

JsonPreprocessor

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Chapter 1

Introduction

JavaScript Object Notation (JSON) is a text-based format for storing any user defined data and can also be used for data interchange between different applications.

But this format has some limitations and the **JsonPreprocessor** has been introduced to fill the gaps.

The **JsonPreprocessor** extends the JSON format by the following features:

1. Parts of a JSON file can be commented out
2. A JSON file can import other JSON files (nested imports)
3. Parameter can be defined, referenced and overwritten (follow up definitions in configuration files overwrite previous definitions of the same parameter)
4. Also Python specific keywords like `True` , `False` and `None` can be used (additionally to the corresponding JSON keywords `true` , `false` and `null`)

The main goal behind the **JsonPreprocessor** is to support huge sets of parameters for complex projects. Like in usual programming languages code comments are useful to explain the meaning of the defined parameters.

Splitting all required parameters into several JSON files - that can import each other - enables to distinguish e.g. between local and global parameters or between specific and common parameters. Another advantage of a file split is: Smaller files with a more specific content are easier to maintain than a huge single file that contains all.

A possible use case for a file split would be to have a software containing several different components with each component requires an individual set of parameters - and therefore an own JSON file. Additionally all components also require a common set of parameters. In this case all common parameters can be defined within an own JSON file that is imported into all other JSON files containing the specific values. This procedure avoids redundancy in parameter definitions.

Another useful side effect is that parameters can be initialized in common JSON files and overwritten in specific JSON files that import the common ones.

But this has consequences: The new features cause some deviations from JSON standard.

These deviations harm the syntax highlighting of editors and also cause invalid findings of JSON format related static code checkers.

To avoid conflicts between the standard JSON format and the extended JSON format described here, the **JsonPreprocessor** uses the alternative file extension `.jsonp` for all JSON files.

References:

The **JsonPreprocessor** is hosted in PyPi (recommended for users) and in GitHub (recommended for developers):

- [JsonPreprocessor in PyPi](#)
- [JsonPreprocessor in GitHub](#)

Details about how to get the **JsonPreprocessor** can be found in the [README](#).

For the development environment **VSCodium** an extension is available to support the extended JSON format of the **JsonPreprocessor**: [vscode-jsonp](#)

Chapter 2

Description

This chapter explains the features of the **JsonPreprocessor** in detail.

2.1 How to execute

The **JsonPreprocessor** is implemented in Python3 and therefore requires a Python3 installation.

A basic Python script to use the **JsonPreprocessor** can look like this:

```
from JsonPreprocessor.CJsonPreprocessor import CJsonPreprocessor
import pprint

json_preprocessor = CJsonPreprocessor()
try:
    values = json_preprocessor.jsonLoad("./file.jsonp")
    pprint.pprint(values)
except Exception as reason:
    print(f'"{reason}"')
```

The main method of the **JsonPreprocessor** is: `jsonLoad`. Input is the path and the name of a JSON file. Output is a dictionary containing all values parsed from this JSON file.

In case of any errors while computing the JSON file, the **JsonPreprocessor** throws an exception. Therefore it is required to call the method `jsonLoad` inside a `try/except` block.

`pprint` is used in this example to give the output a better readability in console.

In the following sections we concentrate on the content of the JSON files and the corresponding results.

The way to get these results is in every case the same: the example script listed above.

2.2 Standard JSON format

The **JsonPreprocessor** supports JSON files with standard extension `.json` and standard content. JSON file:

```
{
  "param1" : "value1",
  "param2" : "value2"
}
```

Output:

```
{'param1': 'value1', 'param2': 'value2'}
```

A JSON file with extension `.jsonp` and same content will produce the same output.

We recommend to give every JSON file the extension `.jsonp` to have a strict separation between the standard and the extended JSON format.

The following example still contains standard JSON content, but with parameters of several different data types (simple and composite).

```
{
  "param_01" : "string",
  "param_02" : 123,
  "param_03" : 4.56,
  "param_04" : ["A", "B", "C"],
  "param_05" : {"A" : 1, "B" : 2, "C" : 3}
}
```

This content produces the following output:

```
{'param_01': 'string',
 'param_02': 123,
 'param_03': 4.56,
 'param_04': ['A', 'B', 'C'],
 'param_05': {'A': 1, 'B': 2, 'C': 3}}
```

2.3 Boolean and null values

JSON supports the boolean values `true` and `false`, and also the null value `null`.

In Python the corresponding values are different: `True`, `False` and `None`.

Because the **JsonPreprocessor** is a Python application and therefore the returned content is required to be formatted Python compatible, the **JsonPreprocessor** does a conversion automatically.

Accepted in JSON files are both styles:

```
{
  "param_06" : true,
  "param_07" : false,
  "param_08" : null,
  "param_09" : True,
  "param_10" : False,
  "param_11" : None
}
```

But the usage of Python keywords (`param_09` - `param_11`) requires a small extension of the example above. The initialization of the **JsonPreprocessor** needs to set the syntax to Python (`syntax="python"`):

```
json_preprocessor = CJsonPreprocessor(syntax="python")
```

Without setting the syntax to Python, the usage of Python keywords within JSON files causes an exception.

!!! Caution: This will be changed: [issues/84](#) !!!

The output contains all keywords in Python style only:

```
{'param_06': True,
 'param_07': False,
 'param_08': None,
 'param_09': True,
 'param_10': False,
 'param_11': None}
```

2.4 Comments

Comments can be added to JSON files with `//` :

```
{
  // JSON keywords
  "param_06" : true,
  "param_07" : false,
  "param_08" : null,
  // Python keywords
  "param_09" : True,
  "param_10" : False,
  "param_11" : None
}
```

All lines starting with `//` , are ignored by the **JsonPreprocessor**. The output of this example is the same than in the previous example.

2.5 Import of JSON files

We assume the following scenario:

A software component *A* requires a set of configuration parameters. A software component *B* that belongs to the same main software or to the same project, requires another set of configuration parameters. Additionally both components require a common set of parameters (with the same values).

The outcome is that at least we need two JSON configuration files:

1. A file `componentA.jsonp` containing all parameters required for component *A*
2. A file `componentB.jsonp` containing all parameters required for component *B*

But with this solution both JSON files would contain also the common set of parameters. This is unfavorable, because the corresponding values need to be maintained at two different positions.

Therefore we extend the list of JSON files by a file containing the common part only:

1. A file `common.jsonp` containing all parameters that are the same for component *A* and component *B*
2. A file `componentA.jsonp` containing all parameters required for component *A*
3. A file `componentB.jsonp` containing all parameters required for component *B*

Finally we use the import mechanism of the **JsonPreprocessor** to import the file `common.jsonp` in file `componentA.jsonp` and also in file `componentB.jsonp`.

This can be the content of the JSON files:

- `common.jsonp`

```
{
  // common parameters
  "common_param_1" : "common value 1",
  "common_param_2" : "common value 2"
}
```

- `componentA.jsonp`

```
{
  // common parameters
  "[import]" : "../common.jsonp",
  //
  // component A parameters
  "componentA_param_1" : "componentA value 1",
  "componentA_param_2" : "componentA value 2"
}
```

- `componentB.jsonp`

```
{
  // common parameters
  "[import]" : "../common.jsonp",
  //
  // component B parameters
  "componentB_param_1" : "componentB value 1",
  "componentB_param_2" : "componentB value 2"
}
```

Explanation:

JSON files are imported with the key `"[import]"`. The value of this key is the path and name of the JSON file to be imported.

A JSON file can contain more than one import. Imports can be nested: An imported JSON file can import further JSON files also.

Outcome:

The file `componentA.jsonp` produces the following output:

```
{'common_param_1': 'common value 1',
'common_param_2': 'common value 2',
'componentA_param_1': 'componentA value 1',
'componentA_param_2': 'componentA value 2'}
```

The file `componentB.jsonp` produces the following output:

```
{'common_param_1': 'common value 1',
'common_param_2': 'common value 2',
'componentB_param_1': 'componentB value 1',
'componentB_param_2': 'componentB value 2'}
```

It can be seen that the returned dictionary contains both the parameters from the loaded JSON file and the parameters imported by the loaded JSON file.

2.6 Overwrite parameters

We take over the scenario from the previous section: We still have a JSON file `componentA.jsonp` containig the parameters for component *A*, a JSON file `componentB.jsonp` for component *B* and a JSON file `common.jsonp` for both components.

But now component *B* requires a different value of a common parameter: Within a JSON file we need to change the value of a parameter that is initialized within an imported file. That is possible.

This is now the content of the JSON files:

- `common.jsonp`

```
{
  // common parameters
  "common_param_1" : "common value 1",
  "common_param_2" : "common value 2"
}
```

- `componentA.jsonp`

```
{
  // common parameters
  "[import]" : "../common.jsonp",
  //
  // component A parameters
  "componentA_param_1" : "componentA value 1",
  "componentA_param_2" : "componentA value 2"
}
```

- `componentB.jsonp`

```
{
  // common parameters
  "[import]" : "../common.jsonp",
  //
  // component B parameters
  "componentB_param_1" : "componentB value 1",
  "componentB_param_2" : "componentB value 2",
  // overwrite parameter initialized by imported file
  "common_param_2" : "common componentB value 2"
}
```

Explanation:

With

```
"common_param_2" : "common componentB value 2"
```

in `componentB.jsonp` the initial definition

```
"common_param_2" : "common value 2"
```

in `common.jsonp` is overwritten.

Outcome:

The file `componentB.jsonp` produces the following output:

```
{'common_param_1': 'common value 1',
'common_param_2': 'common componentB value 2',
'componentB_param_1': 'componentB value 1',
'componentB_param_2': 'componentB value 2'}
```

Important: *The value a parameter has finally, depends on the order of definitions, redefinitions and imports!*

In file `componentB.jsonp` we move the import of `common.jsonp` to the bottom:

```
{
  // component B parameters
  "componentB_param_1" : "componentB value 1",
  "componentB_param_2" : "componentB value 2",
  "common_param_2" : "common componentB value 2"
  //
  // common parameters
  "[import]" : "./common.jsonp",
}
```

Now the imported file overwrites the value initialized in the importing file.

Outcome:

```
{'common_param_1': 'common value 1',
'common_param_2': 'common value 2',
'componentB_param_1': 'componentB value 1',
'componentB_param_2': 'componentB value 2'}
```

Up to now we considered simple data types only. In case we want to overwrite a parameter that is part of a composite data type, we need to extend the syntax. This is explained in the next examples.

Again we take over the scenario from the previous section: We still have a JSON file `componentA.jsonp` containing the parameters for component *A*, a JSON file `componentB.jsonp` for component *B* and a JSON file `common.jsonp` for both components.

But now all values are part of composite data types like lists and dictionaries.

This is the content of the JSON files:

- `common.jsonp`

```
{
  // common parameters
  "common_param_1" : ["common value 1.1", "common value 1.2"],
  "common_param_2" : {"common_key_2_1" : "common value 2.1",
                      "common_key_2_2" : "common value 2.2"}
}
```

- `componentA.jsonp`

```
{
  // common parameters
  "[import]" : "./common.jsonp",
  //
  // component A parameters
  "componentA_param_1" : ["componentA value 1.1", "componentA value 1.2"],
  "componentA_param_2" : {"componentA_key_2_1" : "componentA value 2.1" ,
                          "componentA_key_2_2" : "componentA value 2.2"}
}
```

- `componentB.jsonp`

```
{
  // common parameters
  "[import]" : "./common.jsonp",
  //
  // component B parameters
  "componentB_param_1" : ["componentB value 1.1", "componentB value 1.2"],
  "componentB_param_2" : {"componentB_key_2_1" : "componentB value 2.1" ,
                          "componentB_key_2_2" : "componentB value 2.2"}
}
```

Like in previous examples, the outcome is a merge of the imported JSON file and the importing JSON file, e.g. for `componentA.jsonp` :

```
{'common_param_1': ['common value 1.1', 'common value 1.2'],
 'common_param_2': {'common_key_2_1': 'common value 2.1',
                    'common_key_2_2': 'common value 2.2'},
 'componentA_param_1': ['componentA value 1.1', 'componentA value 1.2'],
 'componentA_param_2': {'componentA_key_2_1': 'componentA value 2.1',
                        'componentA_key_2_2': 'componentA value 2.2'}}
```

Now the following questions need to be answered:

1. How to get the value of an already existing parameter?
2. How to get the value of a single element of a parameter of nested data type (list, dictionary)?
3. How to overwrite the value of a single element of a parameter of nested data type?
4. How to add an element to a parameter of nested data type?

We introduce another JSON file `componentB.2.jsonp` in which we import the JSON file `componentB.jsonp` . In this file we also add content to work with simple and composite data types to answer the questions above.

This is the initial content of `componentB.2.jsonp` :

```
{
  // import of componentB parameters
  "[import]" : "./componentB.jsonp",
  //
  // some additional parameters of simple data type
  "string_val" : "ABC",
  "int_val"    : 123,
  "float_val"  : 4.56,
  "bool_val"   : true,
  "null_val"   : null,

  // access to existing parameters
  "string_val_b"      : ${string_val},
  "int_val_b"         : ${int_val},
  "float_val_b"       : ${float_val},
  "bool_val_b"        : ${bool_val},
  "null_val_b"        : ${null_val},
  "common_param_1_b"  : ${common_param_1},
  "componentB_param_2_b" : ${componentB_param_2}
}
```

The rules for accessing parameters are:

- Existing parameters are accessed by a dollar operator and a pair of curly brackets (`${...}`) with the parameter name inside.
- If the entire expression of the right hand side of the colon is such a dollar operator expression, the entire expression must *not* be encapsulated in quotes.
- The dollar operator keeps the data type of the referenced parameter.

Outcome:

```
{'bool_val': True,
 'bool_val_b': True,
 'common_param_1': ['common value 1.1', 'common value 1.2'],
 'common_param_1_b': ['common value 1.1', 'common value 1.2'],
 'common_param_2': {'common_key_2_1': 'common value 2.1',
                    'common_key_2_2': 'common value 2.2'},
 'componentB_param_1': ['componentB value 1.1', 'componentB value 1.2'],
 'componentB_param_2': {'componentB_key_2_1': 'componentB value 2.1',
                        'componentB_key_2_2': 'componentB value 2.2'},
 'componentB_param_2_b': {'componentB_key_2_1': 'componentB value 2.1',
                           'componentB_key_2_2': 'componentB value 2.2'},
 'float_val': 4.56,
 'float_val_b': 4.56,
 'int_val': 123,
 'int_val_b': 123,
 'null_val': None,
 'null_val_b': None,
 'string_val': 'ABC',
 'string_val_b': 'ABC'}
```

Let's take a deeper look at the following line:

```
"int_val_b" : ${int_val},
```

Like mentioned in the rules above, the dollar operator keeps the data type of the referenced parameter: In case of `int_val` is of type `int` , also `int_val_b` will be of type `int` .

Like mentioned in the rules above, dollar operator expressions must *not* be encapsulated in quotes. But nevertheless it is possible to use quotes. In case of:

```
"int_val_b" : "${int_val}",
```

the parameter `int_val_b` would be of type `string`.

Value of a single element of a parameter of nested data type

To access an element of a list and a key of a dictionary, we change the content of file `componentB.2.jsonp` to:

```
{
  // import of componentB parameters
  "[import]" : "./componentB.jsonp",
  //
  "list_element_0" : "${componentB_param_1}[0]",
  "dict_key_2_2" : ${common_param_2}['common_key_2_2']
}
```

!!! **CAUTION:** Code needs to be adapted (remove quotes) after [issues/85](#) is resolved !!!

Outcome:

```
{'common_param_1': ['common value 1.1', 'common value 1.2'],
 'common_param_2': {'common_key_2_1': 'common value 2.1',
                    'common_key_2_2': 'common value 2.2'},
 'componentB_param_1': ['componentB value 1.1', 'componentB value 1.2'],
 'componentB_param_2': {'componentB_key_2_1': 'componentB value 2.1',
                        'componentB_key_2_2': 'componentB value 2.2'},
 'dict_key_2_2': 'common value 2.2',
 'list_element_0': 'componentB value 1.1'}
```

Overwrite the value of a single element of a parameter of nested data type

In the next example we overwrite the value of a list element and the value of a dictionary key.

Again we change the content of file `componentB.2.jsonp` :

```
{
  // import of componentB parameters
  "[import]" : "./componentB.jsonp",
  //
  ${componentB_param_1}[0] : "componentB value 1.1 (new)",
  ${common_param_2}['common_key_2_1'] : "common value 2.1 (new)"
}
```

The dollar operator syntax at the left hand side of the colon is the same than previously used on the right hand side. The entire expression must *not* be encapsulated in quotes.

Outcome:

The single elements of the list and the dictionary are updated, all other elements are unchanged.

```
{'common_param_1': ['common value 1.1', 'common value 1.2'],
 'common_param_2': {'common_key_2_1': 'common value 2.1 (new)',
                    'common_key_2_2': 'common value 2.2'},
 'componentB_param_1': ['componentB value 1.1 (new)', 'componentB value 1.2'],
 'componentB_param_2': {'componentB_key_2_1': 'componentB value 2.1',
                        'componentB_key_2_2': 'componentB value 2.2'}}
```

Add an element to a parameter of nested data type

Adding further elements to an already existing list is not possible in JSON! But it is possible to add keys to an already existing dictionary.

The following example extends the dictionary `common_param_2` by an additional key `common_key_2_3` :

```
{
  // import of componentB parameters
  "[import]" : "./componentB.jsonp",
  //
  ${common_param_2}['common_key_2_3'] : "common value 2.3"
}
```

Outcome:

```
{'common_param_1': ['common value 1.1', 'common value 1.2'],
 'common_param_2': {'common_key_2_1': 'common value 2.1',
                    'common_key_2_2': 'common value 2.2',
                    'common_key_2_3': 'common value 2.3'},
 'componentB_param_1': ['componentB value 1.1', 'componentB value 1.2'],
 'componentB_param_2': {'componentB_key_2_1': 'componentB value 2.1',
                        'componentB_key_2_2': 'componentB value 2.2'}}
```

Use of a common dictionary

The last example in this section covers the following use case:

- We have several JSON files, each for a certain purpose within a project (e.g. for every feature of this project a separate JSON file).
- They belong together and therefore they are all imported into a main JSON file that is the file that is handed over to the **JsonPreprocessor**.
- Every imported JSON file introduces a certain bunch of parameters. All parameters need to be a part of a common dictionary.
- Outcome is that finally only one single dictionary is used to access the parameters from all JSON files imported in the main JSON file.

To realize this, it is necessary to separate the initialization of the dictionary from all positions where keys are added to this dictionary.

These are the JSON files:

- `project.jsonp`

```
{
  // initialization
  "project_values" : {},
  //
  // add some common values
  ${project_values}['common_project_param_1'] : "common project value 1",
  ${project_values}['common_project_param_2'] : "common project value 2",
  //
  // import feature parameters
  "[import]" : "./featureA.jsonp",
  "[import]" : "./featureB.jsonp",
  "[import]" : "./featureC.jsonp"
}
```

- `featureA.jsonp`

```
{
  // parameters required for feature A
  ${project_values}['featureA_params'] : {},
  ${project_values}['featureA_params']['featureA_param_1'] : "featureA param 1 value",
  ${project_values}['featureA_params']['featureA_param_2'] : "featureA param 2 value"
}
```

- `featureB.jsonp`

```
{
  // parameters required for feature B
  ${project_values}['featureB_params'] : {},
  ${project_values}['featureB_params']['featureB_param_1'] : "featureB param 1 value",
  ${project_values}['featureB_params']['featureB_param_2'] : "featureB param 2 value"
}
```

- `featureC.jsonp`

```
{
  // parameters required for feature C
  ${project_values}['featureC_params'] : {},
  ${project_values}['featureC_params']['featureC_param_1'] : "featureC param 1 value",
  ${project_values}['featureC_params']['featureC_param_2'] : "featureC param 2 value"
}
```

Explanation:

Every `feature*.jsonp` file refer to the dictionary initialized within `project.jsonp` .

Important is that the initialization `"project_values" : {}`, happens at top level (`project.jsonp`), and not within the imported files (`feature*.jsonp`), otherwise follow up initializations would delete previously added keys of this dictionary!

Outcome:

```
{'project_values': {'common_project_param_1': 'common project value 1',
                    'common_project_param_2': 'common project value 2',
                    'featureA_params': {'featureA_param_1': 'featureA param 1 value',
                                         'featureA_param_2': 'featureA param 2 value'},
                    'featureB_params': {'featureB_param_1': 'featureB param 1 value',
                                         'featureB_param_2': 'featureB param 2 value'},
                    'featureC_params': {'featureC_param_1': 'featureC param 1 value',
                                         'featureC_param_2': 'featureC param 2 value'}}}
```

2.7 The dotdict notation

Up to now we have accessed dictionary keys in this way (standard notation):

```
${dictionary}['key']['sub_key']
```

Additionally to this standard notation, the **JsonPreprocessor** supports the so called *dotdict* notation where keys are handled as attributes:

```
${dictionary.key.sub_key}
```

In standard notation keys are encapsulated in square brackets and all together is placed *outside* the curly brackets. In dotdict notation the dictionary name and the keys are separated by dots from each other. All together is placed *inside* the curly brackets.

In standard notation key names are allowed to contain dots:

```
${dictionary}['key']['sub.key']
```

In dotdict notation this would cause ambiguities:

```
${dictionary.key.sub.key}
```

Therefore it is not possible to implement in this way! In case you need to have dots inside key names, you must use the standard notation.

Do you really need dots inside key names?

Please keep in mind: The dotdict notation is a reduced one. Because of parts are missing (e.g. the single quotes around key names), the outcome can be code that is really hard to capture.

Chapter 3

CJsonPreprocessor.py

3.1 Class: CSyntaxType

Imported by:

```
from JsonPreprocessor.CJsonPreprocessor import CSyntaxType
```

3.2 Class: CPythonJSONDecoder

Imported by:

```
from JsonPreprocessor.CJsonPreprocessor import CPythonJSONDecoder
```

Add python data types **and** syntax to json. ``True``, ``False`` **and** ``None`` will be a
↪ accepted as json syntax elements.

Args:

`json.JSONDecoder` (*object*)

Decoder object provided by `json.loads`

3.2.1 Method: custom_scan_once

3.3 Class: CJsonPreprocessor

Imported by:

```
from JsonPreprocessor.CJsonPreprocessor import CJsonPreprocessor
```

CJsonPreprocessor extends the syntax of json.

Features are

- Allow c/c++-style comments within json files.
// single line or part of single line and /* */ multiline comments are possible
- Allow to import json files into json files
"[import]" : "relative/absolute path", imports another json file to exactly this location.
- Allow use of the defined paramaters within json files
In any place the syntax `${basenode.subnode. ... nodename}` allows to reference an already existing parameter.

– Example:

```
{
  "basenode" : {
    subnode : {
      "myparam" : 5
    },
  },
  "myVar" : ${basenode.subnode.myparam}
}
```

- Allow Python data types True, False and None

3.3.1 Method: jsonLoad

This function is the entry point of JsonPreprocessor.

It loads the json file, preprocesses it and returns the preprocessed result as data structure.

Args:

jFile (*string*)

Relative/absolute path to main json file.

%envvariable% and \${envvariable} can be used, too in order to access environment variables.

Returns:

oJson (*dict*)

Preprocessed json file(s) as dictionary data structure

Chapter 4

Appendix

About this package:

Table 4.1: Package setup

Setup parameter	Value
Name	JsonPreprocessor
Version	0.2.5
Date	13.06.2023
Description	Preprocessor for json files
Package URL	python-jsonpreprocessor
Author	Mai Dinh Nam Son
Email	son.maidinhnam@vn.bosch.com
Language	Programming Language :: Python :: 3
License	License :: OSI Approved :: Apache Software License
OS	Operating System :: OS Independent
Python required	>=3.0
Development status	Development Status :: 4 - Beta
Intended audience	Intended Audience :: Developers
Topic	Topic :: Software Development

Chapter 5

History

0.1.0	01/2022
<i>Initial version</i>	
0.1.4	09/2022
<i>Updated documentation</i>	
0.2.3	05/2023
<i>Added dotdict format</i>	
0.2.4	06/2023
<i>Improved dotdict format and update log output</i>	

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