
QFace Documentation

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QFace is a flexible API generator inspired by the Qt API idioms. It uses a common IDL format (called QFace interface document) to define an API. QFace is optimized to write a custom generator based on the common IDL format.

Several code generators for common use cases have already been implemented. These can be used as is or can be used as a base for a custom generator.

QFace is an attempt to establish one interface description language with an easy to use code generator framework. While QFace as an interface description language is Qt friendly, it is not limited to Qt. The hope is that many projects can agree on this interface language and many interesting generators will be created and we all can learn from how other projects generate code from the same IDL.

1.1 The IDL

The IDL uses common API concept such as modules, interfaces, properties, structs and enums/flags. Additionally it knows about lists, maps and models. A list is an array of primitive or complex types. A map is an associative array of key/value pairs. A model is an indicator for large data sets which are typically used via a defined interface or via pagination.

```
module org.example 1.0

interface Echo {
    string message;
    void echo(string message);
    signal broadcast(string message);
    Status status;
}

enum Status {
    Null, Loading, Ready, Error
}
```

The data types provided by QFace can be divided into primitive and complex types:

Primitive Types

- bool
- int
- real

- string
- var

Complex Types

- Interface
- Struct
- Enum
- Flag
- List
- Map
- Model

1.2 Why another IDL

Many IDLs are already in existence. Most of them are bound to a certain technology or library or are limited for a specific use. Only a few IDLs exist which are independent from a technology. From these few which are known to the author none satisfied the requirement from the author to be Qt compatible and easy to use. Also the IDL should be easy to install and be extendable. The unique mix of technologies used in QFace allows it to provide a solid stable IDL with a powerful generation framework.

1.3 Defining APIs

There are many opinions how to define APIs and what the best way is. The idea of QFace is that many projects find it useful and use the same IDL. Consequently, there will be a large set of generators and finally APIs can be compared and unified also if they will be used with different technologies.

Even inside one technology there are often discussions about how an interface shall be coded. QFace allows the different parties to create their own generators based on the same API. Ideally at the end the knowledge how an interface shall be coded will reside in the provided generator.

1.4 Large Projects

In larger projects there is the need to make a large set of operating services available to QML. It is less about defining new visual items in C++, more about creating an abstraction of a service and make it available to the HMI developer inside QML.

This can be a challenge when you create many of these plugins and in the middle of the project you figure out that you have issues with your current design or if the customer in the next project wants to use a different HMI technology. All the knowledge is inside these plugins.

With QFace these companies can be certain that QFace does not lock them into the HMI technology and smaller design issues can be fixed by fixing the generator.

1.5 Remote Services

Some projects use network communication to communicate from the HMI to the services, which might run on a different process or even a networked device. QFace was not designed for remote services as it does not define any storage types (e.g. int32, int16, int64), it only knows an int and does not define how large the int shall be. For this QFace needs to rely on the author of the generators to have a defined protocol to exchange data.

1.6 Complex APIs

QFace is purposely designed to have limited features. The goal is to make QFace easy to use with an easy to remember syntax so that you don't need to be an expert to write interface files.

QFace does not support unions or structs that extend other structs. If you look for these features, QFace is probably the wrong choice.

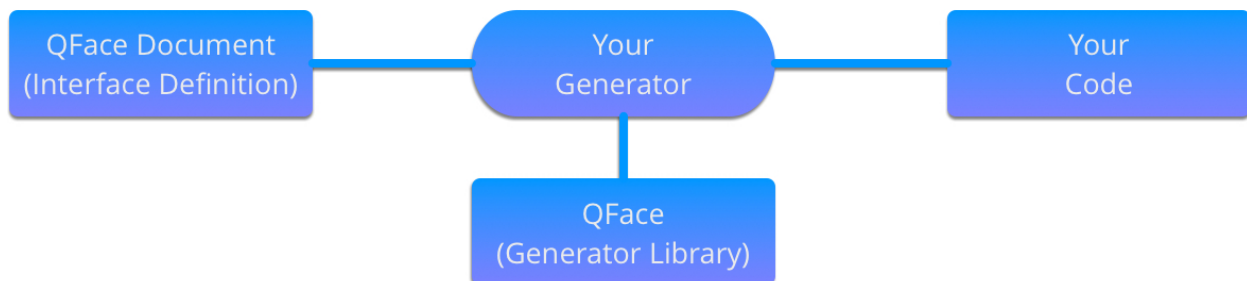
1.7 Limitations

Like other code generation tools, QFace is limited by how much information you can place inside your interface files. In excessive cases code generation might not make sense and hence QFace will also not help.

QFace allows you to use annotations which can add meta information to the interface files. But the generator needs to be designed to understand this meta information. Only the structure of these annotations are defined not the information they carry. Annotations might help to add information to an interface document to better control the code generation process.

2.1 Concept

QFace requires one or more IDL files as input file and a generator to produce output files. The IDL files are named QFace interface documents.



To use QFace you need to write your own generator. A generator is a small python script which reads the QFace document and writes code using template files.

```
# gen.py
from qface.generator import FileSystem, Generator

def generate(input, output):
    # parse the interface files
    system = FileSystem.parse(input)
    # setup the generator
    generator = Generator(search_path='templates')
    # create a context object
    ctx = {'output': output, 'system': system}
    # apply the context on the template and write the output to file
    generator.write('{{output}}/modules.csv', 'modules.csv', ctx)

# call the generation function
generate('sample.qface', 'out')
```

```
python3 gen.py
```

2.2 Code Generation Principle

The code generation is driven by a small script which iterates over the domain model and writes files using the Python Jinja template language. Refer to <http://jinja.pocoo.org> and particularly the template designer documentation at <http://jinja.pocoo.org/docs/dev/templates/>.

```
from qface.generator import FileSystem, Generator

def generate(input, output):
    system = FileSystem.parse(input)
    generator = Generator(searchpath='templates')
    ctx = {'output': output, 'system': system}
    generator.write('{{output}}/modules.csv', 'modules.csv', ctx)
```

This script reads the input directory and returns a system object from the domain model. This is used as the root object for the code generation inside the template language.

```
{% for module in system.modules %}
  {%- for interface in module.interfaces -%}
  INTERFACE, {{module}}.{{interface}}
  {% endfor -%}
  {%- for struct in module.structs -%}
  STRUCT , {{module}}.{{struct}}
  {% endfor -%}
  {%- for enum in module.enums -%}
  ENUM , {{module}}.{{enum}}
  {% endfor -%}
{% endfor %}
```

The template iterates over the domain objects and generates text which is written into the output file. Using the generator write method `generator.write(path, template, context)` the output file path can be specified.

Generator Examples

QFace does provide some real world generators which are hosted as separated projects. Their purpose is merely to showcase how to write a code generator with QFace. They are working and complete examples of general purpose generators.

qface-qtcpp

The QtCPP generator generates a Qt C++ plugin with a QML API ready to be used in your project.

Hosted at: <https://github.com/Pelagicore/qface-qtcpp>

qface-qtqml

The QtQml generator generates a QML only API which ready to be used.

Hosted at: <https://github.com/Pelagicore/qface-qtqml>

qface-qtro

The RO (RemoteObjects) generator generates a client and server project using the Qt5 QtRemoteObejcts library

Hosted at: <https://github.com/Pelagicore/qface-qtro>

From the QML user interface perspective the QtCPP and QtQML generators both provide the same API and are interchangeable.

QFace (Qt interface language) is an Interface Description Language (IDL). While it is primarily designed to define an interface between Qt, QML and C++, it is intended to be flexible enough also to be used in other contexts.

The grammar of QFace is well defined and is based on the concept of modules as larger collections of information.

A module can have several interfaces, structs and/or enums/flags.

```
module <module> <version>
import <module> <version>

interface <Identifier> {
    <type> <identifier>
    <type> <operation> (<parameter>*)
    signal <signal> (<parameter>*)
}

struct <Identifier> {
    <type> <identifier>;
}

enum <Identifier> {
    <name> = <value>,
}

flag <Identifier> {
    <name> = <value>,
}
```

A QFace document always describes one module. Each document can contain one or more interfaces, structs, flags or enums. Each document can import other modules using the import statement.

4.1 Module

A module is identified by its name. A module should be normally a URI where all parts are lowercase (e.g. *entertainment.tuner*). A module may import other modules with the primary purpose being to ensure that dependencies are declared inside the QFace file.

```
// org.example.qface
module org.example 1.0

import org.common 1.0
```

4.2 Interface

An interface is a collection of properties, operations and signals. Properties carry data, whereas the operations normally modify the data. Signals are used to notify the user of changes.

```
interface WeatherStation {
    real temperature;
    void reset();
    signal error(string message);
}
```

QFace allows to extend interfaces using the `extends` keyword after the interface name.

```
interface Station {
    void reset();
    signal error(string message);
}

interface WeatherStation extends Station {
    real temperature;
}
```

Note: For the sake of simplicity, as an API designer you should carefully evaluate if this is required. The typical way in QFace to allow extensions is normally to write your own code-generator and use type annotations.

```
@extends: Station
interface WeatherStation {
    real temperature;
}
```

The API reader does not need to know the internals of the API. The station behavior would be automatically attached by the custom generator.

4.3 Struct

The struct resembles a data container. It consist of a set of fields where each field has a data type and a name.


```
struct Error {
    string message;
    int code;
};
```

Structs can also be nested. A struct can be used everywhere where a type can be used.

```
interface WeatherStation {
    real temperature;
    Error lastError;
    void reset();
    signal error(Error error);
}
```

4.4 Enum/Flag

An enum and flag is an enumeration type. The value of each member is automatically assigned if missing.

```
enum State {
    Null,
    Loading,
    Ready,
    Error
}
```

The value assignment for the enum type is sequential beginning from 0. To specify the exact value you can assign a value to the member.

```
enum State {
    Null = 0,
    Loading = 1,
    Ready = 2,
    Error = 3
}
```

The flag type defines an enumeration type where different values are treated as a bit mask. The values are in the sequence of the 2^n .

```
flag Cell {
    Null,
    Box,
    Wall,
    Figure
}
```

4.5 Types

Types are either local and can be referenced simply by their names, or they are from external modules. In the latter case they need to be referenced with the fully qualified name (`<module>.<symbol>`). A type can be an interface, struct, enum or flag. It is also possible to reference the inner members of the symbols with the fragment syntax (`<module>.<symbol>#<fragment>`).

A module consists of either one or more interfaces, structs and enums/flags. They can come in any number or combination. The interface is the only type which can contain properties, operations and signals. The struct is merely a container to transport structured data. An enum/flag allows the user to encode information used inside the struct or interface as data-type.

Below is an example of a QFace file.

```
module entertainment.tuner 1.0;

import common 1.0

/*! Service Tuner */
interface Tuner {
    /*! property currentStation */
    readonly Station currentStation;
    /*! operation nextStation */
    void nextStation();
    /*! operation previousStation */
    void previousStation();
    /*! operation updateCurrentStation */
    void updateCurrentStation(int stationId);

    list<int> primitiveList;
    list<Station> complexList;
    map<int> simpleMap;
    map<Station> complexMap;
    model<int> primitiveModel;
    model<Station> complexModel;
}

/*! enum State */
enum State {
    /*! value State.Null */
    Null=0,
    /*! value State.Loading */
    Loading=1,
    /*! value State.Ready */
    Ready=2,
    /*! value State.Error */
    Error=3
}

/*! enum Waveband */
enum Waveband {
    /*! value Waveband.FM */
    FM=0,
    /*! value Waveband.AM */
    AM=1
}

flag Features {
    Mono = 0x1,
    Stereo = 0x2,
}

/*! struct Station */
struct Station {
    /*! member stationId */
```

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```

int stationId;
  /*! member name */
  string name;
  /*! last time modified */
  common.TimeStamp modified;
}

```

4.6 Nested Types

A nested type is a complex type which nests another type. These are container types, e.g. list, map or model.

```

list<Color> colors
map<Station> stations
model<WeatherInfo> weather

```

A list is an array of the provided value type. A map specifies only the value type. The key-type should be generic (e.g. a string type) and can be freely chosen by the generator. This allows for example the generator to add an id to each structure and use it as a key in the map.

A model is a special type of a list. It should be able to stream (e.g. add/change/remove) the data and the changes should be reflected by a more advanced API. Also the data could in general grow infinitely and the generator should provide some form of pagination or window API. You should use a model if you expect the data it represents to grow in a way that it may influence the performance of your API.

4.7 Annotations

Annotations allow the writer to add meta data to an interface document. It uses the @ notation followed by valid YAML one line content.

```

@singleton: true
@config: { port: 1234 }
interface Echo {
}

```

More information on annotations can be found in the annotations chapter.

4.8 Comments

Comments use the JavaDoc convention of using an @ sign as prefix with the keyword followed by the required parameters.

Currently only brief, description, see and deprecated are supported doc tags.

The QtCPP built-in generator generates valid Qt documentation out of these comments.

4.9 Default Values

QFace supports the assignment of default values to properties and struct fields. A default values is a text string passed to the generator.

```
interface Counter {
    int count = "0";
    Message lastMessage;
}

struct Message {
    string text = "NO DATA";
}
```

You can use quotes ‘ or double-quotes “ as a marker for text. There is no type check on QFace side. The text-content is directly passed to the generator.

Annotations

Annotations allow to add meta information to your interface definition. It is available to each symbol in the interface.

With annotations an interface author can extend the existing interface with additional meta information, called tags, aka annotations. One or several annotations can precede a module, interface, struct or enum. They are also allowed before an operation, property or signal. Everywhere where a documentation comment is allowed you can also add annotations.

An annotation looks like this

```
@service: {port: 12345}
interface Tuner {
}
```

An embedded annotation precedes a symbol and it starts with an @ sign. A symbol can have more than one annotation line. Each line should be one individual annotation. The content is YAML content. All @ signs preceding a symbol are collected and then evaluated using a YAML parser.

For larger annotations you can use the external annotation document feature (see below).

```
@singleton: yes
@data: [1,2,3]
@config: { values: [LEFT, RIGHT, TOP] }
```

This will result into a YAML content of

```
singleton: yes
data: [1,2,3]
config: { values: [LEFT, RIGHT, TOP] }
```

And the result as Python object would be

```
{
  "data": [ 1, 2, 3 ],
  "singleton": true,
  "config": {
```

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```
"values": [ "LEFT", "RIGHT", "TOP" ]
}
```

5.1 Annotation Documents

QFace allows also to specify these annotations in external documents using the *YAML* syntax. For this you need to create a document with the same name as the QFace document but with the extension *.yaml*. It should have roughly the following format

```
com.pelagicore.ivt.Tuner:
  service:
    port: 12345
```

On the root level should be a fully qualified name of a symbol. The symbol will be looked up and the following annotation information merged with the existing annotations from the QFace document.

5.2 Merging Annotations

The external annotations will be merged on top of the embedded annotations per symbol. Dictionaries will be merged. If a merge can not be done then the external document based annotations will override the embedded annotations.

5.3 Generators

Annotations are available later when navigating the domain model.

```
{% if "service" in interface.tags %}
interface {{interface}} is served on port: {{interface.tags.service.port}}
{% else %}
interface {{interface}} is not served
{% endif %}
```

Note: QFace does not specify specific annotations, but defines just the annotation format. The set of annotations supported must be defined and documented by the generator.

This page provides a basic overview of the YAML syntax as used by QFace in the embedded annotations and the external annotations document.

According to the official YAML website, YAML is “a human friendly data serialization standard for all programming languages”.

6.1 YAML Foundation

For QFace every YAML file is a dictionary of values.

```
@singleton: true
@base: QObject
interface Heater {
}
```

A dictionary in YAML is expressed like this

In an external YAML file the key on the root level is the fully qualified name of the symbol

```
org.example.Heater:
  singleton: true
  base: QObject
```

6.2 Dictionary

A dictionary is a simple `key: value` pair with a colon followed by a space (the space is mandatory).

```
key: value
key2: value
key3:
```

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```
key31: value
key32: value
```

A nested dictionary can be achieved by a new level of indentation.

An alternate form for a dictionary is this

```
key3: { key31: value, key32: value }
```

In a template the dictionary can be used as attributes of an object

```
{% if interface.tags.key == 'value' %}YES{% endif %}
```

To test if a key exists you can use the key in dictionary form

```
{% if 'key' in interface.tags %}YES{% endif %}
```

6.3 List

A list is an array of values

```
- item1
- item2
- item3:
  - item31
  - item32
```

A nested list can be created by indenting the list and postfixing the parent entry with a colon.

An alternate form is

6.3.1 Comments

YAML only knows line comments. A comment starts with a # and ends with line.

```
# this is the key for the value
key: value
```

6.3.2 Primitive Types

YAML understands different primitive types.

string

YAML understands strings either as an identifier or quoted using " or '.

You can use code blocks using the | sign. The block continues until the indentation ends. Or the > folding block, where each new line is replaced with a space.

number

YAML understands different number formats, here is a short list of the most important ones

```
# an integer
value: 10

# an hex value
value: 0xFF

# a float
value: 1.01
```

boolean

YAML understand different values as true/false.

```
positive: yes
positive: true
negative: no
negative: false
```

Besides these words it understand different writing forms (e.g. YES, Yes, Y). Same applies for the negative version.

JSON Meta Export

QFace allows you to easily export the domain model as a JSON document. This enables you to parse the domain information to be used with other tooling.

Inside your generator you need to register the filter first

```
from qface.filters import jsonify

generator = Generator(search_path=search_path)
generator.register_filter('jsonify', jsonify)
```

Then inside the template you can transform any symbol into a JSON string using the `jsonify` filter.

```
{{module|jsonify}}
```

Depending on your need you might want to create a JSON document from the whole system or from each interface or you are just interested in a JSON representation of an enumeration. The portion of the domain model exported to JSON really depends on your custom code generator and on which domain element you apply the `jsonify` filter.

7.1 JSON Format

Taking the example QFace document

```
module org.example 1.0;

interface Echo {
    readonly string currentMessage;
    void echo(Message message);
}

struct Message {
    string text;
```

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```
}  
  
enum Status {  
    Null,  
    Loading,  
    Ready,  
    Error  
}
```

The following JSON output is generated

```
{  
  "name": "org.example",  
  "version": "1.0",  
  "interfaces": [  
    {  
      "name": "Echo",  
      "properties": [  
        {  
          "name": "currentMessage",  
          "type": {  
            "name": "string",  
            "primitive": true  
          },  
          "readonly": true  
        }  
      ],  
      "operations": [  
        {  
          "name": "echo",  
          "parameters": [  
            {  
              "name": "message",  
              "type": {  
                "name": "Message",  
                "complex": true  
              }  
            }  
          ]  
        }  
      ],  
      "signals": []  
    }  
  ],  
  "structs": [  
    {  
      "name": "Message",  
      "fields": [  
        {  
          "name": "text",  
          "type": {  
            "name": "string",  
            "primitive": true  
          }  
        }  
      ]  
    }  
  ]  
}
```

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```
],
"enums": [
  {
    "name": "Status",
    "enum": true,
    "members": [
      {
        "name": "Null",
        "value": 0
      },
      {
        "name": "Loading",
        "value": 1
      },
      {
        "name": "Ready",
        "value": 2
      },
      {
        "name": "Error",
        "value": 3
      }
    ]
  }
]
```


The domain model resembles the structure of our system as objects. It is build by the parser and is the input into the generator.

It is important to understand the domain model as it is the main input for the template generation.

The IDL is converted into an in memory domain model (see `qface/idl/domain.py`)

```
- System
  - Module
    - Import
    - Interface
      - Property
      - Operation
      - Signal
    - Enum
    - Flag
    - Struct
```

The domain model is the base for the code generation. You traverse the domain tree and trigger your own code generation.

```
from qface.generator import FileSystem

system = FileSystem.parse('./interfaces')

for module in sytem.modules:
    print(module.name)

    for interfaces in module.interfaces:
        print(interfaces.name)

    for struct in module.structs:
        print(struct.name)
```

8.1 Debug

At any time you can place a debug breakpoint:

```
import ipdb; ipd.set_trace()
```

See <https://pypi.python.org/pypi/ipdb>

To see the object members just use:

```
dir(module) # list all members of module  
help(module) # prints the documentation
```


QFace is easy to use and easy to extend. Your generator is just a small python script using the qface library. The script iterates over the domain model and writes files using a template language.

See template engine documentation:

- <http://jinja.pocoo.org>
- <http://jinja.pocoo.org/docs/dev/templates>

```
from qface.generator import FileSystem, Generator

def generate(input, output):
    # parse the interface files
    system = FileSystem.parse(input)
    # setup the generator
    generator = Generator(search_path='templates')
    # create a context object
    ctx = {'output': output, 'system': system}
    # apply the context on the template and write the output to file
    generator.write('{{output}}/modules.csv', 'modules.csv', ctx)
```

This script reads the input directory returns a system object from the domain model. This is used as the root object for the code generation inside the template. The context object is applied to the file path as also on the named template document. The output of the template is then written to the given file path.

Below is a simple template which generates a CSV document of all interfaces, structs and enums.

```
{% for module in system.modules %}
  {%- for interface in module.interfaces -%}
  INTERFACE, {{module}}.{{interface}}
  {% endfor -%}
  {%- for struct in module.structs -%}
  STRUCT , {{module}}.{{struct}}
  {% endfor -%}
  {%- for enum in module.enums -%}
```

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```

ENUM    , {{module}}.{{enum}}
{% endfor -%}
{% endfor %}

```

The template code iterates over the domain objects and generates text using a mixture of output blocks `{{}}` and control blocks `{%}`.

9.1 Rule Base Generation

The *RuleGenerator* allows you to extract the documentation rules into an external yaml file. This makes the python script more compact.

```

from qface.generator import FileSystem, RuleGenerator
from path import Path

here = Path(__file__).dirname()

def generate(input, output):
    # parse the interface files
    system = FileSystem.parse(input)
    # setup the generator
    generator = RuleGenerator(search_path=here/'templates', destination=output)
    generator.process_rules(here/'docs.yaml', system)

```

The rules document is divided into several targets. Each target can have an own destination. A target is typical for example and *app*, *client* or *server*. Each target can have rules for the different symbols (system, module, interface, struct, enum). An each rule finally consists of a destination modifier, additional context and a documents collection.

```

<target>:
  <symbol>:
    context: { <key>: <value> }
    destination: <path>
    documents:
      <target>:<source>
    preserve:
      <target>:<source>

```

- `<target>` is a name of the current target (e.g. client, server, plugin)
- `<symbol>` must be either system, module, interface, struct or enum

Here is an example (`docs.yaml`)

```

global:
  destination: '{{dst}}'
  system:
    documents:
      '{{project}}.pro': 'project.pro'
      '.qmake.conf': 'qmake.conf'
      'CMakeLists.txt': 'CMakeLists.txt'
plugin:
  destination: '{{dst}}/plugin'
  module:
    context: {'module_name': '{{module|identifier}}'}
    documents:

```

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```

    '{{module_name}}.pro': 'plugin/plugin.pro'
    'CMakeLists.txt': 'plugin/CMakeLists.txt'
    'plugin.cpp': 'plugin/plugin.cpp'
    'plugin.h': 'plugin/plugin.h'
    'qmldir': 'plugin/qmldir'
interface:
  documents:
    '{{interface|lower}}.h': 'plugin/interface.h'
    '{{interface|lower}}.cpp': 'plugin/interface.cpp'
struct:
  documents:
    '{{struct|lower}}.h': 'plugin/struct.h'
    '{{struct|lower}}.cpp': 'plugin/struct.cpp'

```

The rule generator adds the `dst`, `project` as also the corresponding symbols to the context automatically. On each level you are able to change the destination or update the context.

Features

The rules document allows to conditional write files based on a feature set. The feature set must be a set of tags indicating the features which will then be checked in the `when` section of a rule. The `when` tag needs to be a list of feature switched.

The features are passed to the generator in your custom generator code. The existence of a feature tells the rules engine to check if a `when` section exists conditionally execute this rule.

```

plugin:
  when: [plugin_enabled]
  destination: '{{dst}}/plugin'
  module:
    ...

```

Here the plugin rule will only be run when the feature set contains a 'plugin_enabled' string.

Preserving Documents

Documents can be moved to the `preserve` tag to prevent them to be overwritten. The rules documents has an own marker for this called `preserve`. This is the same dictionary of target/source documents which shall be be marked preserved by the generator.

```

plugin:
  interface:
    documents:
      '{{interface|lower}}.h': 'plugin/interface.h'
  preserve:
    '{{interface|lower}}.cpp': 'plugin/interface.cpp'

```

In the example above the `preserve` listed documents will not be overwritten during a second generator run and can be edited by the user.

Destination and Source

The `destination` tag allows you to specify a prefix for the target destination of the document. It should always contain the `{{dst}}` variable to be placed inside the project folder.

The `source` tag specifies a prefix for the templates resolving. If the template name starts with a `/` the prefix will be ignored.

Destination and source tags are allowed on the target level as also on each system, module and other symbol levels. A tag on a parent symbol will be the default for the child symbols.

Implicit symbol hierarchy

This is the implicit logical hierarchy taken into account:

```
<target>
  <system>
    <module>
      <interface>
      <struct>
      <enum>
```

Typical you place the destination prefix on the module level if your destination depends on the module symbol. For generic templates you would place the destination on the system level. On the system level you can not use child symbols (such as the module) as at this time these symbols are not known yet.

9.2 Parsing Documentation Comments

The comments are provided as raw text to the template engine. You need to parse using the `parse_doc` tag and the you can inspect the documentation object.

See below for a simple example

```
{% with doc = property.comment|parse_doc %}
\brief {{doc.brief}}

{{doc.description}}
{% endwith %}
```

Each tag in the JavaDoc styled comment, will be converted into a property of the object returned by `parse_doc`. All lines without a tag will be merged into the description tag.

9.3 Language Profiles

QFace supports the notion of profile. A profile is a set of features supported by the named profile. The intention of a profile is to make it easier for generator writers to stick to a limited set of language features, also if the overall language is evolving.

Currently there exists three language profiles:

- Micro - A limited set of languages features. The base profile. It does not allow importing of other modules or extending an interface, neither does it support maps.
- Advanced - Builds upon micro and allows imports, maps, interface extension.

- Full - Builds up on advanced and will also contain experimental language features.

The current features defined are: - const operations - const properties - imports - maps - interface extensions

The profiles and features are defined in the *qface.idl.profile* module.

```
from qface.generator import FileSystem
from qface.idl.profile import EProfile

system = FileSystem.parse(input=input, profile=EProfile.MICRO)
```


In the script mode, qface is used as the qface executable. In this mode the code generator consists of a rule document and template files and optionally a filter module.

Whereas normally the generator writer creates an own python package in this mode only some documents are needed and the qface script is used.

10.1 Setup

To get started create a *qface-rules.yml* document and a templates folder:

```
qface-rules.yml
templates/
```

In the rules file you provide the code generation rules according to the rule generator documentation. The templates folder will contain the required templates.

10.2 Filters

To provide extra filter you need to create a *filters.py* document with the declaration of your filters:

```
def echo(s):
    print(s)
    return "World"

filters['echo'] = echo
```

The filters module will be loaded by qface and all entries to the filters dictionary are added to the global lists of Jinja filters.

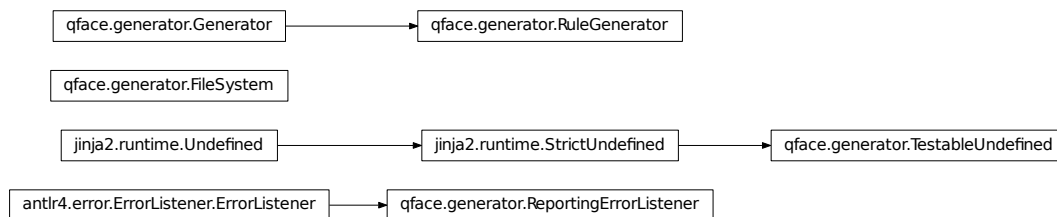
10.3 Running

To run now the generator you can simply call:

```
qface --rules qface-rules.yml --target out counter.qface
```

This will take your rules and generate the files inside the out folder based on the *counter.qface* interface file.

11.1 Generator API



11.1.1 Generator Class

Provides an API for accessing the file system and controlling the generator

11.1.2 FileSystem Class

class `qface.generator.FileSystem`

Bases: `object`

QFace helper functions to work with the file system

static `merge_annotations` (*system*, *document*)

Read a YAML document and for each root symbol identifier updates the tag information of that symbol

static parse (*input, identifier: str = None, use_cache=False, clear_cache=True, pattern='*.qface', profile=<EProfile.FULL: 'full'>*)

Input can be either a file or directory or a list of files or directory. A directory will be parsed recursively. The function returns the resulting system. Stores the result of the run in the domain cache named after the identifier.

Parameters

- **path** – directory to parse
- **identifier** – identifies the parse run. Used to name the cache
- **clear_cache** – clears the domain cache (defaults to true)

strict = False

enables strict parsing

class `qface.generator.Generator` (*search_path, context={}, force=False*)

Bases: `object`

Manages the templates and applies your context data

destination

destination prefix for generator write

get_template (*name*)

Retrieves a single template file from the template loader

register_filter (*name, callback*)

Register your custom template filter

render (*name, context*)

Returns the rendered text from a single template file from the template loader using the given context data

source

source prefix for template lookup

strict = False

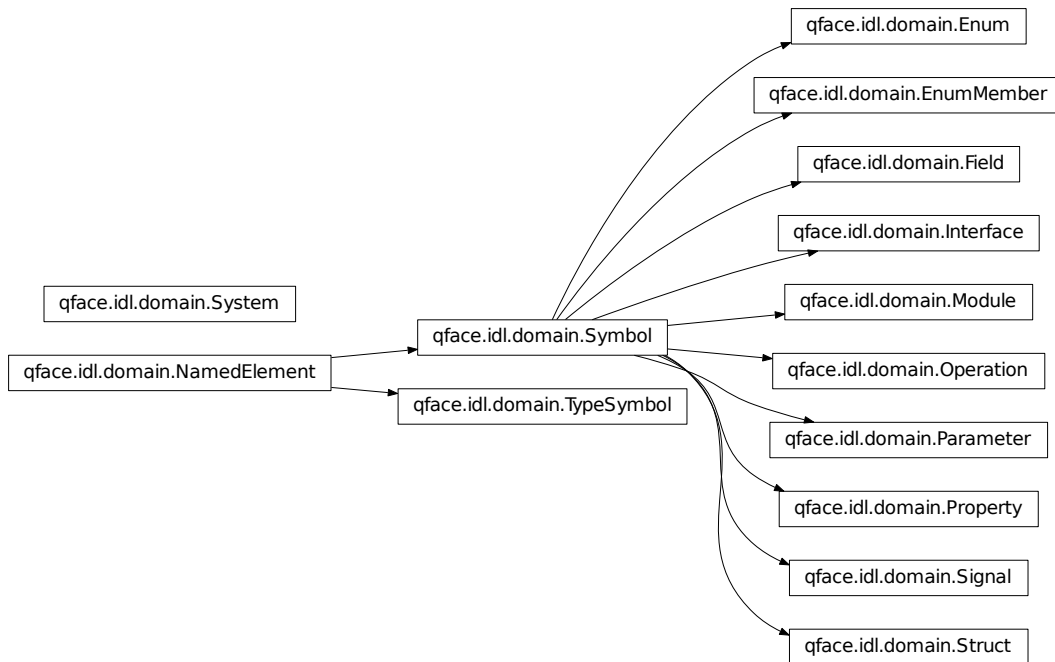
enables strict code generation

write (*file_path, template, context={}, preserve=False, force=False*)

Using a template file name it renders a template into a file given a context

11.2 Template Domain API

This API is exposed to the Jinja template system.



11.2.1 High Level Classes

class `qface.idl.domain.System`

Bases: `object`

The root entity which consist of modules

lookup (*name: str*)

lookup a symbol by fully qualified name.

modules

returns ordered list of module symbols

class `qface.idl.domain.Module` (*name: str, system: qface.idl.domain.System*)

Bases: `qface.idl.domain.Symbol`

Module is a namespace for types, e.g. interfaces, enums, structs

enums

returns ordered list of enum symbols

imports

returns ordered list of import symbols

interfaces

returns ordered list of interface symbols

lookup (*name: str, fragment: str = None*)

lookup a symbol by name. If symbol is not local it will be looked up system wide

majorVersion
returns the major version number of the version information

minorVersion
returns the minor version number of the version information

module_name
returns the last part of the module uri

name_parts
return module name splitted by '.' in parts

structs
returns ordered list of struct symbols

11.2.2 Interface Related Classes

class `qface.idl.domain.Interface` (*name: str, module: qface.idl.domain.Module*)
Bases: `qface.idl.domain.Symbol`

A interface is an object with operations, properties and signals

extends
returns the symbol defined by the extends interface attribute

operations
returns ordered list of operations

properties
returns ordered list of properties

signals
returns ordered list of signals

class `qface.idl.domain.Operation` (*name: str, interface: qface.idl.domain.Interface*)
Bases: `qface.idl.domain.Symbol`

An operation inside a interface

interface = None
the interface the operation is part of

is_const = None
reflects is the operation was declared as const operation

parameters
returns ordered list of parameters

qualified_name
return the fully qualified name (`<module>.<interface>#<operation>`)

class `qface.idl.domain.Parameter` (*name: str, operation: qface.idl.domain.Operation*)
Bases: `qface.idl.domain.Symbol`

An operation parameter

class `qface.idl.domain.Property` (*name: str, interface: qface.idl.domain.Interface*)
Bases: `qface.idl.domain.Symbol`

A typed property inside a interface

is_complex_model
true if type is a model of nested complex types

is_model
true if type is a model

is_primitive_model
true if type is a model of nested primitive types

qualified_name
return the fully qualified name (*<module>.<interface>#<property>*)

11.2.3 Struct Related Classes

class `qface.idl.domain.Struct` (*name: str, module: qface.idl.domain.Module*)
Bases: `qface.idl.domain.Symbol`

Represents a data container

fields
returns ordered list of members

class `qface.idl.domain.Field` (*name: str, struct: qface.idl.domain.Struct*)
Bases: `qface.idl.domain.Symbol`

A member in a struct

qualified_name
return the fully qualified name (*<module>.<struct>#<field>*)

Enum/Flag Related Classes

class `qface.idl.domain.Enum` (*name: str, module: qface.idl.domain.Module*)
Bases: `qface.idl.domain.Symbol`

An enum (flag) inside a module

members
returns ordered list of members

class `qface.idl.domain.EnumMember` (*name: str, enum: qface.idl.domain.Enum*)
Bases: `qface.idl.domain.Symbol`

A enum value

qualified_name ()
return the fully qualified name (*<module>.<enum>#<member>*)

11.2.4 Base Classes

class `qface.idl.domain.NamedElement` (*name, module: qface.idl.domain.Module*)
Bases: `object`

module = None
module the symbol belongs to

name = None
symbol name

qualified_name
return the fully qualified name (*<module>.<name>*)

class `qface.idl.domain.Symbol` (*name: str, module: qface.idl.domain.Module*)

Bases: `qface.idl.domain.NamedElement`

A symbol represents a base class for names elements

add_attribute (*tag, name, value*)

add an attribute (nam, value pair) to the named tag

add_tag (*tag*)

add a tag to the tag list

attribute (*tag, name*)

return attribute by tag and attribute name

comment = None

comment which appeared in QFace right before symbol

contents

return general list of symbol contents

kind = None

the associated type information

system

returns reference to system

tag (*name*)

return tag by name

class `qface.idl.domain.TypeSymbol` (*name: str, parent: qface.idl.domain.NamedElement*)

Bases: `qface.idl.domain.NamedElement`

Defines a type in the system

is_bool

checks if type is primitive and bool

is_complex = None

if type represents a complex type

is_enum

checks if type is an enumeration and reference is enum

is_enumeration

checks if type is complex and instance of type Enum

is_flag

checks if type is an enumeration and reference is flag

is_int

checks if type is primitive and int

is_interface

checks if type is interface

is_list = None

if type represents a list of nested types

is_map = None

if type represents a map of nested types. A key type is not defined

is_model = None

if type represents a model of nested types

is_primitive = None
if type represents a primitive type

is_real
checks if type is primitive and real

is_string
checks if type is primitive and string

is_struct
checks if type is complex and struct

is_valid
checks if type is a valid type

is_var
checks if type is primitive and var

is_void = None
if type represents the void type

nested = None
nested type if symbol is list or model

parent = None
the parent symbol of this type

reference
returns the symbol reference of the type name

type
return the type information. In this case: self

11.2.5 Utility Modules

`qface.watch.monitor` (*args*, *watch*)
reloads the script given by argv when src files changes

`qface.shell.sh` (*args*, ***kwargs*)
runs the given cmd as shell command

The list of features is split between features which are based on the chosen IDL and features which are provided by the generator itself.

IDL Features

- Common modern IDL
- Scalable through modules
- Structure through structs, enums, flags
- Interface API with properties, operations and signals
- Annotations using YAML syntax
- Documentable IDL

Generator Features

- Easy to install using python package manager
- Designed to be extended
- Well defined domain objects
- Template based code generator
- Simple rule based code builder
- Well documented

QFace is a generator framework and is bundled with several reference code generators.

To install qface you need to have python3 installed and typically also pip3

```
pip3 install qface
```

This installs the python qface library onto your system.

You can verify that you have qface installed with

```
python3
```

and then

```
import qface
```

13.1 Custom Generator

For your own generator you need several ingredients. A QFace interface file (here called “sample.qface”), a small script which loads and parses the document (generator.py) and one or more template files, used by the script to generate the resulting code.

The QFace document could look like this

```
// sample.qface
module org.example 1.0

interface Echo {
    string echo(string msg);
}
```

Your generator can now parse the documents and call the templates

```
// generator.py
from qface.generator import FileSystem, Generator

system = FileSystem.parse('sample.qface')
generator = Generator('./templates')
for module in system.modules:
    ctx = { 'module' : module }
    generator.write('{{module}}.txt', 'module.tpl', ctx)
```

The final piece is the template to parameterize the output in this case called “module.tpl”

```
// templates/module.tpl
{% for interface in module.interfaces %}
{{module.name}}
{% endfor %}
```

Now you can simple call your script

```
python3 generator.py
```

And a “org.example.txt” file named after the module should be generated.

See Also

- *Extending*
- *Grammar*
- *Domain Model*
- *API*

13.2 Bundled Generators

QFace has some generators which are bundled with the QFace library. They live in their own repositories. These generators are documented in their respective repositories.

See Also

- `qtcpp`
- `qtqml`

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