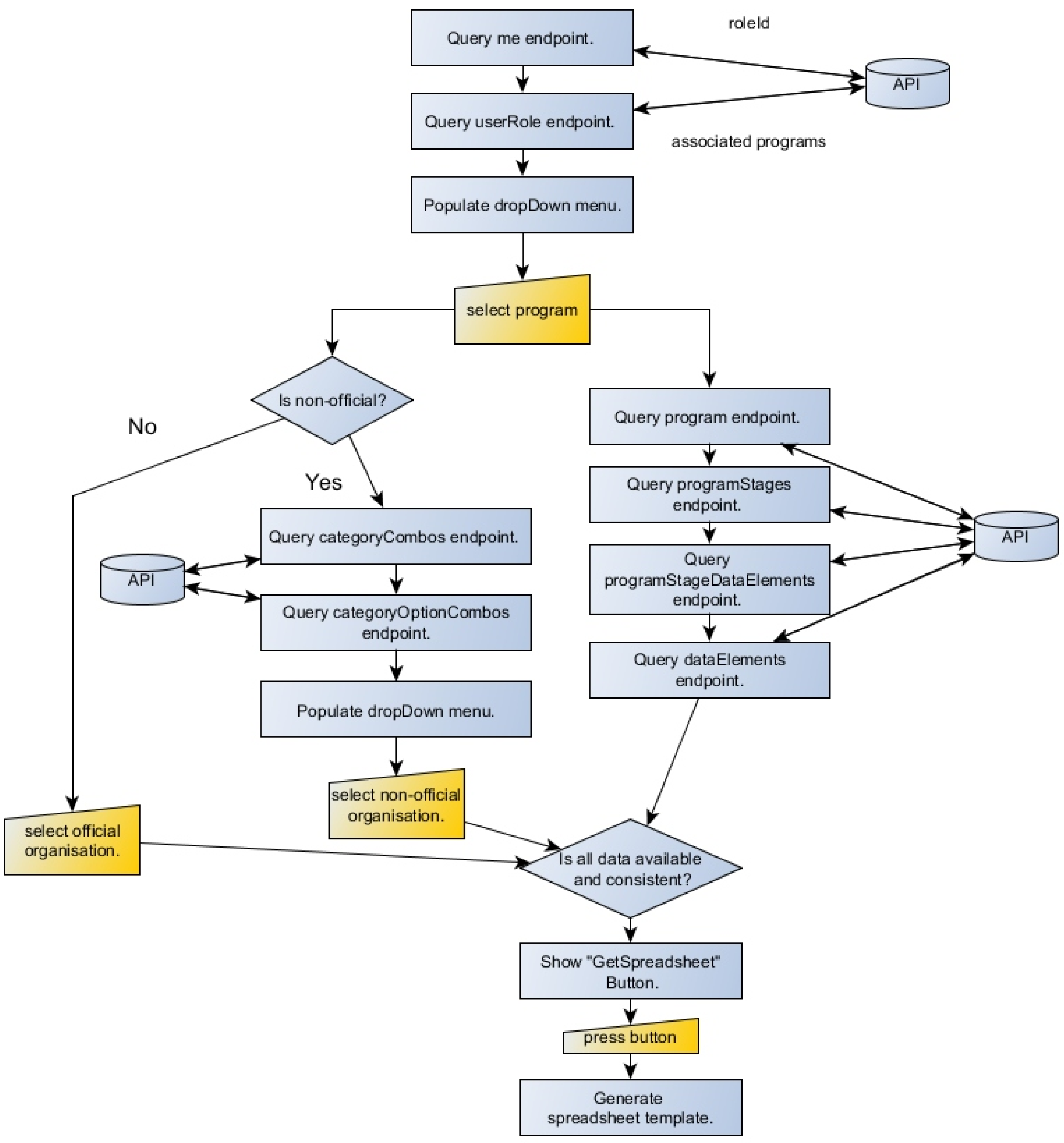
Documentation WISC DHIS2 Bulk Data Upload App


Query me endpoint.
roleId
API
Query userRole endpoint.
associated programs
Populate dropDown menu.
select program
Is non-official?
No
Yes
Query program endpoint.
Query programStages endpoint.
Query programStageDataElements endpoint.
Query dataElements endpoint.
API
Query categoryCombos endpoint.
API
Query categoryOptionCombos endpoint.
Populate dropDown menu.
select non-official organisation.
select official organisation.
Is all data available and consistent?
Show "GetSpreadsheet" Button.
press button
Generate spreadsheet template.

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1 INTRODUCTION

1.1 MOTIVATION

The World Health Organisation (WHO) has set up monitoring programs for a number of neglected tropical diseases, such as Chagas, because the pharmaceutical industry is not financially motivated to develop drugs and vaccines for these diseases. The Chagas disease is caused by the protozoan *Trypanosoma cruzi* [JRM10]. Several bug species from the *Triatominae* family (from the *Hemiptera* order of so-called “true bugs”) are possible vectors of the disease. However, blood transfusion and contaminated food can also transmit the disease[WHO17]. The WHO has set up the World Information System to control the Chagas Disease (WISCC) using the District Health Information System, an integrated web-based information system that was specifically developed for deployment in developing countries [Tea17]. The Bulk Data Upload App was developed in order to facilitate the bulk upload of data to the DHIS2 data base.

1.2 PROCESS OVERVIEW

In a typical usage scenario, a user first downloads a template spreadsheet, copies the data from another spreadsheet or text file to the template, and finally uploads the completed spreadsheet to the DHIS2 system. In the first step, when downloading the template spreadsheet, the user has to decide if he wants to upload data to a program or to a data set and select from either the drop-down list of data sets or programs. In either case, one organizational unit has to be selected from the organizational unit tree. When uploading data to data sets, the user may choose a specific period. Depending on the reporting period of data sets, this might involve choosing a year, year and a month, or a year and a calendar week. The data entry for this specific period will later appear as a hint in the header of the data entry spreadsheet. In general, the user can only select programs or data sets for which he is authorized. After selecting a data set or program, subsequent drop down lists may open: When selecting a program that is associated with non-official organizations (i.e. NGOs, all programs with UCR** as identifier), the respective data provider has to be additionally selected. When selecting a data set, it might be necessary to choose from a list of categories (i.e. different drug companies providing data to the WHO).

Once all necessary options have been selected, an excel spreadsheet will be generated with the “Get spreadsheet template” button. The generated spreadsheet template contains four sheets: The first sheet contains a short description of the app and the spreadsheet. The second sheet contains a header with column labels. The user is supposed to enter his data into this sheet. The third sheet contains a legend that describes the meaning, data types, and possible values of the data elements. The last sheet contains meta data which is needed for the data upload. Once, the user has entered his data into the second sheet, he can continue and upload the spreadsheet. If he does not wish to go through the complete process in one session, he again has to select his organizational unit from the unit tree, the program (or data set), and if applicable his NGO. At the beginning of the upload process, the app tests if the meta data (in sheet nr. 4) coincides with the user supplied information. Then the data is processed and – if no invalid data is detected – the data are send to the DHIS web API[1] and uploaded. The data upload itself is separated into two stages: First, the data is sent in a dry-run mode to the web API. If the API responds that the upload is possible for all supplied data elements, then the data is again sent, and this time it is really imported into the DHIS2 data base. In the following, I will give more details on this workflow.

[1]API stands for Application Programming Interface and it represents a query endpoint from which information from the DHIS2 system can be retrieved by apps. DHIS2 provides a number of specialised APIs.

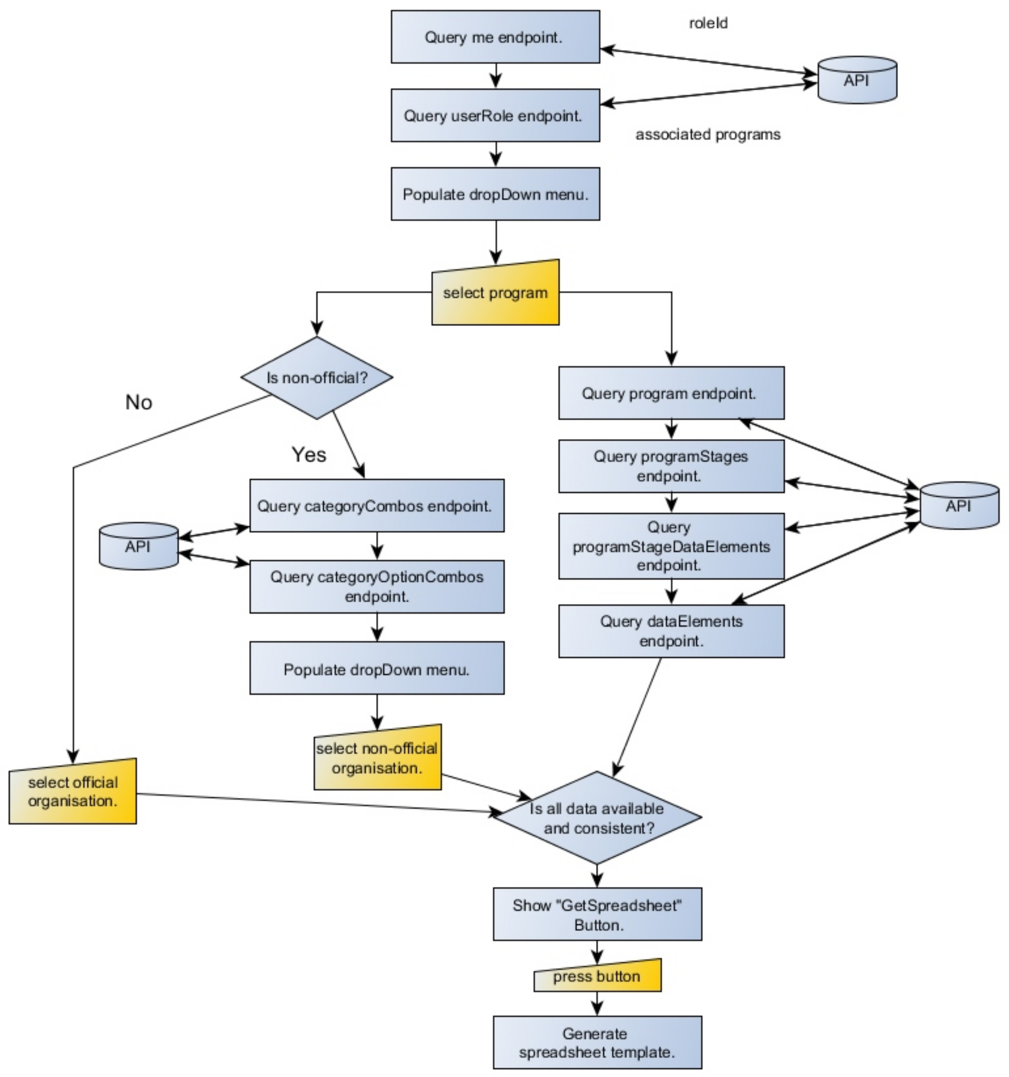
2 WORKFLOW

2.1 DOWNLOADING A TEMPLATE FOR PROGRAMS

The user has to select a program (i.e. form) from a drop-down list. He can only select programs for which he is authorized. The App retrieves this information based on nested calls to the *me* and *userRoles* API. If the program is associated with non-governmental organisations (NGO) – this information can be deduced from the program label – a new drop-down list with the respective NGOs is populated. The organizational unit (short orgunit) has to be selected from an orgunit tree. The template spreadsheet can only be downloaded, if both the orgunit and the program (and if applicable also the NGO) have been selected.

2.2 DOWNLOADING A TEMPLATE FOR DATA SETS

The user has to select a data set from a drop-down list. He can only select data sets for which he is authorized. The App retrieves this information based on nested calls to the *me* and *userRoles* API. A new drop-down list with different data category options for the data set is populated. This drop-down is only shown to the user if there is more than one option. The user may select a time period. The entry in the respective format is then shown in the header of the spreadsheet (column 1). The user has to choose one organizational unit from the orgunit tree. Finally, the template spreadsheet can be downloaded.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Query categoryCombos endpoint.
API
Query categoryOptionCombos endpoint.
Populate dropDown menu.
select non-official organisation.
select official organisation.
Is all data available and consistent?
Show "GetSpreadsheet" Button.
press button
Generate spreadsheet template.

FIGURE 1: DYNAMIC GENERATION OF DROP-DOWN LISTS.

2.3 ENTERING DATA

The generated Excel spreadsheet template contains four sheets:

- The first sheet contains a short description of the app and the spreadsheet structure.
- The second sheet contains a header with column labels.
- The third sheet contains a legend that describes the meaning and data types of the different columns.
- The last sheet contains meta data which is needed for the data upload.

The user is supposed to enter his data into the second sheet. Before, he should have a look at the third sheet which describes the data format of the different columns. This sheet also details which values are possible if the data element is associated with an option set. The last sheet should not be manipulated by the user, it contains meta data which is necessary for the successful upload of the event data from the spreadsheet. Once, the user has entered his data into the first sheet, he can continue with the upload of the spreadsheet.

2.4 DATA UPLOAD FOR PROGRAM DATA

First, the user has to browse the local file system and select the completed spreadsheet using the **File Selection** button. Next, he can choose if the app should validate the geographical location data. For expert users, it is also possible to choose between different log levels in the central panel. The **Upload** button triggers the data upload. If the upload succeeds, a summary of the number of uploaded rows will be printed to the text window. Else, error messages will hint to the potential error sources. During the upload step, the app runs several data cleaning and consistency checks which will be described in the next section.

2.5 DATA UPLOAD FOR DATA SETS

First, the user has to browse the local file system and select the completed spreadsheet using the **File Selection** button. Next, he can choose the "import strategy":

- CREATE: Create new data entries and ignore new values for existing entries.
- UPDATE: Update the values of existing entries.
- CREATE AND UPDATE: Create new data entries and update values for existing entries.

3 INTERNAL CHECKS AND DATA CLEANING

3.1 CONSISTENCY CHECKS

By selecting the option “Latitude and longitude are provided” (only programs), the user forces the app to validate the geographical location data. By default the app does not validate the location data. In the following it is assumed that the user chose to validate the location data.

At the beginning of the upload process, the app tests if the currently selected IDs of program and organizational unit coincide with the meta data which is stored in the third sheet of the Excel file. If any of the IDs do not match, the process is aborted with an error message. In this way, the app ensures that users which submit data to different programs do not try to send data to the wrong program. Users also have to select the correct organizational level in the organization unit tree.

Before the rows are processed, rows are checked for duplicates using the md5 hash function. If there is any duplicate row, the upload process is aborted with an error message. If all these checks were successful, the app proceeds with the following row-wise data checks:

- Are values supplied for the first three columns “ReportingDate”, “Latitude”, “Longitude”?
- Is the ”ReportingDate” correctly supplied with a string of 23 characters?
- Is the ”Latitude” value a valid numeric value between -90.0 and +90.0?
- Is the ”Longitude” value a valid numeric value between -180.0 and +180.0?
- Is this a valid geographical location for the polygon[2] of the organisational unit?
- Is there at least one value for an optional[3] data element?
- Is the supplied value within the set of permitted values of the option set?

Although users can provide rows with missing data, they have to provide all three mandatory columns (compare box) and at least one additional data element. The upload of the data set as a whole does not start before all input rows have been processed. If any of these checks fails for any line, the upload process will be aborted once all rows have been read. The rational is that users should be informed about all possible errors before aborting the process.

[2]The polygon of the organizational unit is recursively retrieved from the *organisationUnits* API: If no polygon can be retrieved for the unit, I retry the query with the parent unit. A maximum recursion depth of three is used. If no polygon is retrievable for the grandparent unit, a warning message is printed informing the user that the location could not be validated because of missing polygon information.

[3]Optional elements are all data elements except ”ReportingDate”, ”Latitude”, and ”Longitude”.

FRAME 1: MANDATORY DATA ELEMENTS

- ReportingDate: 2016-12-01T00:00:00.000
- Latitude $\in [-90.0, +90.0]$
- Longitude $\in [-180.0, +180.0]$
- (Latitude,Longitude) $\in$ Polygon

3.2 DATA CLEANING

Based on a query to the *dataElements* API, the properties *formName* and *valueType* are available for all data elements: The property *formName* is a informative label that is used as header information in the first spreadsheet. The property *valueType* describes the data type and it is used to infer the appropriate type of data cleaning operations:

TABLE 1: VALUE TYPE DEPENDENT DATA CLEANING.

Value type	Remove quotes	Further actions
"COORDINATE"	Yes	
"LONG_TEXT"	Yes	
"TEXT"	Yes	
"INTEGER_POSITIVE"	No	if(x<=0):"",else:x
"TRUE_ONLY"	Yes	if(regex("TRUE")):"true",else:""

3.3 DIFFERENCES BETWEEN PROGRAMS AND DATA SETS

There are a few minor differences in the consistency checks for data that is uploaded to programs and data sets. For data sets, the geographical location is not checked. The data cleaning and the check of valid options for option sets are identical.

4 DEPENDENCIES AND MAINTAINABILITY

This app was developed for DHIS version 2.26. There are more than 20 different calls to the DHIS2 web API (see table below). According to the DHIS2 developer documentation: "The last three API versions will be supported. As an example, DHIS version 2.27 will support API version 27, 26 and 25. Note that the metadata model is not versioned, and that you might experience changes e.g. in associations between objects. These changes will be documented in the DHIS2 major version release notes." As recommendend, I used a global variable "baseUrl" which includes the version number (currently 26) in the API call. In theory, the API calls should be supported in DHIS2 versions 27,28, and 29. However, we recently experienced problems when switching to version 27: The *programStageDataElements* endpoint completely disappeared in the new version (2.27) and support for older version was discontinued at the same time (compare email of Petar Jovanovic from 20.7.2017 to Dhis2-devs mailing list and my bug report with reference DHIS2-1939 [Ger17]). This indicates that changes to the DHIS2 web API have to be monitored closely before switching to a new version. If the DHIS Version is updated, the following maintenance steps have to be carried out:

1. Check if there are changes in the web API that affect the application (table below).
2. If there are relevant changes adapt the API calls.
3. Switch to the new version by updating the *baseUrl* variable in *scripts.js*.

In theory there should be no need to adapt the app during three consequent version updates, but it is recommendable to keep adapting the app to changes in the web API.

TABLE 2: OVERVIEW OF CALLS TO DHIS2 API.

API	JavaScript function	Purpose
me	queryUserRoles()	Retrieve the ID of the user to then query the userRoles API.
userRoles	queryUserRoles()	Retrieve the datasets and programs the user is authorized for.
dataSets	queryDataSetsApi()	Retrieve a list of all datasets (ID and display name) the user is authorized to edit.
dataSets	queryDataSet()	Retrieve the data elements, sections, and categorycombos of this data set.
categoryCombos	queryCategoryCombo()	Queries category option combinations for individual data elements or for the data set as a whole.
categoryOptionCombos	queryCategoryOptionCombo()	Queries ID and display name for a given category option combination.
programs	queryProgramsApi()	Query program names, IDs, stages, and category combinations.
categoryCombos	queryCategoryCombosApi()	Nested calls to three APIs in order to retrieve the name and id of NGOs.
categories	queryCategoryCombosApi()	Nested calls to three APIs in order to retrieve the name and id of NGOs.
categoryOptions	queryCategoryOptionCombos()	Nested calls to three APIs in order to retrieve the name and id of NGOs.
programStages	retrieveProgramStageDataElements()	Retrieves data elements of program stage endpoint.
programStageSections	queryProgramStageSectionsInnerCall()	Retrieve the data elements associated to each program stage section.
sections	queryDataSetSections()	Retrieves the data elements (ID and display name) associated to a data set section.
programStageDataElements	queryProgramStageDataElementsInnerCall()	Retrieves Id, label, and compulsory property associated to a data element.
dataElements	queryDataElement()	Reads label, value type, description, and hasOptionSet property of a given data element.
optionSets	queryOptionsInnerCall()	Read option IDs for given option set.
options	queryOption()	Retrieves the text value for a given option ID.
dataValueSets	importDataFromDataSet()	Upload data for data sets in dry run.
dataValueSets	importDataFromDataSet()	Upload data for data sets.
events	importData()	Upload data for programs.
events	importData()	Upload data for programs in dry run.

5 ACKNOWLEDGMENTS

I am very thankful to Eric Mourin Marin who introduced me to DHIS2 and often helped me in the practical implementation of the app. The developers of the DHIS2 Excel Data Upload App did a great job developing their app and we used some of their code to implement the current app. Marc Garnica Caparros shared his experience using the Excel Data Upload App and some customized Javascript code with me. Petar Jovanovic was defining the desired features of the app and was always available when I had questions or doubts. Lise Grout, Alberto Abelló, Pedro Albajar Vinas, and Oscar Romero Moral were defining the general requirements of the app.

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ONLINE

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