has a title, a text, a creation date, an author, etc. The script `joomlaMultiple.rb` posts a card in Trello to the Joomla CMS.

Joomla³ is one of the most popular CMS overall. It's open source and free of cost. Joomla is written in object oriented PHP [joo10], uses software design patterns [joo12b], and is the result of a fork of the older CMS Mambo⁴ from the year 2005. Mambo has existed since 2000.

The Joomla CMS doesn't have an API for the given specifications. It is built on top of the Joomla *Platform* (formerly known as Joomla *Framework*). This is a framework which provides classes and methods to build a web application on top of it – such as Joomla. Since 2011, the Joomla Platform has been distributed separately from the CMS. This makes it easier for developers to

³Joomla project website: <http://www.joomla.org>

⁴The Mambo foundations website: <http://mambo-foundation.org>

use the Joomla Platform for web applications which are not a CMS. [joo12a] But because there is no API, developers have to access the underlying database to add content to Joomla.

This script has two special arguments additional to the standard set of command-line arguments. The `--section` argument defines a section in Joomla under which the article should be listed. The `--category` does the same for Joomla categories. Sections in Joomla are the top content structure. Every category is related to a section. Articles in Joomla are related to both a section and a category.

```
1 sectionid = options.section.first
2 catid = options.category.first
3
4 cardsToImport.each do |card|
5   trelloJoomlaSync(card['id'], sectionid, catid, '1.5')
6 end
```

Listing 4.22: Passing the needed information to the `trelloJoomlaSync()` method.

The `joomlaMultiple.rb` script gets its data from the API wrapper. The first two lines of listing 4.22 read the section and category ID from the command-line arguments. The API wrapper provides a method to accomplish the synchronisation of a Trello card to Joomla. Thus, the `joomlaMultiple.rb` script simply has to pass an ID of the card which should be synchronised to this function. In line 4, the script traverses the array with the cards to import to Joomla. The next line calls the `trelloJoomlaSync()` method for every card. It just passes the card id, the section id, the category id, and the Joomla version which is used. Everything else is handled by the `trelloJoomlaSync()` method.

4.4.1 Joomla category page

After the cards from Trello are imported to Joomla as articles, they are saved there but not necessarily accessible on the web site. To view the articles on one page, Joomla provides the item type *Category Blog Layout*. This is a menu object type. The user must specify a category when executing the

script. All the articles which are assigned to this category will be displayed on a automatically created web page. If the user wants to display all the imported articles from Trello on one page, he has to create such a category blog layout for the category he specified. The user can customise the appearance of the site.

4.4.2 Single article

Sometimes it makes more sense for all the cards to be stored as a single article in Joomla, which is what the `joomlaSingle.rb` does. This script works exclusively with Joomla version 1.5, which still uses HTML tables for structuring the websites. The script generates a special HTML site of all cards similar to the `html.rb` script described in section 4.1.

4.5 Backup

Used additional libraries:

- `tmpdir`
- `zip`

Trello doesn't provide a complete backup solution. Single cards can be downloaded as `*.json` files, which is hardly viable for a serious backup solution. It might be useful to have the possibility to access the whole view of a users Trello account offline. For example to use it in a dedicated Trello application or another project of dedicated software. The following code provides the user with this essential functionality.

4.5.1 Export

Usage:

```
1 ruby export.rb -n filename -t TOKEN -k KEY
```

Listing 4.23: `export.rb` usage.

The `-n` command-line property specifies the filename used to store the exported data from Trello.

The `export.rb` script at first has to accumulate the data. Unlike in the other scripts, the whole information is here needed all at once and in the most compact structure. There are five major types of content: organizations, boards, lists, cards, and members. The method `getBoardsByMember('me')` determines the boards of the member. `getMembersByBoard()` determines the members by board, meaning this is an array which contains the boards as hashes. One value of these hashes contains all members that are assigned to this board. For each board `getListsByBoard()` determines the related lists. The cards are collected by board as well with the `getCardsByBoard` method. Because this API response doesn't contain the whole information about a card, the card array must be extended with the `getCardsAsArray()` method. This method also downloads attachments, if any. When all the data of these four content types is available, each array is saved to a mutual hash:

```
1 hashBackup = Hash.new
2 hashBackup['boards'] = arrayBoards
3 hashBackup['members'] = arrayMembersByBoards
4 hashBackup['lists'] = arrayLists
5 hashBackup['cards'] = arrayCards
```

Listing 4.24: `joomlaMultiple.rb` usage.

`hashBackup` contains the whole data of a user's Trello account. Now it has to be saved to the backup file.

Saving to JSON files

The JSON library for Ruby described in section 2.4 is able to generate JSON out of Ruby hashes and arrays.

```
1 backupFile = File.new(File.join(Dir.tmpdir, 'backup.json'  
    ), "wb")  
2 backupFile.puts JSON.generate(hashBackup)  
3 backupFile.close()
```

Listing 4.25: Using the temporary directory of the operating system to save the JSON to file.

In line 1 of listing 4.25, a file called `backup.json` is opened. `Dir.tmpdir` determines the path to the temporary directory of the operating system. This works under every operating system Ruby supports. Using the temporary directory has several advantages: Even if the saving process is cancelled, it wouldn't result in a cluttered directory, as the temporary directory is regularly cleaned by the operating system. Also, the `join` method of Ruby's `File` class merges the path of the temporary directory and the file name to a correct path to a file in the temporary directory. `File.new` makes this new file accessible with the variable `backupFile`. To store the generated hash in the file, the script first generates the JSON with the `generate` method of the JSON library. The result is directly stored in the `backup.json` file because the `puts` method applied to the `backupFile` variable accesses the file in the temporary directory. The last step closes the `backup.json` file.

Storing the whole data provided by the Trello API in the backup files is very future-proof. Even if Trello changes the intern structure of their representations of cards or boards, it will be saved in the backup files. Thus the data might be not accessible through other scripts which rely on the present structure, but the information itself is available. Therefore the `export.rb` script must not be changed every time Trello changes its data structures.

Now, there is one JSON file and a directory with attachments. For exchanging the data, this combination is not practical. A single file is needed. In order to achieve that and to minimise file size, the script uses the gem `zip`. `zip` is used to easily generate ZIP archives.

```
1 Zippy.create @filename do |zip|  
2   zip['backup.json'] = File.open(backupFile)  
3
```

```
4 Dir.entries(directoryNameAttachments).each do |file|
5   fileName = File.new(File.join(
6     directoryNameAttachments, file), "r")
7   if file != "." && file != ".."
8     zip['attachments/' + file] = File.open(fileName)
9     fileName.close
10    File.delete(fileName)
11  end
12 end
```

Listing 4.26: Creating a ZIP archive out of the backed up data.

In order to create a single ZIP file, `zip` opens a `create` block. To add a file to the ZIP archive, it can be specified in the same manner as is the case in an array. In line 2 of listing 4.26, a new file with the name `backup.json` is created in the ZIP archive. In the same step, it is filled with the contents of the `backupFile` variable, which is basically the `backup.json` in the temporary directory. In line 4, the script iterates through the attachment directory in the temporary directory. Each attachment is stored in an `attachments` directory in the ZIP archive. After that, the attachments are deleted from the temporary directory. Unless the operating system will delete them anyway when they are not in use, the attachments directory and the `backup.json` file are also deleted. [\[zip12\]](#)

4.5.2 Import

Usage:

```
1 ruby import.rb -n filename -t TOKEN -k KEY
```

Listing 4.27: `import.rb` usage.

In contrast to the `export.rb` script, the user can specify a file to import with the `-n` command. At first, the script checks if the file is a ZIP file. For this, it doesn't use the file name but the MIME type of the file.

A MIME type is an identifying string, composed of two parts, for file formats on the internet. Originally MIME types were used in email attachments to enable the mail applications to determine what kind of files is attached to an email. Today web browsers handle also various types of media. Every file has its MIME type attached as meta data. A ZIP file is of the MIME type `application/zip`, where `application` is the *type* and `zip` the *subtype*. The `application` type is used for multi purpose files. [rfc96]

```
1 if `file -Ib #{@filename}`.gsub(/;.*\n/, "") != "
   application/zip"
2   puts "ERROR: The backup\index{Backup} file has to be a
      ZIP\index{ZIP} file!"
3   abort
4 end
```

Listing 4.28: Checking if the file has the MIME type “application/zip”

In line 1, the `file -Ib #{@filename}` is a bash call for receiving the MIME type of a file. Ruby executes it and with the `gsub`-Method cuts the MIME part out of the received string. Although the quality of code structure is compromised by using this shell script, reverting to a separate gem would be disproportionately laborious for the sake of this singular instance.

Due to privacy reasons comments, votes, and subscriptions can’t be imported with the API. Only for the Trello account used by the script comments, votes, and subscriptions can be done. Sometimes comments may be important to understand a thought that resulted in a conversation. To keep conversations understandable it adds all comments. The comments written by another account are marked with the date of the original comment and the user name and ID of the account that wrote it.

Trello provides an API call to invite members to boards and organizations. In order to assigned the members to cards the members have to accept the invitation. In most cases the different members won’t be only at the time of the import. The `memberimport.rb` script enables the user to add the missing members later to the respective cards.

4.5.3 Member import

While importing the old cards they are created again in Trello with new IDs. In the backups the members are stored in association with the old IDs of the cards. To dedicate the members to the new cards there have to be a mapping from the old card IDs to the new card IDs, which is applied while execution of the `import.rb` script. The mapping is represented by a Ruby hash. After the script's execution is finished the hash is simply saved in an additional file in the backup ZIP file, called `cards.json`. When `memberimport.rb` is executed it reads the `cards.json`, converts it to a hash in Ruby and adds the missing members. Member which are already assigned to a card are not affected. To keep the boards and card up to date, every time an invited member of a board or organization accepts its invitation the `memberimport.rb` script should be executed.

4.6 Close all boards and organizations

`closeboards.rb` is more of a helper tool for developers. While developing Trello, several test accounts emerge which now and then get crowded with test boards and organizations. The execution of this script will close all boards and organizations in the specified Trello account. The CLI isn't applied here because it would be too dangerous. If the wrong account was accidentally indicated, all the boards would be lost.

```
1 boards = getBoardsByMember('me')
2
3 boards.each do |board|
4   begin
5     putCloseBoard(board['id'])
6     rescue => e
7       puts e.response
8     else
9       puts "Board "+board['name']+" (" +board['id']+" )
          closed!"
10    end
```

```
11 end
12
13 orgas = getOrganizationsByMember('me')
14
15 orgas.each do |orga|
16   begin
17     deleteOrganization(orga['id'])
18   rescue => e
19     puts e.response
20   else
21     puts "Organization "+orga['name']+" ("+orga['id']+" )
        deleted!"
22   end
23 end
```

Listing 4.29: closeboards.rb

Chapter 5

Conclusion

In this thesis a Ruby-based API wrapper for the collaboration tool Trello was developed. Chapter 3 discussed its implementation and extensions to provide a convenient tool for developers to access Trello. With this API wrapper, developers can build every kind of script that works with data in Trello. A command-line interface was applied to the scripts to enable the developer to use the same script for multiple calls. Example scripts which use the API wrapper were described in chapter 4. The first script exports Trello cards to an HTML file. Thus every kind of structured data file could be created with this approach. Two other scripts extract due dates of cards in Trello to Google Calendar or provide it as an iCalendar file. To fill a CMS with content stored in Trello, a synchronisation script for the popular Joomla CMS was developed. Finally, a backup solution is described to save all the information of a Trello account with organizations, boards, lists, cards, and its additions to a single file. This backup file is saved as a ZIP file and includes pure JSON. Thus it is easy to read for third party applications. The backup file can also be imported again in Trello.

Overall, this thesis provides instruments to build applications in Ruby which interact with the Trello API. Several practical examples were presented. Most of them will be used in a productive environment.

Chapter 6

Outlook

6.1 Trello Alfred Extension

Alfred is a small Mac application which simplifies the way one can search the web or access all sorts of applications. It simply consists of an input field which one can access with a keystroke combination. It is alike to an extended Spotlight (on Mac) or Windows Search (on Windows). Developers can write extensions to access other web services and applications with Alfred. It even is possible to run scripts with Alfred. With that possibility given, it is perfect for accessing Trello while working in a fast and easy way. [\[alf12\]](#)

There are three commands to add or read cards with this extension:

1. `trello [board-name]` will return the card-names and statuses of this board.
2. `trello [board-name] [list-name]` will return card-names and statuses of this list in this board.
3. `trello [board-name] [text for a new card]` will add a new card with the specified text to the first list of this board.
4. `trello [board-name] [list-name] [text for a new card]` will add a new card with the specified text to this list of this board.

If you enter `trello Berlin Visit the Reichstag` in Alfred, the extension looks for a board called *Berlin*. If it finds nothing, it looks for *Berlin Visit* and so forth. It is therefore advisable for board names to not end on an imperative. The thought behind this operating principle is that it's very unlikely for a board name to end on an imperative and that imperatives are often used for card titles because cards are generally phrased as a command to oneself.

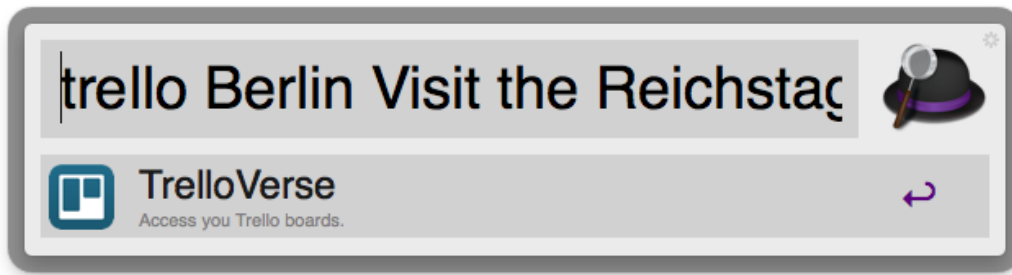


Figure 6.1: Alfred Extension for Trello: This command would add a card with the name *Visit the Reichstag* to the board called *Berlin*.

If you omit the text after the board name, the extension will show you all card names of this board and their statuses.

Sometimes, there are several boards with similar names. In this case, the extension will pick the “last” match. If you have two boards called *Berlin* and *Berlin sightseeing*, the extension will pick *Berlin sightseeing*. This approach makes sense considering that, if the extension would pick the first match – in this case *Berlin* – it wouldn't be possible at all to access *Berlin sightseeing*. When aiming to access *Berlin* and add a new card beginning with *sightseeing*, one has to put this board name between tick marks.

6.2 Native applications

Although Trello is an extremely good web-app, I'm convinced that a native application is always the better solution. Firstly, it is a dedicated app and therefore integrated with the operating system. Especially for todo-applications, it is favourable to be able to access the system's notification system. This way, the application can stay invisible in the background until the user actually needs to be alerted, thus granting an undisturbed working environment.

There are mobile applications for iOS [tre12a] and Android [tre12c] by Trello itself, but there is no Mac, Windows, or Linux application.

A native application would even speed up the Alfred extension because it could cache the data. This way, there wouldn't be a need for an actual HTTP request for every command by the Alfred extension. And, if a HTTP request is necessary, the user doesn't have to wait as the application will handle the command in the background.

6.3 New interesting methods

During the period of this thesis Trello introduced several new features and API calls. Some of them couldn't be considered in the thesis, for time reasons.

6.3.1 Card Cover Images

Trello introduced *Card Cover Images*.¹ Covers are special images, attached to a card. They are shown on the front of the card in Trello. Image attachments used as covers could have a different context than other attachments. It could be an icon to which reflects the scope of a card, for example.

6.3.2 Searching

Developers can now use the API to search² a Trello account. The archive can be searched, too. This function might be useful especially for desktop applications.

¹Blog post about Card Cover Images: <http://blog.trello.com/card-cover-images-and-drag-and-drop-attachments/>

²Blog post about the new Trello search: <https://trello.com/docs/api/search/index.html>

6.3.3 Google Drive integration

The integration with Google Drive³ isn't an API function, yet. But if it is accessible over the API it might be an interesting feature. Desktop applications could add attachments to a Trello card and at the same time Trello uploads those attachments to Google Drive. That could be something like an automatic portfolio generator. All material for a project would be automatically saved in a directory.

³Blog post about the Google Drive integration: <http://blog.trello.com/introducing-google-drive-integration/>

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